THE LINUX FOUNDATION
TRAINING

Linux Foundation 認定試験準備ガイド

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The Linux Foundation 認定試験の準備ガイドへようこそ。

本ガイドは、（認定取得に必要となるすべてについて）網羅的な情報提供をするものではなく、また、ここで書かれている内容をすべて活用することで Linux Foundation認定試験の合格を保証するようなものでもありません。

どちらかというと本ガイドは皆さんにこの試験がどんな内容を取り扱うのか情報を提供し、皆さんがお持ちの知識・経験をより強固にできるようなリソースを示すものです。本ガイドが、皆さんのLinux Foundation認定取得の助けになれば幸いです。

Linux Foundation認定について

Linuxに対する需要はこれまでになく大きくなり、その能力のある就職希望者には多くの採用枠が存在しています。企業側が適性のある就職希望者を見極める上で、Linux認定資格は重要な役割を担っています。

次のような事実があります。

- 今日、Linuxの労働市場はグローバルなものである。
- Linuxのスキル認定で最良のものは、その人が実際にコマンドラインを用いた能力を反映するものである。
- より多くの企業が、1つだけではなくさまざまな種類のLinuxディストリビューションを使用するようになってきている。
- このことから、本Linux認定試験は以下を満たすものとなる。
  - いつでもどこでもオンライン：テストセンターに足を運ぶことなく、トップレベルのLinux認定を受けることができる。
  - 実技ベース：ひっかけ問題や選択問題といったものはなく、日頃用いているコマンドラインでスキルを示すことができる。
  - ディストロに対して柔軟：CentOSまたは Ubuntuで認定試験を受けることができる。Linux Foundationの認定資格は、受験時のディストリビューションに関係なくLinuxのスキルや知識を持つことを証明する。

本ガイドについて

このガイドの目的は、受験者が満を持してLinux Foundation認定試験を迎えられるようにすることです。ガイドには試験を受ける際に行う実際のプロセスに関する情報や、試験を受けるための準備に役立つリソースに関する情報が含まれています。また本ガイドは定期的に更新しますので、コメント、提案、その他のフィードバックがある場合は、ぜひこちらまでお知らせください。

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CHAPTER ONE

Preparing for the Exam

I - Domains and Competencies

The following two checklists are for the Linux Foundation Certified System Administrator and Engineer exams, respectively. They'll show you what you should know before taking the exam and give you a guide to study from.

Linux Foundation Certified System Administrator

Linux Foundation Certified Engineer

Linux Foundation Certified System Administrator

Domains & Competencies

The Linux Foundation worked with industry experts and the Linux kernel community to identify the core domains and the critical skills, knowledge and abilities ("competencies") applicable to each certification. Performance-based exams were then developed based on the competencies that were identified.

Essential Commands - 25%

- Log into local & remote graphical and text mode consoles
- Search for files
- Evaluate and compare the basic file system features and options
- Compare and manipulate file content
- Use input-output redirection (e.g. >, >>, |, 2>)
- Analyze text using basic regular expressions
- Archive, backup, compress, unpack, and uncompress files
- Create, delete, copy, and move files and directories
- Create and manage hard and soft links
- List, set, and change standard file permissions
- Read, and use system documentation
- Manage access to the root account

Operation of Running Systems - 20%

- Boot, reboot, and shut down a system safely
- Boot or change system into different operating modes
- Install, configure and troubleshoot bootloaders
- Diagnose and manage processes
- Locate and analyze system log files
- Schedule tasks to run at a set date and time
- Verify completion of scheduled jobs
- Update software to provide required functionality and security
- Verify the integrity and availability of resources
- Verify the integrity and availability of key processes
- Change kernel runtime parameters, persistent and non-persistent
- Use scripting to automate system maintenance tasks
- Manage the startup process and services (In Services Configuration)
- List and identify SELinux/AppArmor file and process contexts
- Manage Software
- Identify the component of a Linux distribution that a file belongs to

User and Group Management - 10%

- Create, delete, and modify local user accounts
- Create, delete, and modify local groups and group memberships
- Manage system-wide environment profiles
- Manage template user environment
- Configure user resource limits
- Manage user privileges
- Configure PAM

Linux Foundation Certified System Administrator

Domains & Competencies Continued

Networking - 12%

- Configure networking and hostname resolution statically or dynamically
- Configure network services to start automatically at boot
- Implement packet filtering
- Start, stop, and check the status of network services
- Statically route IP traffic
- Synchronize time using other network peers

Service Configuration - 20%

- Configure a caching DNS server
- Maintain a DNS zone
- Configure email aliases
- Configure SSH servers and clients
- Restrict access to the HTTP proxy server
- Configure an IMAP and IMAPS service
- Query and modify the behavior of system services at various operating modes
- Configure an HTTP server
- Configure HTTP server log files
- Configure a database server
- Restrict access to a web page
- Manage and configure containers
- Manage and configure Virtual Machines

Storage Management - 13%

- List, create, delete, and modify physical storage partitions
- Manage and configure LVM storage
- Create and configure encrypted storage
- Configure systems to mount file systems at or during boot
- Configure and manage swap space
- Create and manage RAID devices
- Configure systems to mount file systems on demand
- Create, manage and diagnose advanced file system permissions
- Setup user and group disk quotas for filesystems
- Create and configure file systems

Linux Foundation Certified Engineer

Domains & Competencies

LFCE Exam builds on the **Domains and Competencies from the LFCS Exam**. The list of Domains and Competencies for the LFCE Exam below should be considered in combination with the Domains and Competencies listed for the LFCS Exam.

Essential Commands - 5%

- Use version control tools
- Manipulate file content programmatically
- Run commands on many systems simultaneously
- Install Linux Distribution

Operation of Running Systems - 18%

- Monitor, tune and troubleshoot system performance
- Update operating systems to provide required functionality and security
- Update the kernel and ensure the system is bootable
- Script automation tools to make work faster and more accurate
- Train team members on new technology or changes to existing systems
- Maintain systems via configuration management tools
- Maintain the integrity and availability of hardware
- Develop and test disaster recovery plans
- Support incident management for outages/trouble
- Produce and deliver reports on system use (processor, memory, disk, and network), outages, and user requests
- Monitor security and conduct audits
- Manipulate Linux system during the recovery process
- Use udev for device detection and management
- Configure and modify SELinux/AppArmor policies

User and Group Management - 10%

- Connect to an external authentication source
- Configure advanced PAM

Networking - 15%

- Monitor, tune and troubleshoot network performance
- Configure network traffic tunneling
- Configure a system to perform Network Address Translation
- Dynamically route IP traffic
- Implement advanced packet filtering

Service Configuration - 17%

- Implement and configure an HTTP server
- Implement and configure time synchronization server
- Implement and configure network logging server
- Configure a DHCP server
- Implement and configure an SMTP service
- Implement and configure the HTTP proxy server
- Configure host-based and user-based security for a service
- Implement and configure a centralized authentication server
- Implement and configure a PXE Boot server
- Implement and configure an authoritative DNS server

Linux Foundation Certified Engineer

Domains & Competencies Continued

Storage Management - 10%

- Manage advanced LVM configuration
- Identify storage devices using block device attributes
- Manage Linux file system features and flags
- Implement and configure remote block storage devices
- Implement and configure network shares

System Design and Deployment - 25%

- Define a capacity planning strategy
- Conduct post deployment verifications
- Create and maintain software packages
- Create, configure and maintain containers
- Deploy, configure, and maintain high availability/clustering/ replication

II - Free Training Resources

LFS101X Intro To Linux Course

If you are new (or relatively new) to Linux, we suggest you enroll in the free, 100% online and self-paced 'Intro to Linux' course on edX. You do not need to pay for the Verified certificate (though you may choose to do so if you wish). Everybody's background and experience is different, so feel free to use as much or as little of the course as you need to increase your familiarity. There is no requirement for you to take the whole course or even to pass the final exam. It is there to make sure that you have the foundational knowledge that will help you, particularly for The Linux Foundation Certified System Administrator exam.
edx.org/course/linuxfoundationx/linuxfoundationx-lfs101x-introduction-1621

Practice Using the Browser-Based Terminal

Since the exam terminal is delivered in your browser, it will behave slightly different than an SSH client or local install. (See Chapter 2, Section III below for more information). If you'd like to get more information on Gate One, which is used to deliver the terminal in your exam console, please visit the following link - **https://github.com/liftoff/GateOne**

The Linux Foundation Youtube Channel

The Linux Foundation YouTube channel is packed with resources, including keynotes and presentations from LinuxCon and other conferences, tutorials, and other informational videos about Linux in general. In particular, you'll want to take a look at the Linux Training playlist.
youtube.com/user/TheLinuxFoundation

What Is Linux

Don't know much about Linux? This article contains all the information you need, to get up to speed on the Linux platform including answering what is Linux, why use Linux and also provides guidance on how to pick a distribution, and how to install Linux.
linux.com/what-is-linux

Ops School

Ops School is a community-built course and reference guide for people interested in a career in systems administration. Not all of the articles are complete, but the vast majority are well-written and technically correct. They are organized by topic and difficulty, making it easy to find the subject you're interested in. A couple of lessons that you might find helpful are:

Text Editing 101
opsschool.org/en/latest/text_editing_101.html

Unix Fundamentals 101 > File systems
opsschool.org/en/latest/filesystems_101.html

Distribution-Specific Manuals & Guides

Each of the exam-eligible distros has a vast body of helpful content and guides to help you with whatever issue you're currently struggling with. Once you've selected your exam distro, it would be a good idea to look up the individual items on the Domains and Competencies checklist for your distro, even if it's just to refresh your memory. The links below are for official resources created and blessed by the distro maintainers.

CentOS: wiki.centos.org/HowTos

Ubuntu: help.ubuntu.com/community/CommunityHelpWiki

Free Prep Resources For Red Hat, Etc

Since all reputable Linux certifications (e.g. Red Hat) have been developed by experts, you will likely find that free resources available as preparation for those exams will also be useful in preparing for The Linux Foundation exams.

III - Paid Training Resources

If you are interested in a more guided approach to test preparation, there are some additional paid options you may want to consider:

LFS201 - Essentials of System Administration

This self-paced, online course is designed to give you a fundamental understanding of skills and knowledge necessary to be a system administrator. With over 80 hands-on labs it provides excellent preparation for the Linux Foundation Certified System Administrator certification exam. You have 12 months to complete the course at your own pace.
https://training.linuxfoundation.org/training/essentials-of-linux-system-administration/?_sft_course_mode=e-learning&_sf_s=LFS201

LFS211 - Linux Networking and Administration

This self-paced, online course is designed to build your skills and knowledge with hands-on labs in advanced Linux networking and administration topics. It provides excellent preparation for the Linux Foundation Certified Engineer certification exam. You have 12 months to complete the course at your own pace.
training.linuxfoundation.org/linux-courses/system-administration-training/linux-networking-and-administration

LFS301 - Linux System Administration

This 4-day course covers all the domains and competencies required for the LFCS exam. The course may be taken in a classroom or online (using screen sharing and a conference call line), so you'll be able to ask questions or get more clarification on specific items. You will also spend some quality time in hands-on learning and discovery throughout the course to aid your learning and retention.
training.linuxfoundation.org/linux-courses/system-administration-training/linux-system-administration

LFS311 - Advanced Linux System Administration and Networking

This 4-day course covers all the domains and competencies required for the LFCE exam. The course may be taken in a classroom or online (using screen sharing and a conference call line), so you'll be able to ask questions or get more clarification on specific items. You will also spend some quality time in hands-on learning and discovery throughout the course, which aids your learning and retention.
https://training.linuxfoundation.org/training/advanced-linux-system-administration-and-networking/?_sf_s=LFS311

Please visit **https://training.linuxfoundation.org/training/course-catalog/** for current pricing and availability.

Please note that paid training is not required to pass either exam.

CHAPTER TWO

Taking the Exam

I - System Requirements

Linux Foundation Certification exams are proctored by a live person via webcam and you will answer all exam questions using a terminal in your web browser.

You don't have to install anything extra, but there are a few hardware and software requirements that must be met in order to take the exam. Because your time to take the exam is limited to two hours, you want to make sure your equipment is ready and meets minimum requirements well in advance of taking the exam. You don't want to lose any precious exam time dealing with technical difficulties.

You can use this link to check your system compatibility at any time: **examslocal.com/ScheduleExam/Home/CompatibilityCheck**

The system requirements include:

- **Chrome or Chromium browser** - You must be running the current version of Chrome or Chromium because the exam video feed relies on the WebRTC extension. (This is the same technology Google uses for Hangouts.)
- **A single functioning webcam** - Please don't have more than one connected. To make sure that your webcam will be sufficient, try holding up your ID while viewing your webcam feed to ensure your placement and resolution are sufficient for the person viewing your feed to read your ID.
- **A functioning microphone** - Please check to make sure it is working before you start your exam session.
- **Cookies enabled** - You must enable cookies for third-party applications to take the exam. Don't worry, you can enable them when starting your exam and then disable and delete them as soon as you complete your exam.
- **Bandwidth** - You can take your Linux Foundation Certification Exam when and where you want. However, it is incumbent upon you to ensure that you have a fast, stable Internet connection. We recommend turning off any bandwidth-intensive services (file sync and sharing apps like Dropbox, BitTorrent, etc.) and if you share your Internet connection with anyone else, asking them to avoid using bandwidth intensive services (like video streaming) while you're taking your exam.
  Minimum Speeds: 500Kbps download and 256Kbps upload
  Recommended Speeds: 5Mbps or higher download and upload
- **Ports** - Make sure that port 80 and port 443 are open on your machine.

II - Your Physical Environment

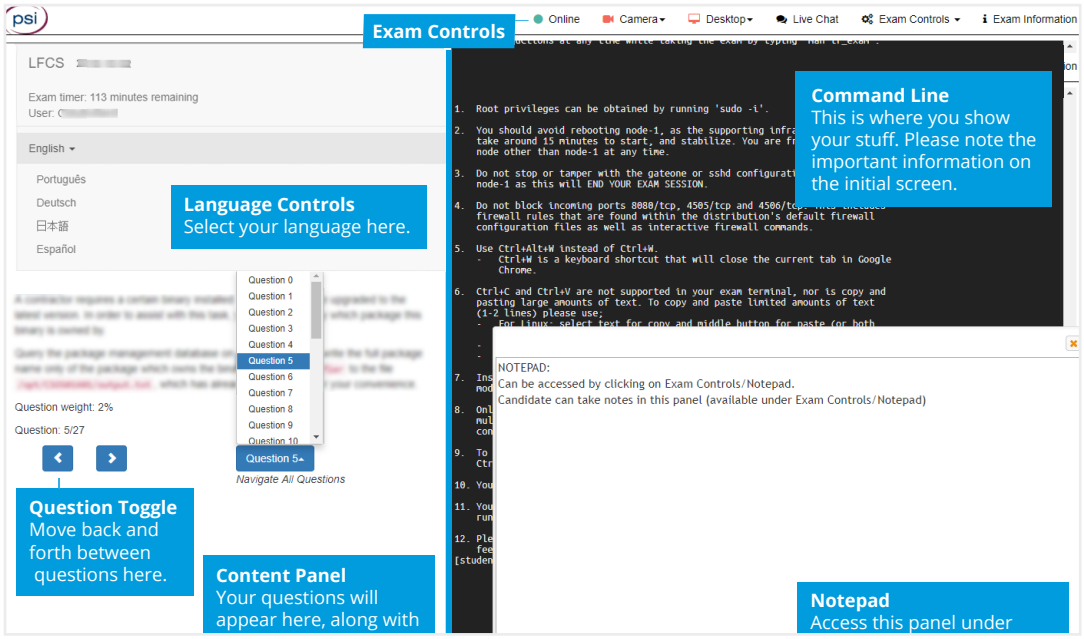
You only have two hours to complete your Linux Foundation Certification Exam and the clock keeps running once you start, so you'll want to make sure that you take the exam somewhere distraction-free where you can focus 100%.

Here are some things to consider:

- Think about possible sources of distractions (kids, loud music, pets) and have a plan for minimizing them.
- Use the bathroom right before you start your exam.
- Turn off cell phones, instant messaging programs, notifications, email, etc.
- Take off your Google Glass, Samsung Gear, Apple Watch, or any other electronic device. They're not allowed.
- See 'Testing Location Requirements' in the Candidate Handbook for more detailed info: **training.linuxfoundation.org/go/candidate_handbook**

III - Understanding the Exam Interface

Because the exam is delivered 100% through the browser, it's important for you to take a few minutes to familiarize yourself with the experience.



Question and Section Navigation

Objectives can only be navigated linearly using the left and right arrows at bottom, but don't feel compelled to do questions in the order presented. You can skip ahead and return to previous objectives later. If you think you might forget which objective you skipped or want to revisit, use a text file in the command-line terminal, or the notepad provided within Exam Controls, to make notes.

The default language for Exam objectives is English. Click on the Spanish, Portuguese, Japanese or German buttons to see objectives presented in the selected language. (All other aspects of the exam, e.g. the communication with proctor and the command-line terminal, will be presented and supported in English only.) The alternative language options are only available for the exam objectives.

Terminal Commands

Since your terminal is running within your browser, there are several important guidelines that you should pay close attention to. These are shown in your terminal at the start of your exam and are available at any time using man lf_exam:

1. Root privileges can be obtained by running 'sudo -i'.
2. You should avoid rebooting node-1, as the supporting infrastructure will take around 15 minutes to start, and stabilize. You are free to reboot any node other than node-1 at any time.
3. Do not stop or tamper with the gateone or sshd configuration and process on node-1 as this will END YOUR EXAM SESSION.
4. Do not block incoming ports 8080/tcp, 4505/tcp and 4506/tcp. This includes firewall rules that are found within the distribution's default firewall configuration files as well as interactive firewall commands.
5. Use Ctrl+Alt+W instead of Ctrl+W.
   - Ctrl+W is a keyboard shortcut that will close the current tab in Google Chrome.
6. Ctrl+C and Ctrl+V are not supported in your exam terminal, nor is copy and pasting large amounts of text. To copy and paste limited amounts of text (1-2 lines) please use;
   - **For Linux:** select text for copy and middle button for paste (or both left and right simultaneously if you have no middle button).
   - **For Mac:** ⌘+C to copy and ⌘+V to paste.
   - **For Windows:** Ctrl+Insert to copy and Shift+Insert to paste.
7. Installation of services and applications included in this exam may require modification of system security policies to successfully complete.
8. Only a single terminal console is available during the exam. Terminal multiplexers such as GNU Screen and tmux can be used to create virtual consoles.
9. To change the font size in the terminal please use the native Chrome keys: Ctrl and '+' or Ctrl and '-'.
10. You should avoid changing the locale of the system during your exam.
11. You should not manipulate the firewall of node-1, or tamper with any of the running lxd or dnsmasq processes.

Environment

To provide a rich production-like experience, you will be provided with a base server node (referred to as "node-1" throughout) and few or many other nodes, some local (containers of varying limitation) and some remote. Several very important rules apply.

1. You can `ssh <other_node>` from the `student` or `root` accounts on `node-1` at any time and simply log out from `<other_node>` to return to the base node. Clear instructions are provided in each relevant item. Where they are not, you should perform the task on `node-1`.
2. Things you must **never do** on `node-1`:
   - Reboot. Never reboot `node-1`. If you do, you can expect
     a 10-15 minute wait for all exam-supporting infrastructure and services to come online

correctly. All nodes other than `node-1`, however, can be rebooted at any time.

- Change the firewall configuration or network configuration. All network items, or other items that require isolation from base exam services will run in an isolated environment on some node other than `node-1`. You are free to manipulate services as needed on these isolated nodes. **Do not** ever modify the firewall configuration (`iptables.*`, `ufw`, `firewald`, etc.) on `node-1`, or manipulate other core services on `node-1` (`lxd.*`, `lxc.*`, dnsmasq, routing, resolver configuration, etc.) unless **explicitly** told to do so.
- Tamper with `sshd` or its configuration. Any `sshd`-related item(s) will be directed to a node other than `node-1`.
- Modify `/etc/suoders` or `/etc/suoders.d/*` on the base node. You'll be directed to an appropriate node for any `sudo` configuration-related item.

About The Linux Installation For Exams

You get a standard install of the distro you selected for your Exam. These standard installs may not have all the services that you like to use and may include some services that you actively avoid. You are free to download and install programs and services via your exam terminal, as long as you comply with all exam rules. You may also disable any already configured services. So feel free to install YAST, disable SELinux, or make any other Exam-compliant changes that make you feel more at home while taking the Exam. Just remember to balance your time, as installation and configuration time counts against yourtwo-hour time limit for the Exam.

IV - Checklist for Exam Day

- Make sure your government-issued photo ID is available and double check that the name matches your Linux Foundation ID Profile on identity.linuxfoundation.org.
- Check your Internet connection and turn on your browser's ability to accept third-party cookies.
- Review the guidelines for using the exam terminal to avoid 'muscle memory' accidents using commands that are not supported. Use of Ctrl-C and Ctrl-V resulting in terminal instability is the most common error.
- Practice looking up man, info and help pages for a few minutes beforehand. This will help you to get into the rhythm should you need to look something up during the exam.

Conclusion

Achieving a Linux Foundation Certification truly is an achievement, and we hope you find this guide to be helpful in reaching that goal. And in true open source fashion, if you find additional resources that are helpful, please let us know at **certificationsupport@linuxfoundation.org** and we may include them in a future version.

Thank you for your contribution and good luck!

The Linux Foundation promotes, protects and standardizes Linux by providing unified resources and services needed for open source to successfully compete with closed platforms.

To learn more about our Linux Training program, please visit us at **training.linuxfoundation.org**.