Chapter

1

Preparing Your Environment

Before beginning your journey to successfully pass the CompTIA Linux+ certification exam, you need a learning space. A *learning space* consists of Linux systems (virtual or physical), where you can actively try out, practice, and explore various Linux commands and utilities. Besides reading this book, having a private space to work freely will assist in your success.

You may already have experience working with Linux in your enterprise environment. However, most likely you are using only one Linux distribution. Training with more than one distribution is needed to pass the Linux+ exam.

In addition, your employer may frown upon any risky behavior on their systems. You need to feel free to try out Linux commands that may cause a system to crash. Your own learning space, containing various Linux distributions and their assorted tools, is a key factor in successfully passing the Linux+ exam.

This chapter begins by looking at a few items concerning the setup of your learning space environment. We will also explore various Linux distributions for your learning space. At the chapter's end, we'll cover a method for accessing the Linux command line.

Setting Up a Learning Space

Your learning space needs to be an environment where you can freely explore Linux and its various distributions (called *distros* for short) and utilities. Whereas some companies may have a spare Linux server available for you to fully use, many of us are not so lucky. Even if you are a student, with a nice lab environment already set up and available for your use, you may want your own space, where you can explore without restrictions.

Although there are many different ways to set up your personal learning space, we will focus on only a few, such as setting up Linux on an old laptop, implementing a virtualized environment, and using the cloud. Hopefully the ideas here will spur you on to setting up a helpful exploration and study environment.

Using That Old Laptop

If you've got a spare or old laptop sitting around, repurposing it as your Linux learning space may work well for you. This is especially useful if you like to move your study environment, such as, for example, moving to a different and quieter location in your home when things get a little loud and crazy. An old desktop will also work, but you will be less mobile.

Whatever system you choose, ensure that it has enough capacity to handle the minimum hardware requirements for a learning space. If you plan on installing multiple Linux distributions on a single system, booting them individually, and not using a virtualized environment, then Table 1.1 will serve as your requirements guide.

TABLE 1.1 Hardware requirements for using a single distribution at a time

Resource	Minimum	Recommended
Memory	2 GB	>= 4 GB
Free disk space	25 GB	>= 30 GB
Processor	2 GHz dual core	> 2 GHz dual core

Although you can use this learning space, it is certainly not ideal. In addition, you can expect this type of Linux learning environment to boot and operate slowly. This learning space environment should be used only if you have no other options.

Creating a Virtualized Environment

Creating a virtualized environment for your Linux learning space is ideal. This setting will allow you to boot multiple Linux distributions at the same time, enable you to move quickly between them, and provide compare and contrast experiences. In addition, you can explore networking utilities more thoroughly in such an environment.

If you are unfamiliar with a virtualized environment, do not despair. Not only are there many resources on the Internet that can get you up to speed, but we also cover virtualization concepts in Chapter 28, "Understanding Cloud and Virtualization Concepts."

There are several excellent and free virtualization products (called *hypervisors* or *virtual machine managers*) that you can install. They include the following:

Oracle VirtualBox This actively developed open source software is available at `www.virtualbox.org`. It can run on Linux, Windows, Macintosh, and even Solaris. You can use VirtualBox to run multiple Linux distributions at the same time, assuming your hardware has enough resources. The website is loaded with helpful documentation and has community forums to help you create your Linux learning space.

VMware Workstation Player VMware Workstation Pro is a proprietary closed source virtualization product. VMware offers a free version called Workstation Player, which is available at `www.vmware.com/products/workstation-player.html`. This free version does have its limits. Workstation Player will only allow you to run a single virtual machine at time. Also, if you want to install it at your company's site, you must pay a fee to do so.

If you are using a Mac, VMware Workstation Player will not work on your system. Instead, VMware offers a separate virtualization product called VMware Fusion. It is available at `www.vmware.com/products/fusion.html`. Unfortunately, Fusion is not free, but you can try it out for free.

Microsoft Hyper-V Server 2019 This closed source virtualization product is available on many current Windows 64-bit versions, such as Windows 10 Professional and Enterprise. However, Windows 10 Home edition does not support it. You can use Hyper-V to run multiple Linux distributions at the same time, assuming your hardware has enough resources.

Please don't feel limited by this list. It includes only a few suggested hypervisors for you to investigate. If you have found a virtualization product that works better for your environment, use it for your learning space.

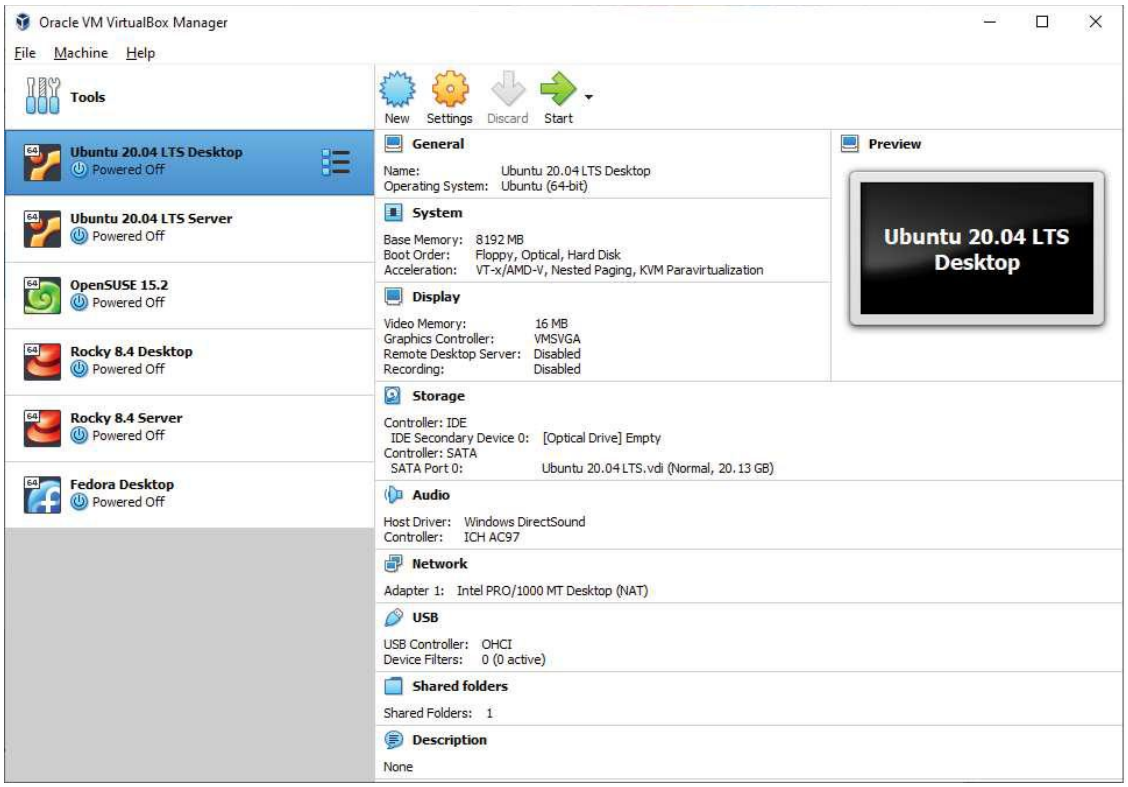
Prior to selecting and installing a particular hypervisor, determine if your laptop or chosen system has enough capacity to handle the entire learning space's minimum hardware requirements. If you plan on installing and running multiple Linux distributions at the same time, use Table 1.2 as a guide for your needed hardware resources. However, be aware that the virtualization products' websites may provide more detailed information.

TABLE 1.2 Hardware requirements for using a virtualization product

Resource	Minimum	Recommended
Memory	8 GB	>= 8 GB
Free disk space	70 GB	>= 100 GB
Processor	x86_64 2 GHz dual core	x86_64 > 2 GHz dual core

Using a virtualized learning space is very flexible. Figure 1.1 shows an example of this type of elastic learning space environment.

FIGURE 1.1 Learning space using Oracle VirtualBox



Notice in the learning space depicted in Figure 1.1 that there are two installations of both the Ubuntu and Rocky Linux distributions. These distributions provide the ability to install either a server-oriented environment or a graphical desktop-oriented environment. With VirtualBox you can easily install both environments and compare them!

Hopefully you are starting to gather some ideas of how you want to configure your private learning space. Before you do, there is one more platform category we need to explore.

Jumping to the Cloud

If you do not own a laptop or desktop with enough resources to provide a multiple Linux distribution learning space, consider the cloud. While cloud servers have become increasingly popular for large environments, they can also provide an easy way to run just a single Linux system.

There are many cloud service providers where you can start up various Linux distribution virtual machines, such as Amazon Web Services (AWS), Microsoft Azure, and DigitalOcean. Cloud services change rapidly, so you may not be able to find the Linux distribution versions

you need. However, it is worth your time to take a look at the various offerings from cloud service providers. The cloud just might be a cheaper option for your learning space than a new computer.

If you choose to use a cloud service, the service may not give you a way to explore certain CompTIA Linux+ objectives, such as, for example, modifying how a Linux server boots via BIOS versus UEFI. Keep this in mind as you explore your learning space venue.

Before you settle on the location for your learning space, consider the various recommended Linux distributions and their versions. These are additional components of your successful learning space environment.

Exploring Linux Distributions

The CompTIA Linux+ certification is vendor neutral. In practical terms, that means no particular Linux distribution is the focus of the exam. If you have experience with Red Hat Enterprise Linux (RHEL), you need to learn more about utilities and features on Ubuntu and openSUSE distributions, and vice versa.

It is tempting to think that Linux distributions are all the same and that few differences exist between them. Unfortunately, this is a fallacy. We like to compare the Linux kernel to a car's engine and a distribution to a car's features. If you have ever rented a car, the car's features are often rather different than the features of the car you normally drive. When you get into the rented car, you have to take a few minutes to adjust the seat, view the various car controls, and figure out how to use them prior to taking off onto the roadway. This is also true with learning new distributions. The good news is that if you have lots of previous experience with Linux, learning a new distribution is not that difficult.

Linux distributions are often based on other distributions or distribution forks. Two popular distribution groups, which contain distributions helpful to passing the Linux+ exam, are Red Hat based and Debian based. Differences between these two groups include software packages, names, and their management tools; configuration filenames and/or locations; software release schedules; firewall configuration utilities; and so on. Red Hat Inc. tends to focus on businesses and enterprise computing, whereas the Debian Project focuses on free software. Due to these various differences, it is necessary to use distributions from both groups in your learning space.

It is important to understand which Linux distros will help you in successfully passing the CompTIA Linux+ certification exam. In addition, you should know which particular distribution versions are helpful.

Looking at Red Hat Enterprise Linux

The original Red Hat Linux started life in 1995 as an open source project. It gained in popularity to the point where it was at one time the most popular Linux distribution, used in educational environments, in corporate environments, and even by casual Linux hobbyists.

However, in 2003 Red Hat discontinued the Red Hat Linux project in favor of the Red Hat Enterprise Linux (RHEL) project. The RHEL project is primarily focused on business Linux environments. RHEL is a commercial package; thus under most situations you must purchase a license to use it. In return, Red Hat provides full customer support to help with setting up and troubleshooting the Linux system, unlike most other Linux distributions.

Fortunately for Linux hobbyists, there is an alternative way to run RHEL. Since Linux is an open source software package, Red Hat is required to release the source code for RHEL. A few other Linux distributions have popped up using the RHEL source code. The most popular had been the Community Enterprise Operating System (CentOS). It was nearly an exact duplicate of RHEL, and a great free study resource for the CompTIA Linux+ certification exam.

However, as is often the case in the fast-moving Linux world, things have changed. In 2014 CentOS joined Red Hat's Open Source and Standards team, and in 2020 Red Hat replaced the original CentOS project with a new development version called CentOS Stream. Although you can still freely obtain CentOS Stream, it's no longer an exact duplicate of the current RHEL version, but rather a testing ground for new concepts, making it less beneficial as a study resource.

But have no fear, the original developers of CentOS have started yet another distribution, named Rocky Linux. Rocky Linux has gone back to the origins of CentOS—it's an exact duplicate of the latest RHEL version. You can obtain a Rocky Linux distribution ISO from the Rocky website at `www.rockylinux.org`. Be aware that this distribution, like many others, comes in multiple flavors. We recommend you obtain the Rocky BaseOS download package, in the 8.x version series (at the time of this writing, at version 8.5).

As time goes on, new Rocky distribution versions will be available. Although it is always tempting to get the latest and greatest version, it is not beneficial to use it in your learning space. Remember that the CompTIA Linux+ objectives are static until the next time the certification exam is updated. Therefore, it is wise to use the distribution versions that were available at the certification exam's creation time.

As you install Rocky Linux, you'll be prompted for the environment you want to install. For learning Linux, it's usually best to install a graphical desktop environment, because that provides the easiest way to access all of the Linux features you'll need to learn about.

After you install your Rocky Linux version 8.x BaseOS distribution, you should update the software packages. Do this by logging into the root account using the password you set up during installation and issuing the commands shown in Listing 1.1.

Listing 1.1: Updating software on Rocky Linux

```
# sudo dnf update
Loaded plugins: fastestmirror
[...]
Upgrade  3 Packages

Total download size: 1.3 M
Is this ok [y/d/N]: y
[...]
Complete!
#
```

While RHEL (and its derivatives) is a popular distro, you also need a distribution in the Debian camp. Next, we'll explore the Ubuntu distribution.

Looking at Ubuntu

The Ubuntu Linux distribution is managed by Canonical LTD and has been around since 2004. This free and popular Linux distro is based on the Debian distribution and is a must-have in your personal Linux learning space.

You can obtain the Ubuntu distro ISO from `www.ubuntu.com`. There are several flavors of Ubuntu, and if you'd like to ensure that you can follow the examples in this book, we recommend you download the Ubuntu Desktop version 20.04 LTS.

The LTS in the Ubuntu version name stands for Long-Term Support. This is an indicator Canonical uses to show that it will provide maintenance and security updates for an extended time period. In the case of 20.04 LTS, you can count on these updates through April 2025.

If you are unfamiliar with Ubuntu, you need to be aware of a few important items. By default, you cannot log into the root account. Instead, when you need to use super user privileges, log into the account you set up at installation and put the command **sudo** in front of your command-line commands. An example is shown in Listing 1.2.

Listing 1.2: Using sudo on Ubuntu

```
$ sudo grep root /etc/shadow
root:!:17737:0:99999:7:::
$
```

If you have never issued command-line commands in a terminal, it is recommended you read this entire chapter prior to attempting to do so. You will read more about terminals later in this chapter.

Another important item concerns installing Ubuntu. If you are connected to a network, you can automatically update the distribution's software when you install the distribution. You will see this option listed in the installation process as `Download updates during the installation` with a check box next to it. If you choose to not install updates during the installation, you can update the software via the command line later on by manually issuing the commands shown in Listing 1.3 in a terminal, using super user privileges.

Listing 1.3: Updating software on Ubuntu

```
$ sudo apt-get update
[sudo] password for Christine:
Hit:1 http://us.archive.ubuntu.com/ubuntu bionic InRelease
Get:2 http://us.archive.ubuntu.com/ubuntu bionic-updates InRelease
[88.7 kB]
[...]
Fetched 1,053 kB in 2s (631 kB/s)
Reading package lists... Done
$
$ sudo apt-get dist-upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
The following packages will be upgraded:
[...]
Do you want to continue? [Y/n] Y
[...]
$
```

If you have room for only two Linux distros, Rocky Linux and Ubuntu make fine choices. If you have additional resources, it would be worthwhile to add another distribution, openSUSE.

Looking at openSUSE

The openSUSE distro had its first release in 1994, under a different name, SUSE Linux. There have been many companies involved in supporting it, with the Germany-based company SUSE being the original.

This distro has a very loyal and solid following. Not only is the openSUSE distribution strongly supported by community developers, the openSUSE users love it as well. One of its unique and popular utilities is the Yet another Setup Tool (YaST). YaST, which can be thought of as a command center utility, allows you to control many system services from one interface.

You can obtain the openSUSE distribution ISO from `https://software.opensuse.org`. This distro comes in two primary flavors, Leap and Tumbleweed. We recommend you select openSUSE Leap in the version 15.x series.

The openSUSE community changed its distribution's version numbering scheme in 2017. The version before 15.0 was 42.3. Be aware of this dramatic change when you go to obtain openSUSE Leap.

Once you have successfully installed openSUSE, it is a good idea to update all the software prior to exploring this distro. To update the software via the command line, manually issue the commands shown in Listing 1.4 in a terminal, using super user privileges.

Listing 1.4: Updating software on openSUSE

```
$ sudo zypper patch
[sudo] password for root:
Loading repository data...
Reading installed packages...
Resolving package dependencies...
[...]
    Note: System reboot required.
Continue? [y/n/...? shows all options] (y): y
[...]
Warning: One of the installed patches requires a
reboot of your machine. Reboot as soon as possible.
There are some running programs that might use files
deleted by recent upgrade. You may wish to check and
restart some of them. Run 'zypper ps -s' to list these programs.
$
```

You may have noticed that the last three distros use different commands for updating software. This is another reason you need to have access to multiple distributions in your learning space. We'll look at one more important distro next.

Looking at Fedora

Fedora is maintained by the Fedora Project, which is sponsored by Red Hat. Innovative and sometimes bleeding-edge software is one of this distribution's great features. If you want to try something new, Fedora is for you. This distro, like the others, comes in multiple flavors, which are called *editions* by the Fedora Project. We recommend Fedora 34 Workstation edition. You can get a copy of this Fedora ISO at `https://getfedora.org`.

Be aware that this particular distro updates its versions every six months. Therefore, you may need to retrieve Fedora 34 Workstation from this location instead: `https://dl.fedoraproject.org/pub/fedora/linux/releases/34/Workstation`.

The Fedora distro comes not only in multiple flavors, but also in multiple spins. A spin is an extra special flavor of Fedora. For example, if you are not happy with the default GUI that comes prepackaged with Fedora, you can opt for a spin that has a different GUI. If you want to browse the various Fedora spins available, take a look at the Fedora Project spins' website, `https://spins.fedoraproject.org`.

Similar to the Ubuntu distro, by default you cannot log into the root account. Instead, when you need to use super user privileges, log into the account you set up at installation, and put the command **`sudo`** in front of your command-line commands.

Once you've got Fedora Workstation successfully installed, update the software. To update the software via the command line, log into the account you set up at installation, and manually issue the commands shown in Listing 1.5 in a terminal, using super user privileges.

Listing 1.5: Updating software on Fedora

```
$ sudo su -c 'dnf upgrade'
[sudo] password for Christine:
[...]
Install    4 Packages
Upgrade  161 Packages

Total download size: 295 M
Is this ok [y/N]: y
Downloading Packages:
[...]
Complete!
$
```

If very few packages get updated, you may need to add an additional option to your command. Issue the command **`sudo su -c 'dnf upgrade -refresh'`** in a command-line terminal.

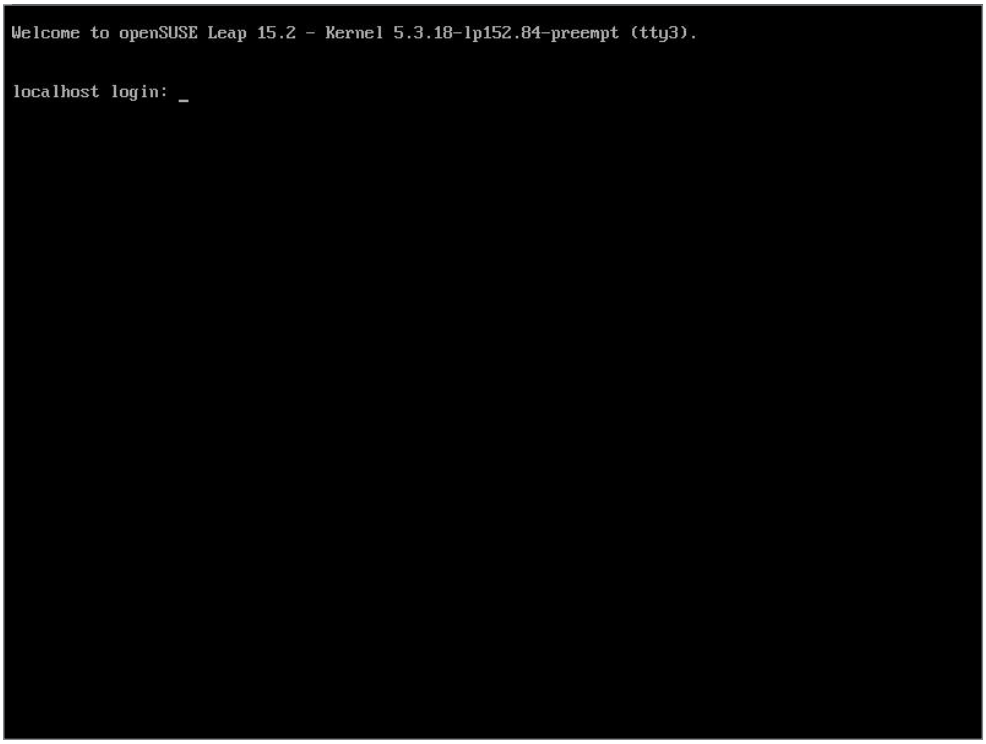
If you have spent your time on Linux in the GUI or are fairly new to Linux, you may be unfamiliar with how to access a command-line terminal. The next section will help. If you are a seasoned command-line user, you can skip this section.

Locating a Terminal

For exploring Linux and preparing to take the CompTIA Linux+ certification exam, you need to spend some time at the command line. The terminal is your gateway to the command line. Once you understand how to locate and use this terminal, you can start progressing through the rest of this book's contents.

The simplest way to reach a terminal in most distributions is by pressing the key combination Ctrl+Alt plus one of the function keys (usually F2 or F3) after the system boots. This will take you to a terminal named tty2. After entering the username and password you created during the Linux distribution's installation, you will be provided with a prompt. Figure 1.2 shows a tty3 terminal on the openSUSE distribution.

FIGURE 1.2 openSUSE tty3 terminal



At the terminal prompt, you can start entering commands. If you have newly installed the distro, go ahead and update its software as directed earlier in this chapter. To leave this terminal, simply type in the command **`exit`**.

If you're using a graphical desktop environment, you can also access the command line by using a terminal application.

Summary

A learning space is a virtual or physical Linux system where you can explore, practice, and try out various Linux commands and utilities. A private learning space is a necessity to be successful in passing the CompTIA Linux+ certification exam. You can set up a learning space on an old laptop, on a current laptop using a hypervisor, or within the cloud.

Having multiple Linux distributions in your learning space is also essential. Because the distributions have differences, it is important to have them readily available to explore those differences.

Once you have your Linux learning space set up, you can start to dive into the CompTIA Linux+ certification objectives. We'll begin covering those objectives in the next chapter.