Quickstart instructions for Volumes 2 and 3 of the self-study course "Using and Administering Linux – Zero to SysAdmin"

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Objectives

This document provides a solution to students who have already worked through Volumes 1 and/or 2 of the Linux self-study course, "*Using and Administering Linux – Zero to SysAdmin*[1]" with a means to continue taking this course starting with either Volume 2 or Volume 3 in the event that there is a need to recreate the state of the virtual machine (VM) and virtual network at the beginning of either Volume 2 or 3.

This might be the case in the event that you have completed Volume 1 and a significant amount of time has elapsed before you could continue and the original VM was deleted or changed significantly. This might also be necessary if the physical host on which the first one or two volumes of the course were taken is no longer available for some reason, or you may wish to set up a second host in a separate location for use in your own experimentation.

Of course if you have been following along with the first volumes of this self-study course, you should also have made snapshots of the VM at the ends of Volumes 1 and 2, as well as various points within each volume, and should be able to recover from there. However, this might also be needed in the event that you – as I have done myself on occasion – have borked the VM so badly that the only reasonable way to continue is to start over from a known state in which the VM is ready to begin at the beginning of Volume 2 or 3 of the course.

This document makes the following assumptions.

1. That you have the knowledge and skills to install VirtualBox on either a Linux or Windows host.
2. That you have administrative authority (root) to do so.
3. That you have the knowledge and skills to configure the virtual network according to a given set of specifications.
4. That you have the knowledge and skills to download and install a Fedora ISO image onto the hard drive of the host system.
5. That you are able to install Linux conforming to a given set of specifications.
6. That you are able to download a tar archive from the Apress repository and extract its contents on the VM.
7. That you can run the downloaded script with command line options to run it in such a manner as to duplicate as nearly as possible the appropriate state of the VM as it should be at the beginning of Volume 2 or 3 of this course.

This document will provide you with the following information.

1. How to choose a computer host on which to install VirtualBox and a virtual machine (VM) on which you can perform the experiments.
2. The specifications for a small VM, StudentVM1, that you will need to create.
3. The specifications required to configure the virtual network adapter as needed for this course.

[1]Both, David, *Using and Administering Linux – Zero to SysAdmin*, http://www.both.org/?page_id=1183

4. The specific Fedora distribution of Linux required to install on the VM.
5. The location from which to download a script that can be used configure the VM state to be as near as possible to that needed to start at the beginning of Volume 2 or Volume 3 of this self-study course.

The most recent version of this document and the quickstart.sh script is available from the Apress GitHub at https://raw.githubusercontent.com/Apress/using-and-administering-linux-volume-2/master/quickstart.zip. Download the Zip file that contains them both. Extract the content of the quickstart.zip file. Open this QuickStartVol2and3.odt document, read it, and follow the directions. This document will guide you through the steps required to:

1. Download the latest version of VirtualBox for your operating system.
2. Install VirtualBox.
3. Create a virtual network with specific configuration that will be used in Volumes 2 and 3 of this self-study course.
4. Use VirtualBox to create a virtual machine host.
5. Install The latest version of Fedora on the VM.
6. Install the accompanying quickstart.sh script on the VM.
7. Run the script to configure the VM appropriately for the start of Volume 2 or Volume 3 of this course.

Tip: This document and the accompanying script are not required if you start with Volume 1 of this course.

Warning: This document is provided solely as an aid to students who have a need to recreate the state of the StudentVM1 virtual machine as closely as possible as it should exist at the beginning of either Volume 2 or Volume 3 of this three-part self-study course. You must already have the skills required to perform all of the necessary tasks to accomplish this. In other words, you must have already been through either one or both of the preceding volumes of this course and have performed the experiments therein, or have equivalent knowledge and experience.

Introduction

About this self-study course

This Linux training course, "Using and Administering Linux – Zero to SysAdmin," consists of three volumes. Each of these three volumes is closely connected and they build upon each other. It is not normally possible or recommended to start with Volume 2 or Volume 3 because they both depend upon a virtual environment – a virtual network and a virtual machine – that are created in Volume 1 and that is modified by many of the experiments in all three volumes.

This Linux training course differs from others because it is a complete self-study course. You should start at the beginning of Volume 1 and read the text, perform all of the experiments, and do all of the chapter exercises through to the end of Volume 3. If you do this, even if you are starting from zero knowledge about Linux, you can learn the tasks necessary to becoming a Linux System Administrator, a SysAdmin.

Another difference this course has over others, is that all of the experiments are performed on one or more virtual machines (VMs) in a virtual network. Using the free software, VirtualBox, you will create this virtual environment on any reasonably sized host, whether Linux or Windows. In this virtual environment you are free to experiment on your own, make mistakes that could damage the Linux installation of a hardware host, and still be able to recover completely by restoring the Linux VM host from any one of multiple snapshots. This flexibility to take risks and yet recover easily makes it possible to learn more than would otherwise be possible.

The three volumes of this course present a complete, end to end Linux training course for students like you who know before you start that you want to learn to be a Linux System Administrator – a SysAdmin. This Linux self-study course will allow you to learn Linux right from the beginning with the objective of becoming a SysAdmin.

What this course is not

This course is not a certification study guide. It is not designed to help you pass a certification test of any type. This course is intended purely to help you become a good or perhaps even great SysAdmin, not to pass a test.

There are a few good certification tests. Red Hat and Cisco certifications are among the best because they are based on the test-taker's ability to perform specific tasks. I am not familiar with any of the other certification tests because I have not taken them. But the courses you can take and books you can purchase to help you pass those tests are designed to help you pass the tests and not to administer a Linux host or network. That does not make them bad – just different from this course.

Content overview

This quick overview of the contents of each volume should serve as a quick orientation guide if you need to locate specific information. If you are trying to decide whether to purchase these companion volumes, it will give you a good overview of the entire course.

Using and Administering Linux: Volume 1, Zero to SysAdmin: Getting Started

Volume 1 of this training course introduces operating systems in general and Linux in particular. It briefly explores the The Linux Philosophy for SysAdmins[2] in preparation for the rest of the course.

It then guides you through the use of VirtualBox to create a virtual machine (VM) and a virtual network to use as a test laboratory for performing the many experiments that are used throughout the course. In Chapter 5, you will install the Xfce version of Fedora – a popular and powerful Linux distribution – on the VM. In Chapter 6 you will learn to use the Xfce desktop which will enable you to leverage your growing command line interface (CLI) expertise as you proceed through the course.

Chapters 7 and 8 will get you started using the Linux command line and introduce you to some of the basic Linux commands and their capabilities. In Chapter 9 you will learn about data streams and the Linux tools used to manipulate them. And in Chapter 10 you will learn a bit about several text editors which are indispensable to advanced Linux users and system administrators. You will learn how to use the Vim editor well enough to perform the editing required of a SysAdmin.

Chapter 11 through 13 start your work as a SysAdmin and takes you through some specific tasks such as installing software updates and new software. Chapters 14 and 15 discuss more terminal emulators and some advanced shell skills. In Chapter 16 you will learn about the sequence of events that take place as the computer boots and Linux starts up. Chapter 17 shows you how to configure your shell to personalize it in ways that can seriously enhance your command line efficiency.

Finally, Chapter 18 and 19 dive into all things file and filesystems.

Using and Administering Linux: Volume 2, Zero to SysAdmin: Advanced Topics

ISBN-13: 978-1484254547

Volume 2 of Using and Administering Linux introduces you to some incredibly powerful and useful advanced topics that every SysAdmin must know.

In Chapters 1 and 2 you will experience an in-depth exploration of logical volume management – and what that even means – as well as the use of file managers to manipulate files and directories. Chapter 3 introduces the concept that, in Linux, everything is a file. You will also learn some fun and interesting uses of the fact that everything is a file.

[2]Both, David, *The Linux Philosophy for SysAdmins*, Apress, 2018

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In Chapter 4 you will learn to use several tools that enable the SysAdmin to manage and monitor running processes. Chapter 5 enables you to experience the power of the special filesystems, such as /proc, that enable us as SysAdmins to monitor and tune the kernel while it is running – without a reboot.

Chapter 6 will introduce you to regular expressions and the power that using them for pattern matching can bring to the command line, while Chapter 7 discusses managing printers and printing from the command line. In Chapter 8 you will use several tools to unlock the secrets of the hardware in which your Linux operating system is running.

Chapters 9 through 11 show you how to do some simple – and not so simple – command line programming and how to automate various administrative tasks.

You will begin to learn the details of networking in Chapter 12, and Chapters 13 through 15 show you how to manage the many services that are required in a Linux system. You will also explore the underlying software that manages the hardware and can detect when hardware devices such as USB thumb drives are installed and how the system reacts to that.

Chapter 15 shows you how to use the logs and journals to look for clues to problems and confirmation that things are working correctly.

Chapters 17 and 18 show you how to enhance the security of your Linux systems, including how to perform easy local and remote backups.

Using and Administering Linux: Volume 3, Zero to SysAdmin: Network Services

ISBN-13: 978-1484254844

In Volume 3 of Using and Administering Linux you will start by creating a new VM on the existing virtual network. This new VM will be used as a server for the rest of this course and it will replace some of the functions performed by the virtual router that is part of our virtual network.

Chapter 2 begins this transformation from simple workstation to server by adding a new network interface card (NIC) to the VM so that it can act as a firewall and router, then changing its network configuration from DHCP to static. This includes configuring both NICs so that one is connected to the existing virtual router so as to allow connections to the outside world, and so that the other NIC connects to the new “inside” network that will contain the existing VM.

Chapters 3 and 4 guide you through setting up the necessary services, DHCP and DNS, that are required to support a managed, internal network, and Chapter 5 takes you through configuration of SSHD to provide secure remote access between Linux hosts. In Chapter 6 you will convert the new server into a router with a simple yet effective firewall.

You will learn to install and configure an enterprise class email server that can detect and block most spam and malware in Chapters 7 through 9. Chapter 10 takes you through setting up a web server and in Chapter 11 you will set up WordPress, a flexible and powerful content management system.

In Chapter 12 you return to email by setting up a mailing list using MailMan. Then Chapter 13 guides you through sharing files to both Linux and Windows hosts. Sometimes accessing a desktop remotely is the only way to do some things so in Chapter 14 you will do just that.

Chapter 15 shows you how to set up a time server on your network and how to determine its accuracy. Although we have incorporated security in all aspects of what has already been covered, Chapter 16 covers some additional security topics.

Chapter 17 discusses package management from the other direction by guiding you through the process of creating an RPM package for the distribution of your own scripts and configuration files.

Finally, Chapter 18 will get you started in the right direction because I know you are going to ask, "Where do I go from here?"

What this procedure does

The procedures outlined in this document enable you to create a VM using VirtualBox and to install Fedora on the VM. Then you can use the script that you downloaded in the tarball archive along with this document to perform the following tasks to prepare the VM to start either Volume 2 or Volume 3 of the self-study course.

- Install all RPM packages that have been installed during the experiments performed during the previous volume or volumes of the course.
- Perform as much configuration of the StudentVM1 as possible in order to bring it as close to the desired state as possible.
- Download files used for experiments from the Apress GitHub repository.
- Create most of the files that were generated during the previous experiments. Some of these files will be used during experiments in the remaining volumes of the course.

Note: The content of the files created during the execution of the script will not necessarily be the same as that as would have been created by you during the previous volumes of the course. This may result in some incorrect or different results than displayed in the remaining volumes of the course.

What this procedure does not do

This procedure cannot restore all of the personal experimentation that you might have done during previous volumes. It cannot configure the Lxde desktop, or any of the desktop applications. It cannot set your personal desktop configuration.

Host system specifications

This section provides a general set of specifications for the host computer needed to run VirtualBox and the StudentVM1 virtual machine.

Note: In this document the term “host” means the physical computer system on which you will install the VirtualBox virtualization software and create and run the virtual machine, StudentVM1, which will be used for the installation of Fedora and the course experiments. The virtual machine is also referred to as the guest.

Hardware specifications

In order to perform the experiments contained in this course you must have access to a single physical computer that can run a single virtual machine, and at least two virtual machines for the last volume in this series. These hardware specifications are intended to provide you with some guidance for selecting a computer for use with this course.

The hardware specifications listed here should be enough to handle at least three virtual machines because at least two and possibly three will be required in Volume 3. You should nevertheless consider these hardware specifications as a *minimum* for use during this course. More is always better.

The motherboard, Processor, and memory should be 64-bit. Many of the 32-bit versions of Linux are no longer supported. Figure 1 is a list of the minimum physical hardware requirements for this course. More is always better.

Component	Description
Processor / CPU	The Intel i5 or i7 processors or an AMD equivalent; at least 4 cores plus hyperthreading with support for virtualization; 2.5GHz or higher CPU speed.
Motherboard	Capable of supporting the Intel processor you selected above; USB support for a keyboard and mouse; video output that matches the video connector of your display (see below) such as VGA, HDMI or DVI.
Memory	I recommend at least 8GB or RAM for your host system. This will allow sufficient memory for multiple VMs and still have enough available for the host itself.
Hard drive	Internal or external hard drive with at least 300GB of free space for storage of virtual machine disk drives.

Component	Description
Network	One Ethernet network interface card (NIC) that has support for 1Gb connections.
Keyboard and mouse	Seems obvious but just being thorough.
Video display	Any decent screen monitor will do so long as it is at least HD resolution and large enough to allow for a VM window of sufficien size to contain multiple open terminal and application windows in a side-by-side arrangement.
Internet connection	The physical host must have an Internet connection with at least 2Mb/s download speeds. Greater download speed is highly recommended and will make downloading faster and result in less waiting.

Figure 1: Physical system minimum hardware requirements.

Host Operating System Requirements

In all probability the computer you use will already have an operating system installed and it will most likely be Windows. Preferably you will have the latest version which, as of this writing, is Windows 10 with all updates installed.

The preferred operating system for your physical lab host would be Fedora 30 or the most recent version of Fedora that is currently available. Any recent version of Linux is fine so long as it is 64-bit. I recommend Fedora 30 or more recent if you have a choice. I strongly recommend using the most recent version of Fedora because that is what I am using in this self-study course and you won't need to make any adjustments for other distributions. You will be using Fedora on the virtual machines anyway so this makes the most sense. Regardless of which operating system is installed as the host OS on your lab system, you should use VirtualBox as the virtualization platform for these experiments because it is open source and free of charge. All of the procedures for creating the VMs and the virtual network are based on VirtualBox so I strongly suggest that you use it for virtualizing your lab environment. Other virtualization tools would probably work but it would be your own responsibility to install and configure them and the VMs you create.

VirtualBox

The VirtualBox virtualization software can be downloaded from web pages accessible from the URL at https://www.virtualbox.org/wiki/Downloads.

Note: You must have root access, i.e., the root password, on a Linux host, or be the administrator on a Windows host in order to install VirtualBox. You will also need to have a non-root user account on the Linux host.

The virtual machine

This section describes the specifications required for the creation of the StudentVM1 virtual machine.

VirtualBox

VirtualBox is the virtualization software required for this course.

Download the latest version of VirtualBox for the host operating system from https://www.virtualbox.org/. Click through to the downloads section, select the host operating system. For Windows, the download of the installer starts immediately. For Linux you must then choose the correct version of VirtualBox for the Linux distribution running on the host.

The AMD version is the 64-bit version of VirtualBox and is used for both AMD and Intel processors. Do not use the i386 version under any circumstances.

Download the correct version of VirtualBox and install it using the directions found in the VirtualBox user manual.

VirtualBox Manager

Before creating the VM itself, we need to create a virtual network that has a well defined configuration. This will enable the experiments in this course to work as designed. After the virtual network has been configured we will create the virtual machine and configure it properly for use in the experiments. This VM will also be used in the follow-on course.

Both tasks, configuring the virtual network and creating the VM, are accomplished using the VirtualBox Manager which is a GUI interface that is used to create and manage VMs.

Start by locating the Oracle VM Virtual Box item in the application launcher on your desktop. Click on this icon to launch the VirtualBox Manager. The first time the VirtualBox Manager is launched it displays the VirtualBox Welcome shown in Figure 2.

Figure 2: The VirtualBox Manager welcome is displayed the first time it is launched.

The Virtual Manager is identical in both Windows and Linux. The steps required to create your VM is the same. Although VirtualBox can be managed from the command line I find that, for me, working with the GUI interface is quick and easy. Although I am a strong proponent of using the command line, I find that using the VirtualBox Manager GUI interface is easy and quick enough for the type of work I am doing. Besides, for the purposes of this document, it will probably be easier for you. Using the GUI will certainly enable you to more easily find and understand the available options.

Configuring the virtual network

Before creating the virtual machine, let's configure the virtual network. The virtual network is a private network that exists only on the VirtualBox host. It is designed to allow the user to manage access to the outside world. The virtual router which is created also provides services such as DHCP and name services for the VMs that are created on the virtual network.

VirtualBox has a number of interesting options for connecting the VM hosts to a network. The Oracle VM VirtualBox User Manual[3] lists these options with excellent descriptions of the capabilities of each as well as their limitations.

[3]The Oracle VM VirtualBox User Manual (PDF),
https://download.virtualbox.org/virtualbox/5.2.16/UserManual.pdf , 96-107

The simplest is the default which is using Network Address Translation[4] (NAT) which allows the VM to talk to the Internet but which does not allow multiple VM hosts to talk to each other. Because we will need our VM to be able to communicate with at least one more host in the next course, this option won't be appropriate for us. We will instead use the NAT Network option which allows hosts to communicate with each other on the virtual network as well as the outside world through a virtual router. The limitation of the NAT Network option is that it does not allow communication from the physical host into the virtual network. We can overcome that limitation if we need to, but the NAT Network option gives us the virtual network environment that most closely resembles a real network so that is what we will use.

We will discuss networking in more detail during the course, but for now, the folks at whatismyipaddress.com, referenced in footnote 3, have the best short description of NAT, while Wikipedia[5] has an excellent, if somewhat long and esoteric, discussion of NAT. We will use the VirtualBox Manager to create and configure the virtual NAT Network.

1. The VirtualBox Manager should be open. If it is not, start the VirtualBox manager now.
2. On the Menu bar, click on **File => Preferences**.
3. Click on the Network folder on the left side of the Preferences window as shown in Figure 3.

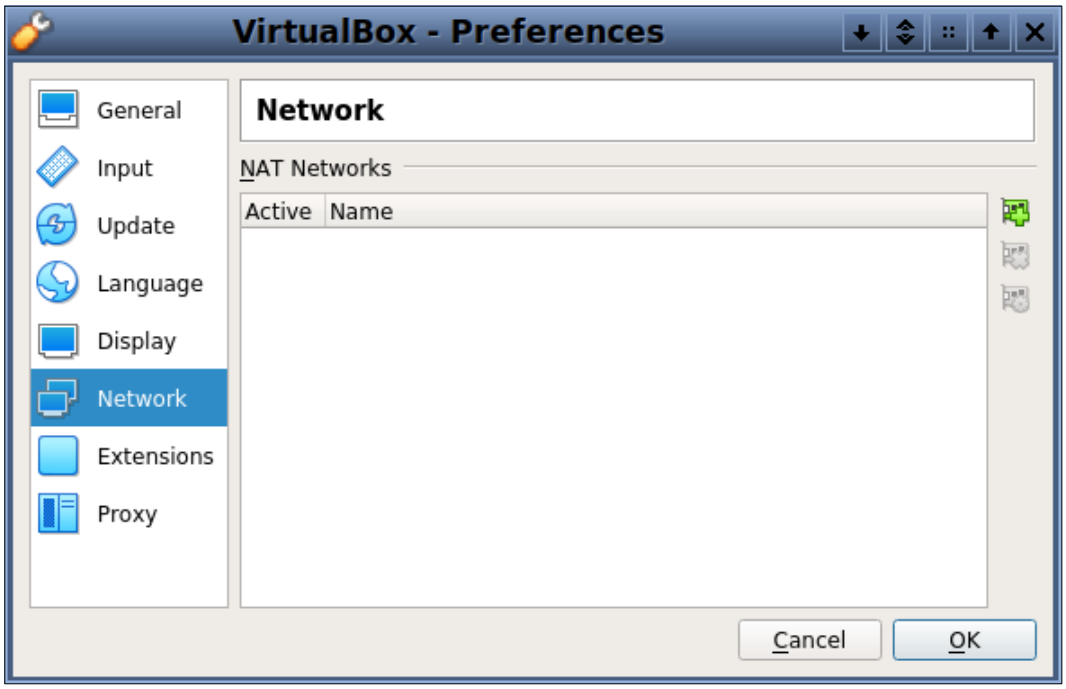

Figure 3: Select the Network folder to add a NAT Network.

4. On the right side of the Preferences dialog box, click on the little network adapter icon with the green + (plus) sign to add a new NAT network. The network is added and configured automatically.

[4] https://whatismyipaddress.com/nat

[5] Wikipedia, *Network Address Translation*, https://en.wikipedia.org/wiki/Network_address_translation

5. Double click on the new NatNetwork or the bottom icon on the right side of the Preferences dialog box and change the Network Name to StudentNetwork as in Figure 4.

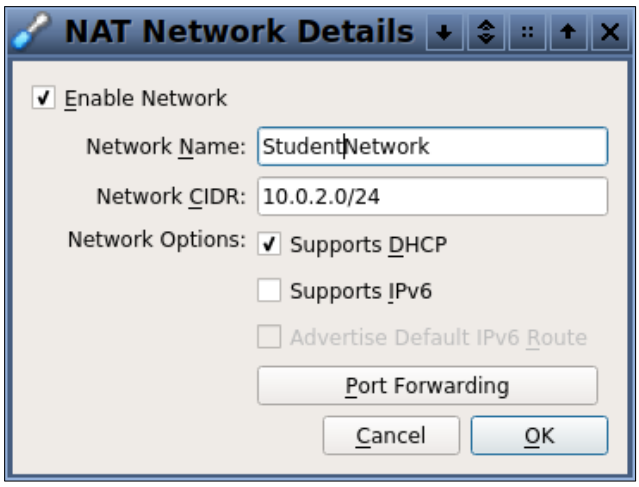

Figure 4: Change the Network Name to StudentNetwork.

6. Click on the OK button to complete the name change, and then click the OK button on the Preferences dialog.

   The virtual network configuration is complete.

Disk space

In order to have space for the virtual machines that we will be using in this course, it may be necessary to clear some space on a hard drive. You should make backups of your system before taking this step. If you have a host with about 300GB of free hard drive space already available for your home directory, you can skip this section. If you have less than that amount of space available, you will need to allocate some disk space for storing the virtual hard drives and other files required for the virtual machines.

I found it a useful alternative to allocate an external USB hard drive on which to locate the virtual machines for the experiments in this course. I don't have an external hard drive smaller than 500GB and I had this one on hand so it is what I used. I suggest using an external USB hard drive that is designated by the vendor to be at least 300GB capacity. In reality, less than that will be available to the user after the partition is created and formatted. Be sure to make a backup of any data on this external hard drive that you might want to keep.

Download the ISO image file

Now is a good time to download the Fedora[7] ISO live image file. This is just a file that is an image we can copy to a CD or USB thumb drive. You can insert the CD or thumb drive into a computer and boot from it

[7]Fedora Project, *Fedora's Mission and Foundations*, https://docs.fedoraproject.org/en-US/project/

to run Linux in a test drive environment. Booting this live image device on your computer will not make any changes to the hard drive of the computer until you install Linux.

For our purposes we will not need to install the image on a hardware device such as a USB thumb drive, all we need to do is download the image so this will be very easy. The VM we create will boot directly from the live image file when we are ready to install Linux – no external physical media will be needed.

We will use the Fedora image for Xfce[7] which is one of the alternate desktops. We could use KDE or GNOME, but for this course we will use Xfce which is much smaller and uses far less system resources. It is also fast and has all of the features we need in a desktop for this course without a lot of extra features that cause code bloat and reduced performance. The Xfce desktop is also very stable so does not change much between Fedora releases which occur every six months or so. Be sure to use the Fedora release that is most current at the time you take this course.

Note: Although Fedora 29 is used in this document and in the course itself, be sure to use the most recent release of Fedora and the installation ISO image.

Use your favorite browser and navigate to the following URL which automatically takes you to the most recent release of the Fedora Xfce ISO image:

https://spins.fedoraproject.org/xfce/download/index.html.

Click on the button with the **Download** label.

For students with a Linux host, select the /tmp directory in which to store the download and click on the **Save** button. If you have a Windows host or a browser that does not allow you to select a download directory, the default download directory is fine. Just be sure you know where the downloaded ISO image file is located on the hard drive.

We will use this file when we install Fedora Linux on the VM but we need to create the virtual machine first.

Create the VM

You need to first create the VM and then make some configuration changes – things that cannot be set during the initial creation of the VM. Figure 5 is the list of specifications you will need to create and configure the StudentVM1 virtual machine.

Any setting that is not listed in Figure 5 needs no changes made to it.

[7]Fedora Project, *Xfce*, https://spins.fedoraproject.org/xfce/

Setting	Value
General	

Quickstart Setup

Setting	Value
VM Name	StudentVM1
Operating system	Fedora 64-bit
File location	Default. Do not change unless you have a non-standard location for the files such as an external hard drive.
Groups	Virtual Network for Training
System	
Base memory	4096MB. If the host computer has plenty of RAM, allocating more base memory to the VM is good but not necessary.
Processors	2
Boot order	Optical, Hard disk
Acceleration	VT-x/AMD-V, Nested Paging, KVM Paravirtualization. These are the default settings
Display	
Video memory	128MB
Remote desktop server	Disabled
SATA Storage Controller	
Number of SATA ports	4. The default is 1 but you will need a total of 4.
SATA Disk devices	
All virtual hard drives should be SATA and attached to the single SATA controller. All virtual hard drives should be the default .vdi type.	

SATA port	Virtual Disk Name	/dev name	Comment
0	StudentVM1.vdi	/dev/sda	60GB. This device is created during creation of the virtual machine.
1	StudentVM1-1.vdi	/dev/sdb	20GB. This device must be added after the VM has been created.

Setting		Value	
2	StudentVM1-2.vdi	/dev/sdc	2GB. This device must be added after the VM has been created.
3	StudentVM1-3.vdi	/dev/sdd	2GB. This device must be added after the VM has been created.
Network			
Adapter 1		Connect to StudentNetwork NAT network.	

Figure 5: The specifications for the StudentVM1 virtual machine.

Creating additional virtual drives

Some chapters have the student create additional virtual drives that will be used throughout the rest of the course. This cannot be done using a script from within the VM so we need to create them.

In the VirtualBox Manager open the **Settings** dialog and go to the **Storage** tab. On the SATA controller line, click on the rightmost icon to add a new hard drive. Hover over the icon and the hint says, "Adds hard disk." Click on the **Adds hard disk** icon. Then, for each new virtual drive, click on the **Create new disk** button. Leave VDI as the hard disk file type and click on **Next** to continue. Leave the storage as **Dynamically allocated** and click the **Next** button.

On the **File location and size** dialog, we won't change the default location but we will change the file names to **StudentVM1-1**, **StudentVM2**, and **StudentVM3** and set the sizes to those specified in Figure 5. Click on the **Create** button to complete creation of the new virtual hard drive. Click on the **OK** button to close the settings dialog.

Install Fedora

Now that the virtual network and virtual machine have been created we can perform the installation of Fedora.

Boot the Fedora live image

If this were a physical host, you would create a physical USB thumb drive with the ISO image on it and plug it into a USB slot on your host. In order to boot the live ISO image in our VM we need to "insert" it into a logical device.

1. Open the **Settings** for the StudentVM1 VM.

2. Select the **Storage** page.
3. Click on the **Empty** disk icon on the **IDE** controller. If you do not have an IDE controller on your VM – which is possible but very unlikely – you can right click on the white space in the Storage Devices panel and choose to add a new IDE controller. Only one IDE controller can be added.
4. Click on the **CD** icon to the right of the **Optical Drive** field of the IDE controller. As you can see in Figure 6, this opens a selection list that enables us to select which ISO image to mount on this device.
5. Unlike my workstation, your computer will probably have no images in this list. Select the **Choose Virtual Optical Disk File** item.

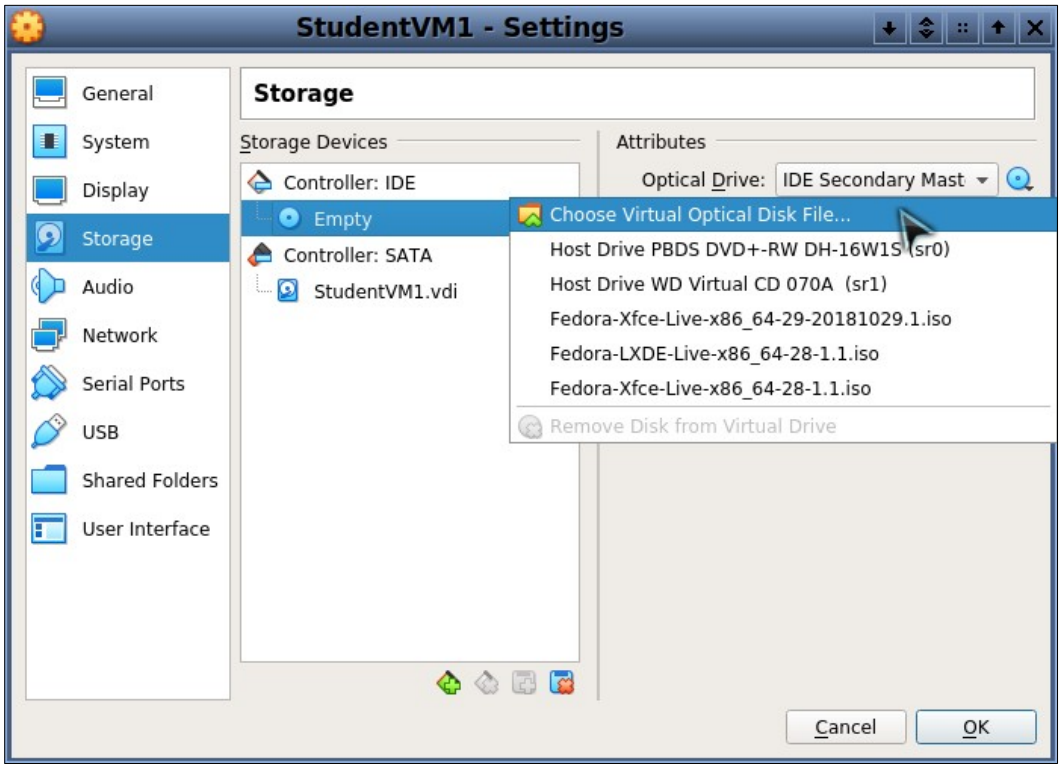

*Figure 6: Select **Choose Virtual Optical Disk File** to locate and mount the ISO image.*

6. Navigate to the location in which you stored the file when you downloaded it and click on the file, then click **Open** to set the mount. In Figure 7 we see the ISO image file which is located in the /tmp directory.

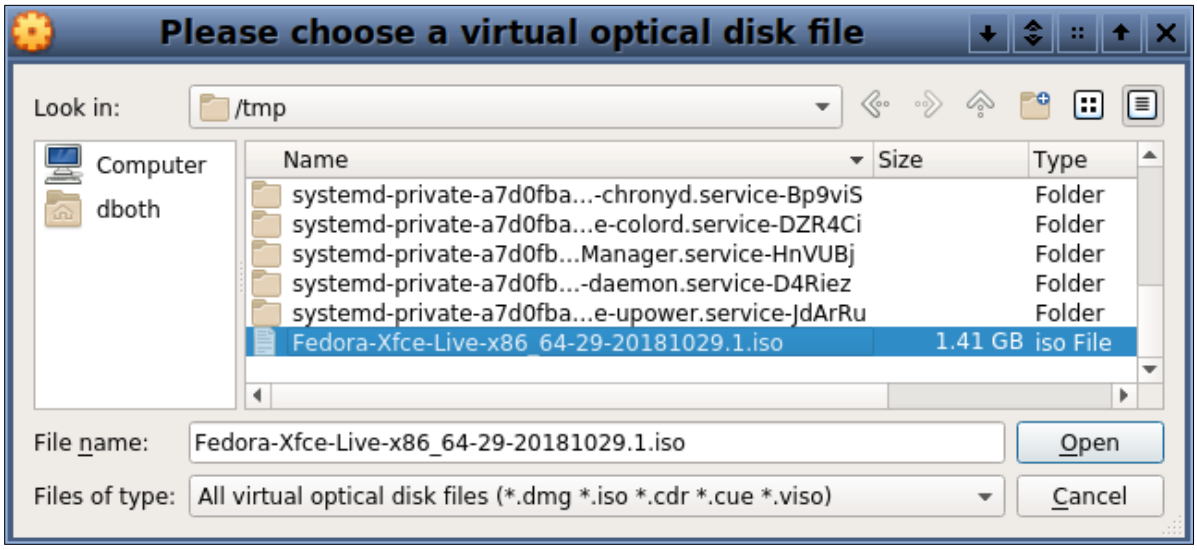

Figure 7: Select the ISO image file and then click on ***Open.***

7. Verify that the correct file is selected for the IDE controller in the Storage Devices box as shown in Figure 8. Click OK. The Fedora live ISO image file is now "inserted" in the virtual optical drive and we are ready to boot the VM for the first time.

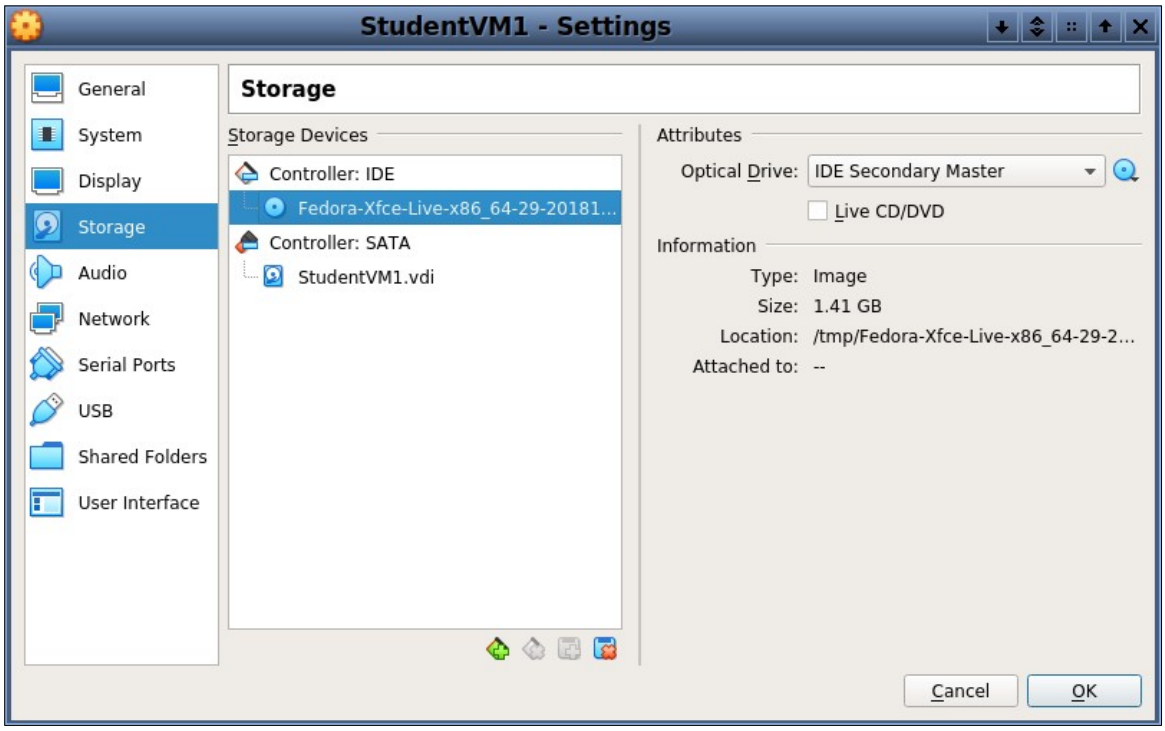

Figure 8: The Fedora live image ISO file is now "inserted" in the virtual optical drive.

8. To boot the VM, be sure that the **StudentVM1** virtual machine is selected and click on the green **Start** arrow in the icon bar of the VirtualBox Manager. This launches the VM which opens a window in which the VM will run and boots to the image file. The first screen you see is shown in

Figure 9. The first time you use VirtualBox on any physical host, you will also get a message, "You have the Auto capture keyboard option turned on. This will cause the Virtual Machine to automatically capture the keyboard every time the VM window is activated..." and then you'll see also get a similar message about mouse pointer integration. They're just informational, but you can change these settings if you like.

9. This first screen has a countdown timer and the second item is already selected. After the timer counts down to zero, or when you press the Enter key, this selection will first test the install medium to detect any errors and then boot to the installer if there are no problems. We can skip the test because it is far less useful for our image file than it would be for a physical DVD or USB thumb drive. Press the UP arrow on your keyboard to highlight the entry **Start Fedora-Xfce-Live 29**, as shown in Figure 9, and press the **Enter** key on your keyboard.

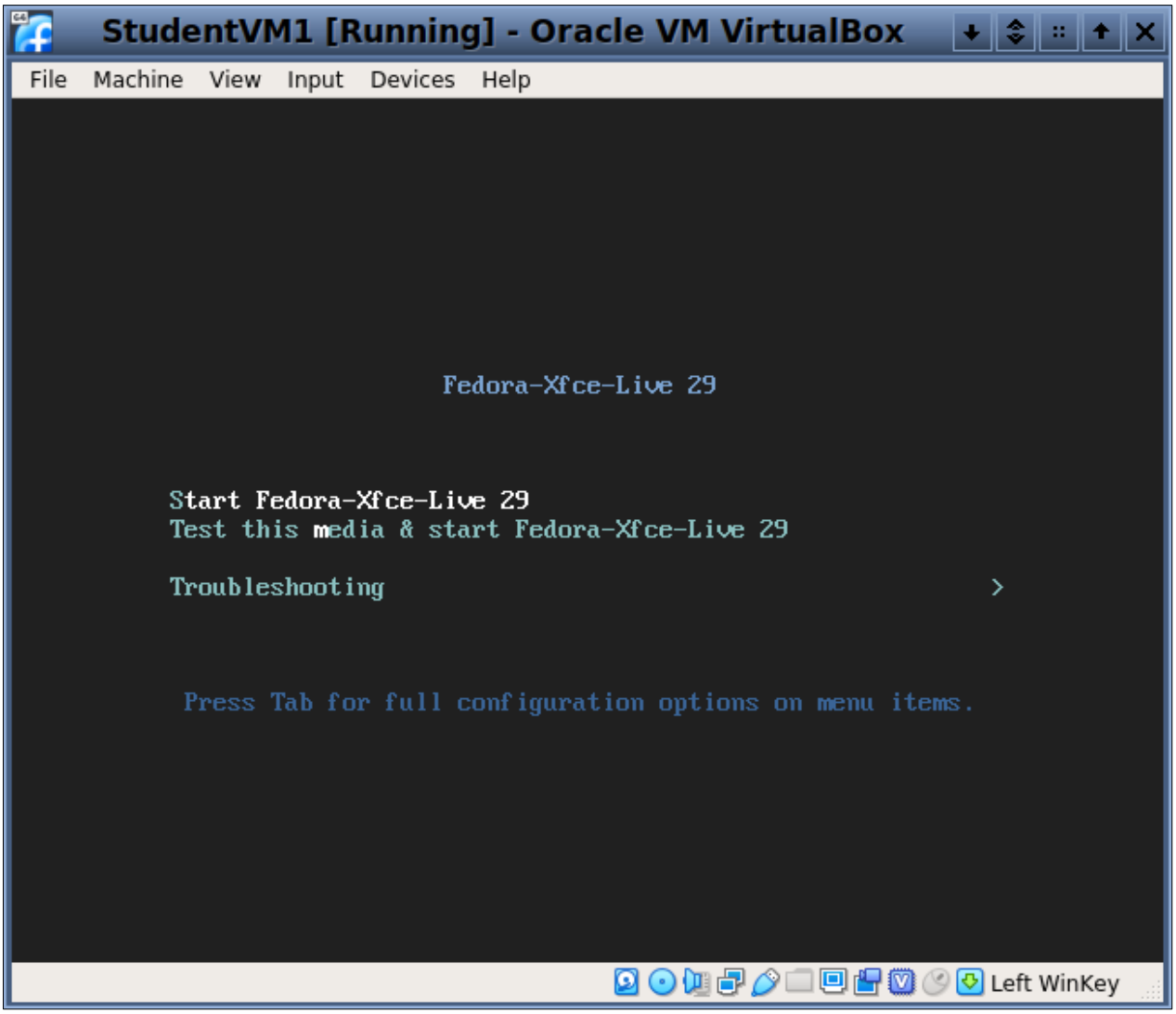

*Figure 9: Select the **Start Fedora-Xfce-Live 29** menu item and press **Enter**.*

10. The VM boots into a login screen as shown in Figure 10. The only user account is the Live System User and there is no password. Click on the **Log In** button to access the live desktop.

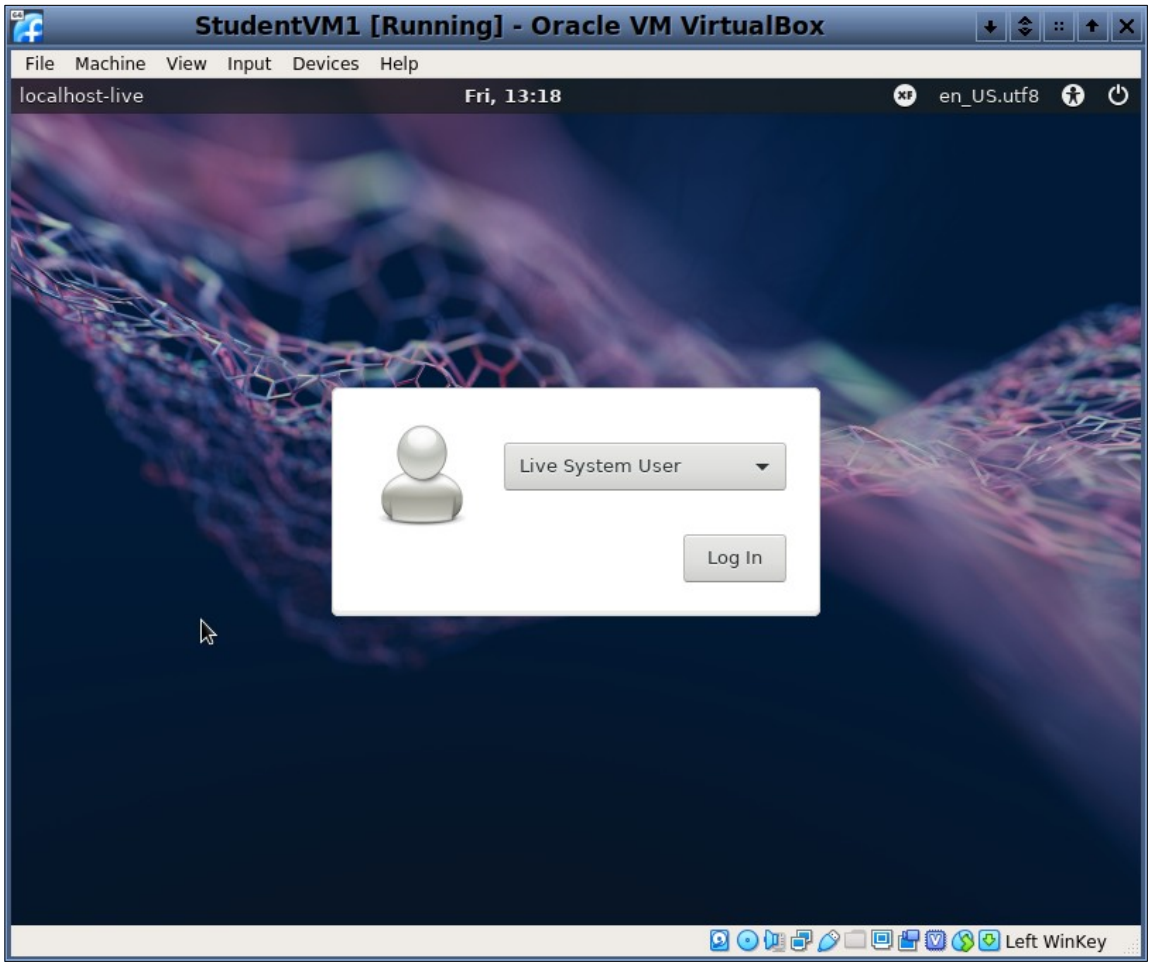

*Figure 10: Click the **Log In** button to login.*

Your VM is now booted to the Live Image and you could spend some time exploring Linux without installing it. In fact, if I go shopping at my local computer store – I stay away from the big box stores because they never have what I want – I take my trusty Live Linux thumb drive and try out the various systems that my local computer store has on display. This lets me test Linux on them and not disturb the Windows installations that are already there.

Start the installation

Installing Fedora from the Live Image is easy, especially when using all of the defaults. We won't use the defaults because we are going to make a few changes, the most complex one being to the virtual hard drive partitioning. If you have any questions about the details of installation and want more information, you can go to the Fedora installation documentation at, https://docs.fedoraproject.org/en-US/fedora/f29/install-guide/install/Installing_Using_Anaconda/ . This URL will be different for later versions of Fedora. Just be sure to use the correct Fedora release number when you enter the URL.

To start the Fedora Linux installation, double-click on the **Install to Hard Drive** icon on the desktop as shown in Figure 11. As on any physical or virtual machine, the Live Image does not touch the hard drive until we tell it to install Linux.

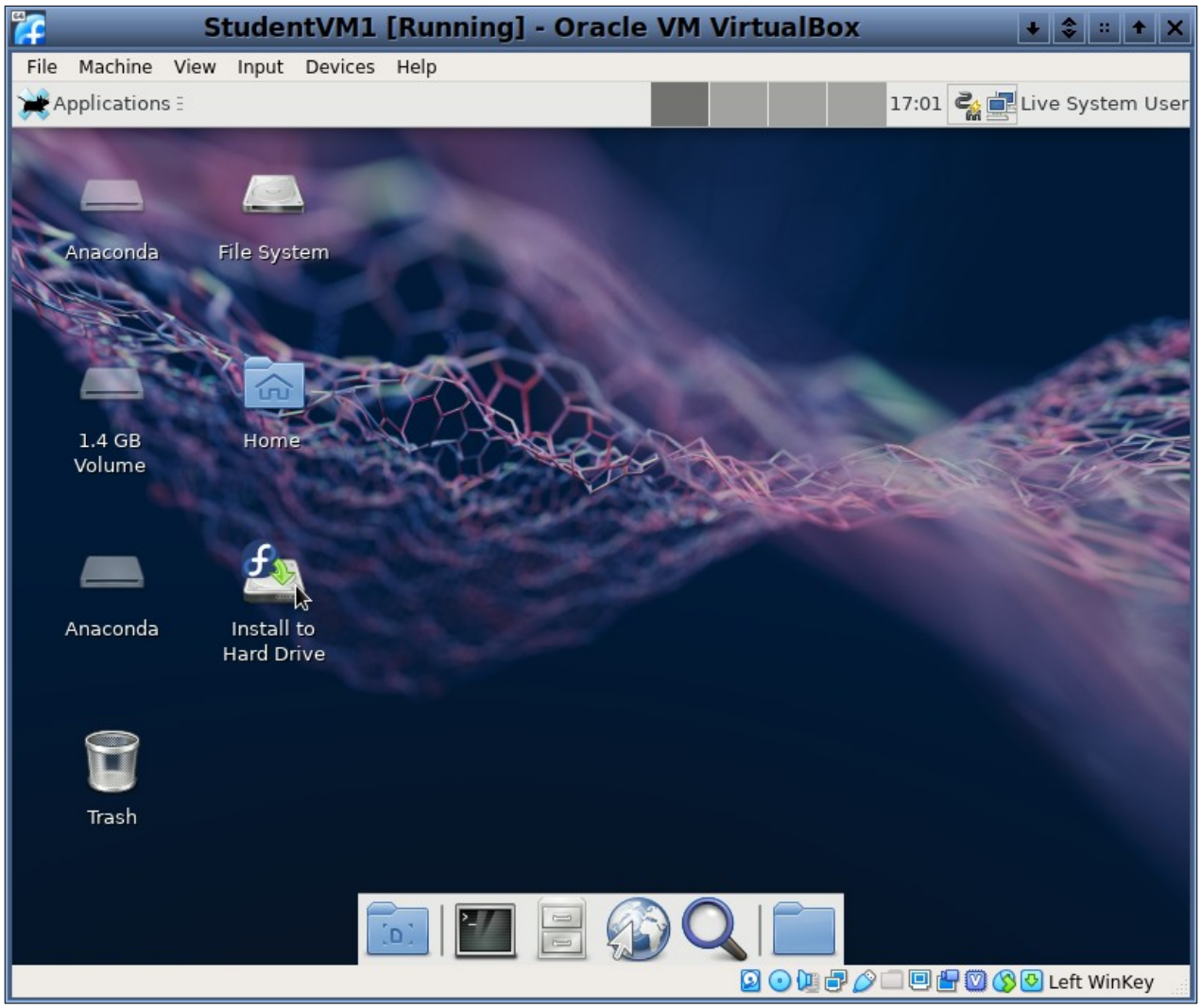

*Figure 11: Double-click on the **Install to Hard Drive** icon to start the Fedora installation.*

A double-click on **Install to Hard Drive** launches the Anaconda installer. The first screen displayed by Anaconda is the Welcome screen where you can choose the language that will be used during the installation process. If your preferred language is not English, select the correct language for you on this screen. Then click the **Continue** button.

Set the host name

Click on the **Network & Host Name** option on the **Installation Summary** dialog as shown in Figure 12. This host name is the one that the computer will be known to itself as. It is the host name that you will see on the command prompt line.

The external world, that is any node on the network to which this host is connected, sees a computer as the host name set up in whichever name service you are using. So it is possible that you might ping or ssh to a computer using one name and that it will have a different name once you are logged into it.

By convention, computer host names are usually in lowercase. Note that the name of the VM is in mixed case, StudentVM1, but that is not the host name and has no network usage.

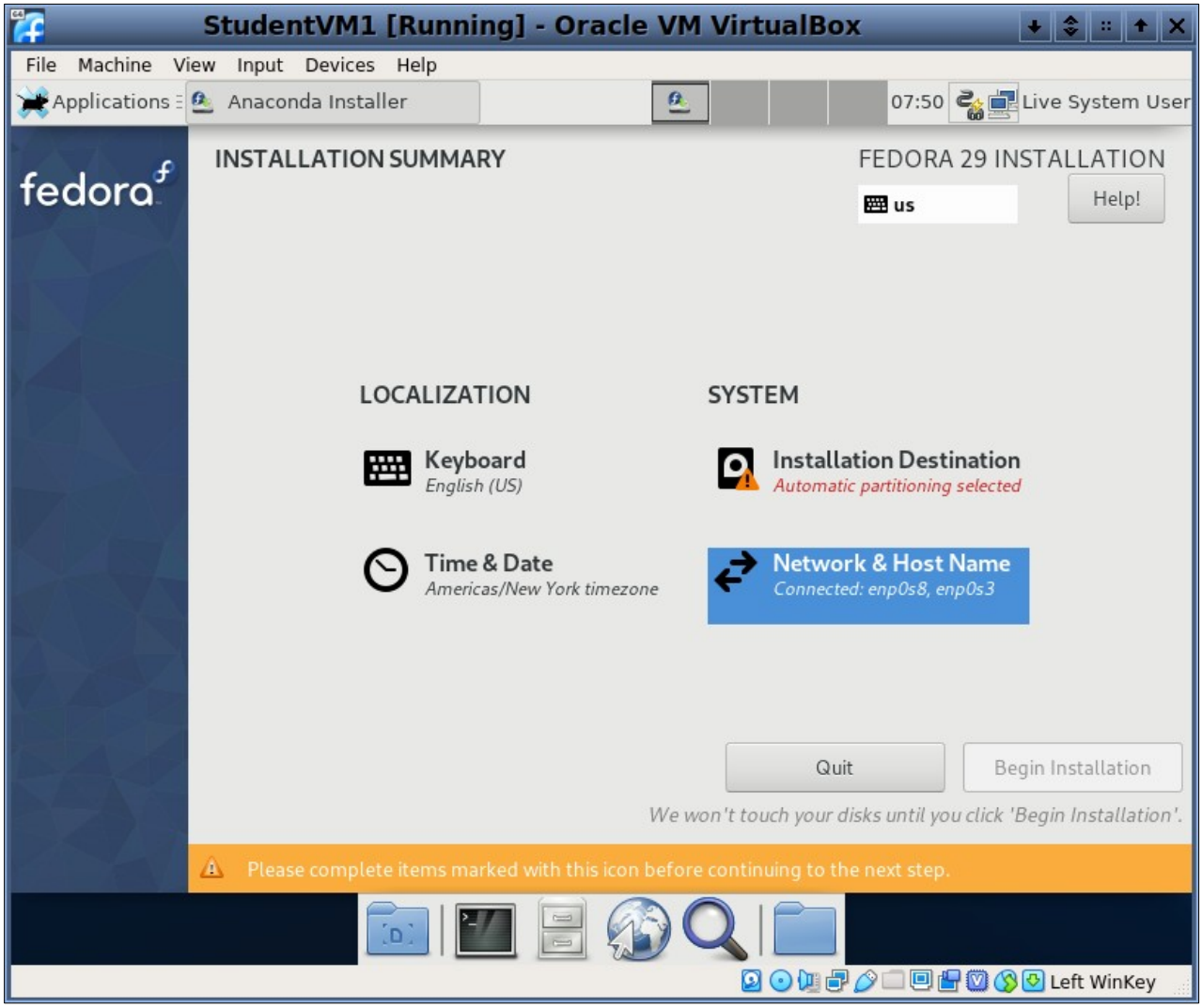

*Figure 12: Select **Network & Host Name** to set the host name for the VM.*

In the **Host Name** field, type the host name **studentvm1** in all lowercase letters and then click on **Apply**. That is all we need to do on this dialog so click on the blue **Done** button on the upper left. This will take you back to the Installation Summary dialog.

Note that there are no options for selecting any additional software packages to install in any of the Live images. If you want to install additional software, you must do it after the basic installation.

Hard drive partitioning

The second and most important thing we need to change is to partition the hard drive in a more standard, recommended manner. We do this rather than taking the default way which is easy for most beginners but which is definitely not the best partitioning setup for a workstation intended for training a SysAdmin. We will explore the details of why this partitioning scheme is better in Chapter 19 of this volume, Filesystems.

In Figure 12, notice that the **Installation Destination** Has a caution icon and the text, **Automatic partitioning** in red. Click on **Installation Destination** and you get the dialog shown in Figure 13.

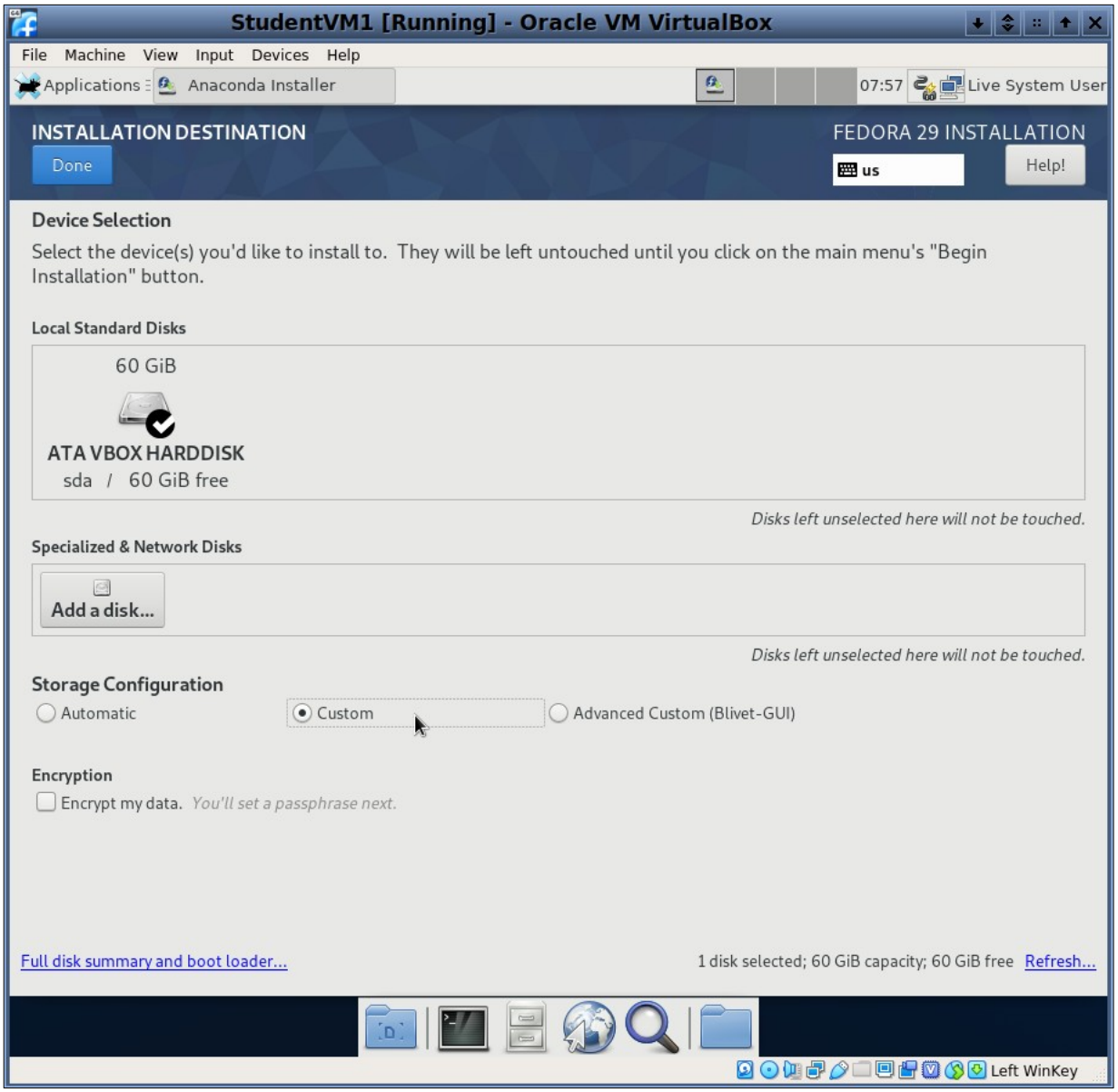

*Figure 13: Select **Custom** for **Storage Configuration**, then click on **Done**.*

We have multiple virtual disk drives in this but select only the 60GB sda device as the installation target.

The size of the VM display window at this point may be too small to contain the entire dialog box. It is hard to see, but there is a scroll bar on the right side of this dialog. Scroll down using the scroll bar or the scroll wheel on your mouse until you get to the bottom. You should also be able to resize the window in which the VM is running to make it big enough to see the entire dialog box as in Figure 14.

You should see **Storage Configuration** and three options. We are going to perform a custom configuration so select the middle radio button, **Custom**. Then click on **Done**.

The next dialog, which you can see in Figure 5-9, is the one where we will do a good deal of work.

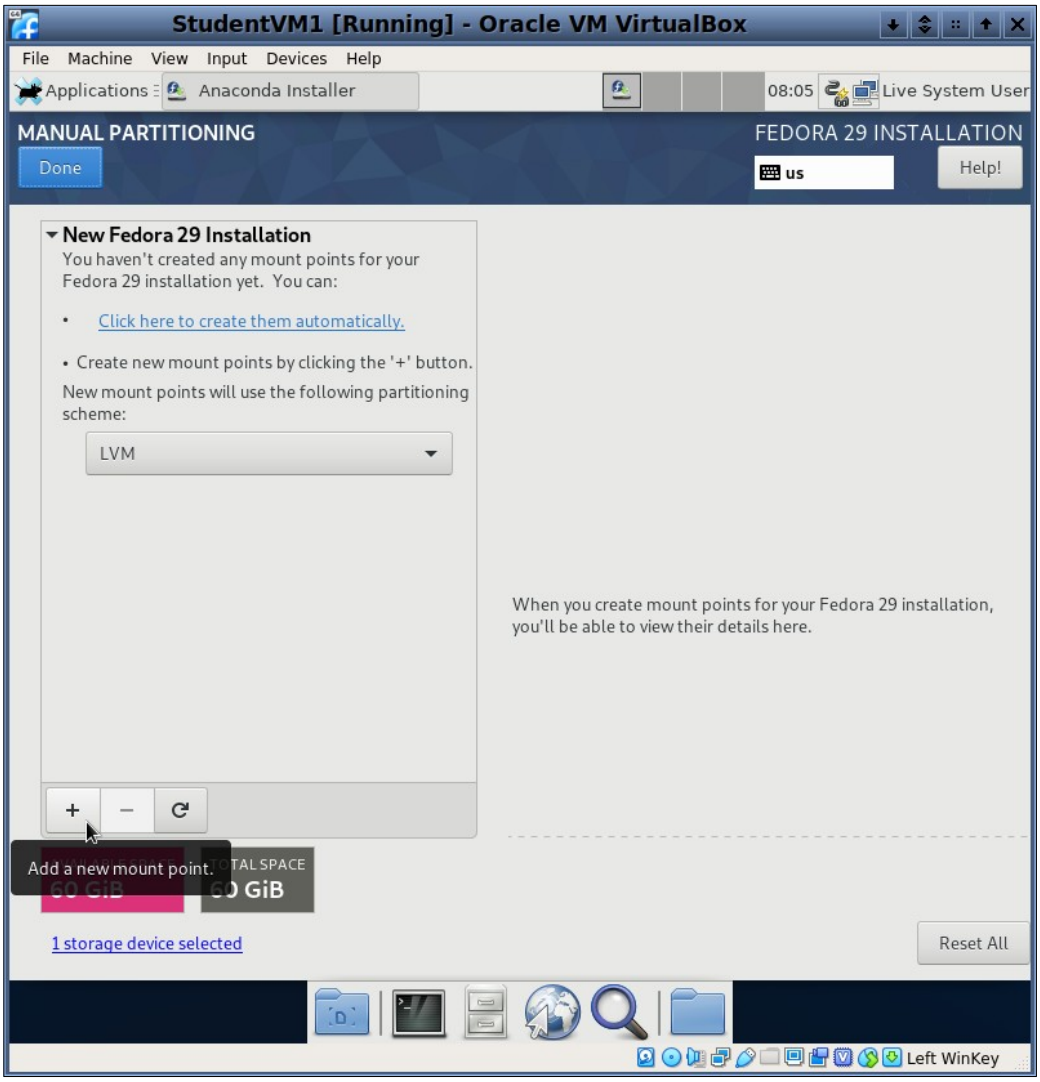

Figure 14: The Manual Partitioning dialog.

What we need to do is create a partitioning scheme like the one shown in Figure 15. The partition sizes in this table are not appropriate for a real-world working system but they are more than sufficient for use in this educational environment. However it is possible and not unreasonable to install a working Fedora system with a GUI desktop in about 20GB and I have done so. Of course it would be somewhat limited but it would be usable.

In Figure 15 you can see what are usually considered the standard filesystems that most books and SysAdmins – well at least I – recommend. Note that for Red Hat based distributions including Fedora, the directory structure is always created but separate filesystems – partitions – may or may not be.

Mount Point	Partition	Filesystem Type	Size (GiB)	Label
/boot	Standard	EXT4	1.0	boot

Mount Point	Partition	Filesystem Type	Size (GiB)	Label
/ (root)	LVM	EXT4	2.0	root
/usr	LVM	EXT4	15.0	usr
/home	LVM	EXT4	2.0	home
/var	LVM	EXT4	10.0	var
/tmp	LVM	EXT4	5.0	tmp
swap	swap	swap	4.0	swap
Total			**39.00**	

Figure 15: The disk partitions – filesystems – and their sizes.

Theoretically, because of the fact that we created a brand new virtual hard drive for this VM, there should be no existing partitions on this hard drive. If you are not following these instructions exactly or are using a physical or virtual hard drive with existing partitions, use this page to delete all existing partitions before you continue any further. If, as in Figure 14, you you see the message that you have not created any mount points, then continue.

To add the first partition, click on the plus (+) button as illustrated in Figure 14. This results in the display of the Add Mount Point dialog box as shown in Figure 16. Enter Select /boot as the first mount point and type 1G in the Desired Capacity field.

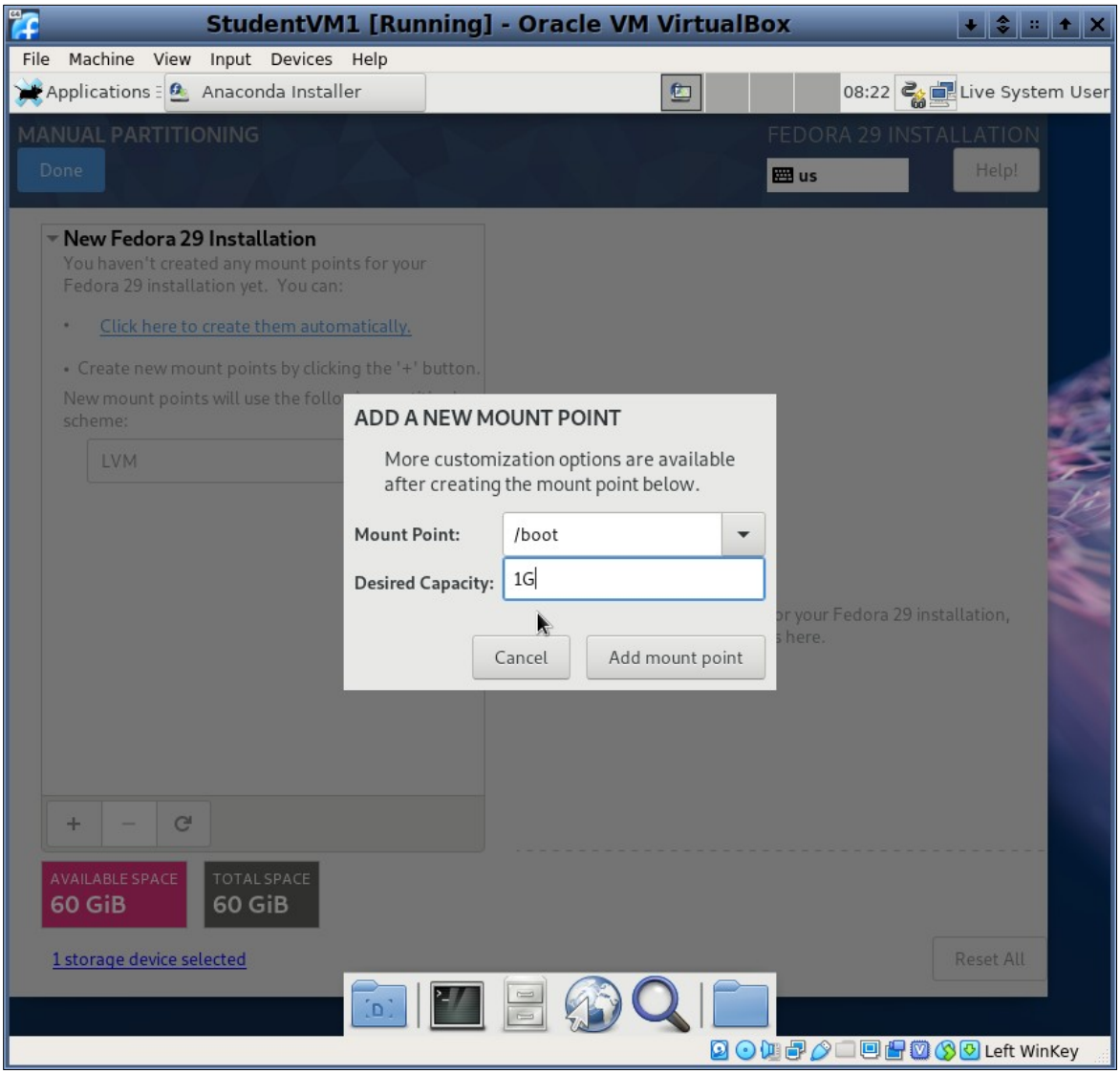

Figure 16: Set the mount point and size desired for the /boot partition.

After entering the correct data for this partition, click the **Add mount point** button to proceed. At this point the Manual Partitioning dialog looks like Figure 17. Notice that, if the VM window is a bit small, there is a scroll bar at the right side of the screen. If you hover your mouse there, the scroll bar becomes a bit wider so is easier to see and manipulate. You can also resize the VM window if you have not already.

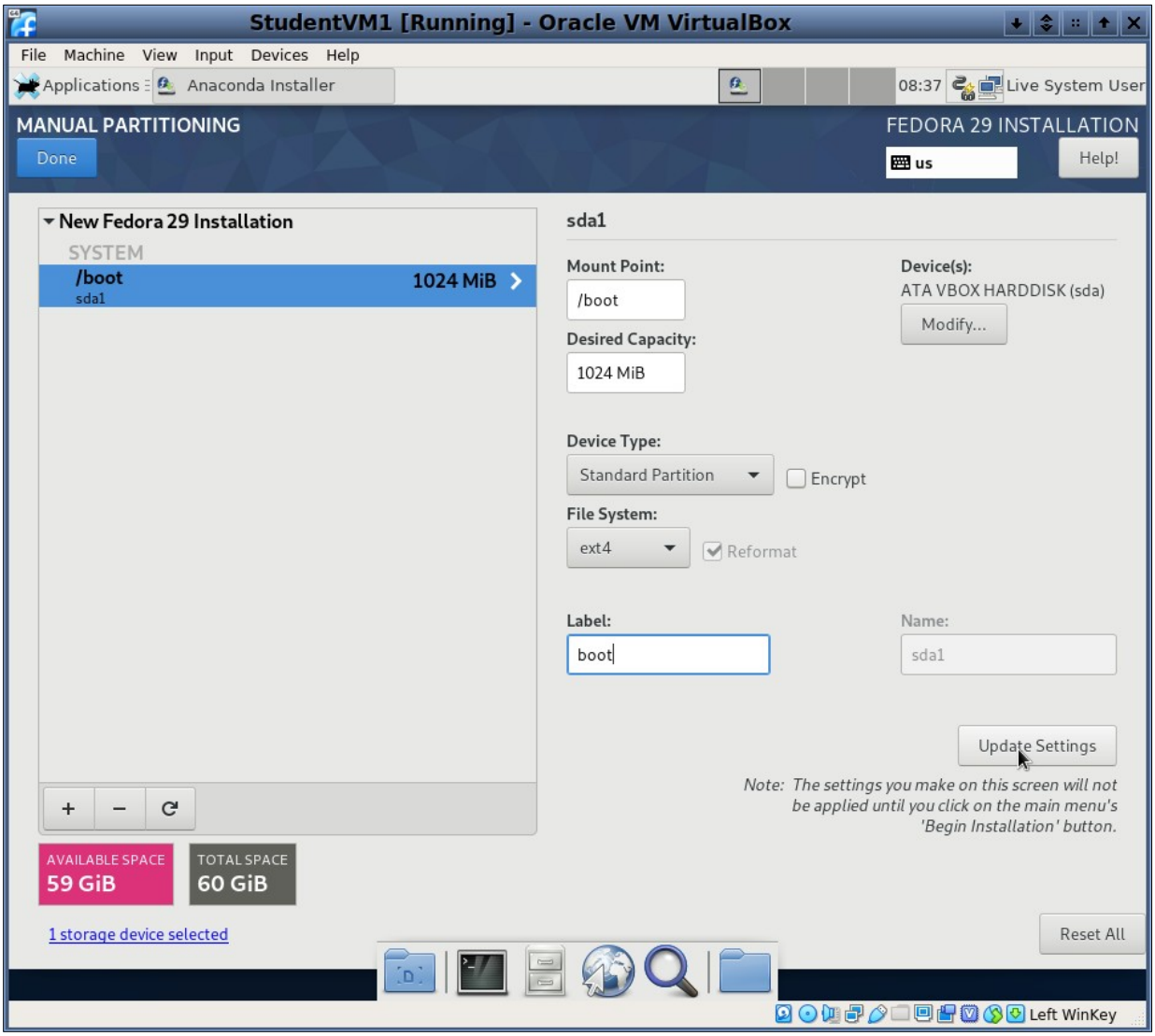

Figure 17: Creating the /boot partition.

if necessary, scroll down so that you can see the Label field. Enter the label for this partition as "boot" without the quotes. As mentioned before, I find that labels make working with various components of the filesystem much easier than would be possible without them.

After typing in the label, click on the **Update Settings** button to save the changes you made.

Continue creating mount points by clicking the + button. Select / (the root filesystem) and type 2G for the size as shown in Figure 18. Click on **Add mount point** to continue.

The root filesystem is the top level of the Linux directory tree on any Linux host. All other filesystems will be mounted at various mount points on the root filesystem.

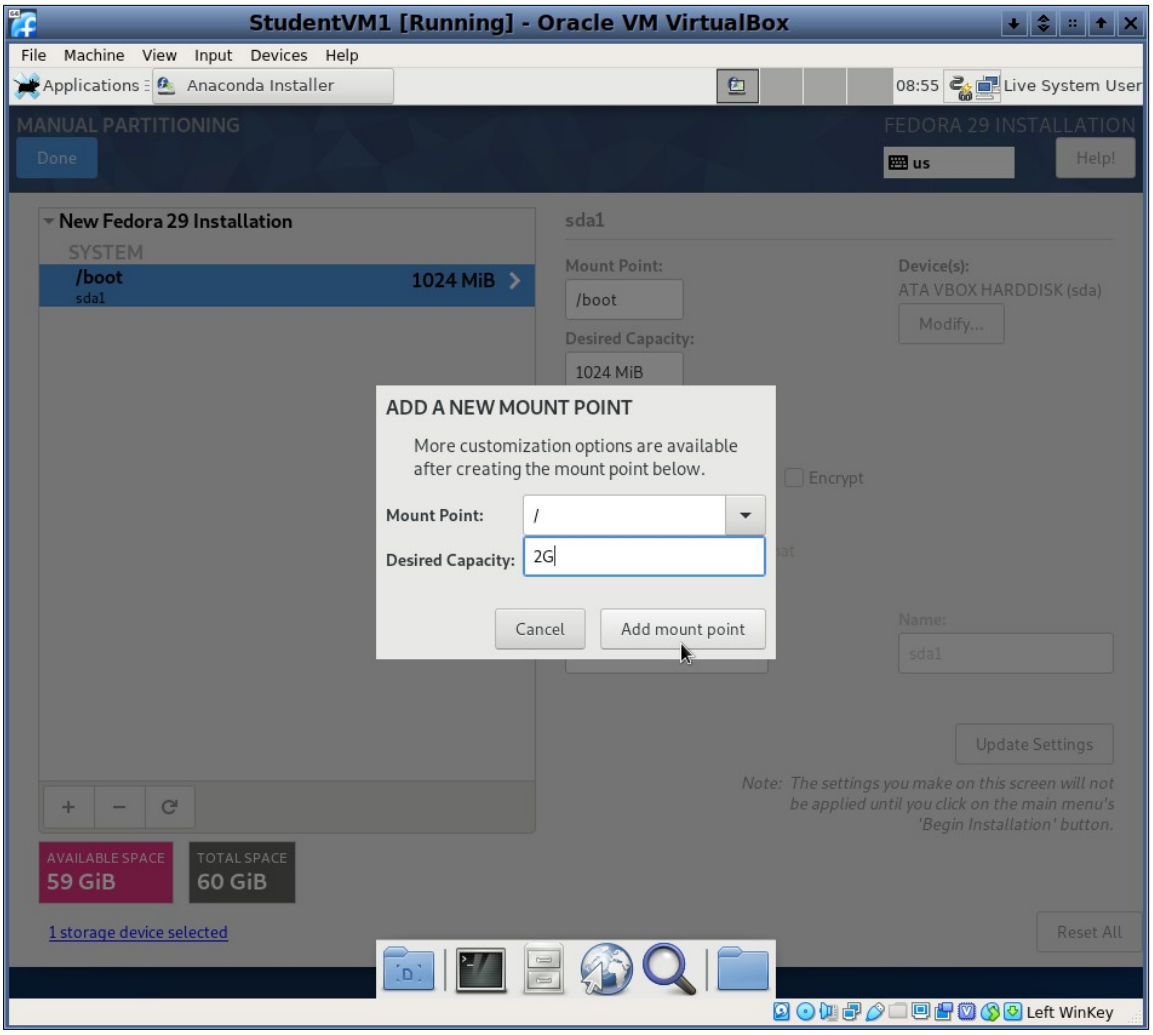

Figure 18: Adding the root filesystem.

Now scroll down in the right pane of the Manual Partitioning dialog and type in the label “root” as shown in Figure 19. Notice that the device type is now LVM for Logical Volume Management, and there is a volume group name.

We are not yet done because we want to do one more thing before proceeding. If we do nothing else to define the size of the volume group that will be created when the hard drive is formatted, the volume group will take only the 41G or so, as we specify our filesystems in Table 5-1, and it will leave the rest of the disk empty and inaccessible. We could fix that later and the result would work but it would be less than elegant.

In order to include all of the remaining space available on our virtual disk in the volume group (VG), we need to modify the VG specification. Click on the **Modify** button under **Volume Group**.

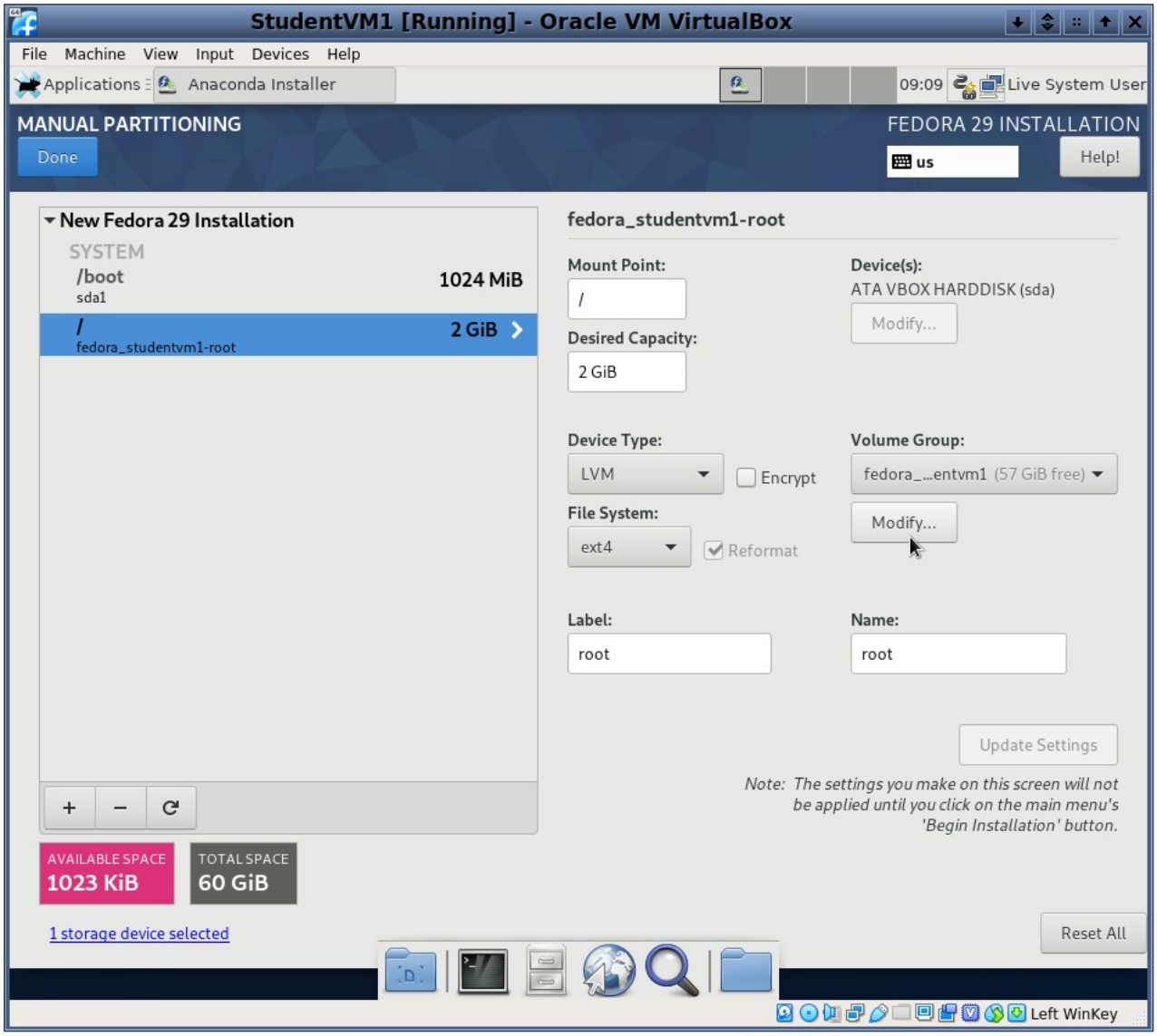

*Figure 19: After entering the "root" label, click on **Modify** to make changes to the volume group.*

We will not need to modify the volume group size more than once. After making the change to the volume group while creating this logical volume (LV) the VG size is set and we don't need to do this on following LVs. The only change we need to make on the rest of the logical volumes is to set the label.

The Configure Volume Group dialog would also allow us to change other things like the name of the volume group but unless there is some imperative to do so we should leave the rest of these configuration items alone. Nothing that we will do in this course requires any further changes to the volume group configuration.

Under the **Size policy** selection box in the **Configure Volume Group** dialog box, click on **As large as possible** as shown in Figure 20. This will cause the volume group to expand to include all of the remaining free space on the hard drive. Then click **Save**. Add the label "root" and click the Update Settings button.

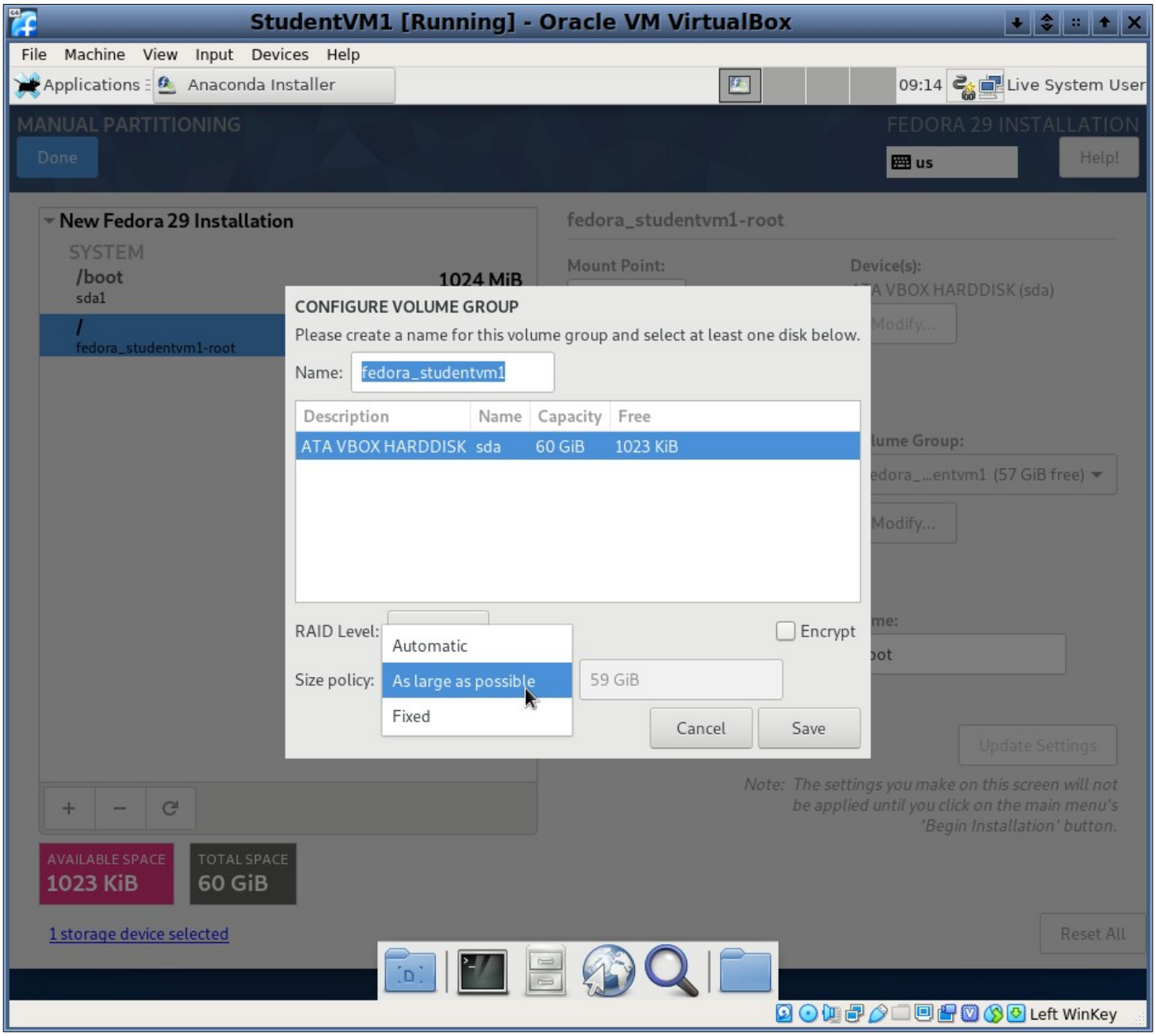

Figure 20: Configuring the volume group to use all available disk space.

Go ahead and add the other partitions, except for the swap partition, as shown in Figure 15. You will notice that the /usr and /tmp partitions are not in the list of mount points. For these partitions just type in the partition names, being sure to use the leading slash (/), and then proceed as you would with any other partition.

Begin the installation

We have now completed all of the Linux configuration items needed for our VM. To start the installation procedure, click on the blue **Begin Installation** button.

We have a couple tasks that need to be performed during the installation. We do not need to wait until the installation has completed before we can set the root password and add a non-root user. Notice in Figure 21 that there are warnings superimposed over the Root Password and User Creation options. It is not required that we create a non-root user and we could do it later. Since we have this opportunity to do so now, let's go ahead and take care of both of these remaining tasks.

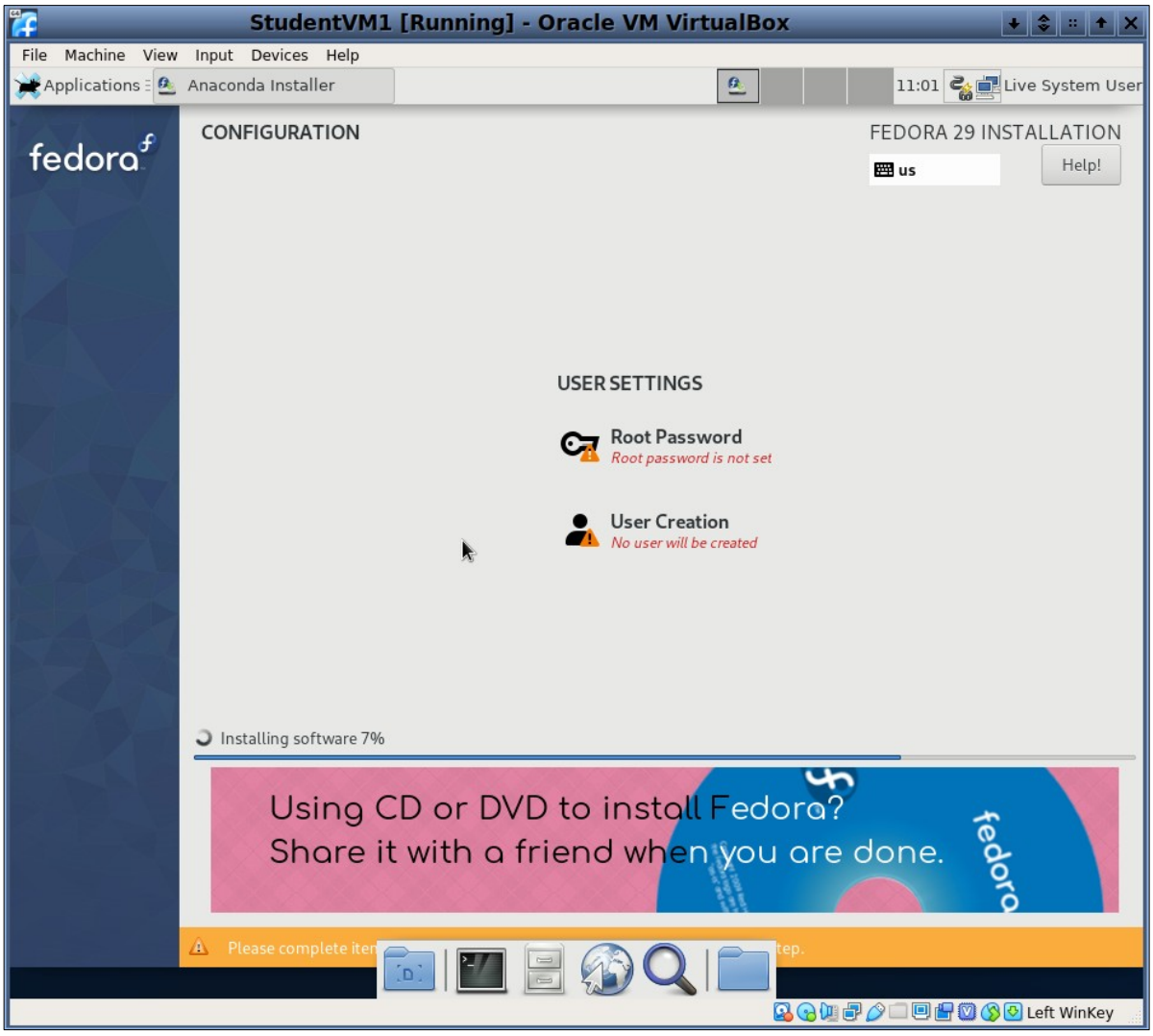

Figure 21: The installation process has started.

Set the root password

Click on **Root Password** to set the password for root. Type in the password twice as shown in Figure 22. Notice the warning message at the bottom of the root password dialog which says that the password I entered is based on a dictionary word.

Because of the weak password, you must click on the blue **Done** button twice to verify that you really want to use this weal password. If, as root, you set a weak password for root or a non-privileged

user from the command line you would receive a similar message but you could continue anyway. This is because root can do anything, even set poor passwords for themselves or non-root users. The non-privileged users must set a good password and are not allowed to circumvent the rules for the creation of good passwords.

However, you should enter a stronger password – one which does not generate any warnings – and then click the **Done** button.

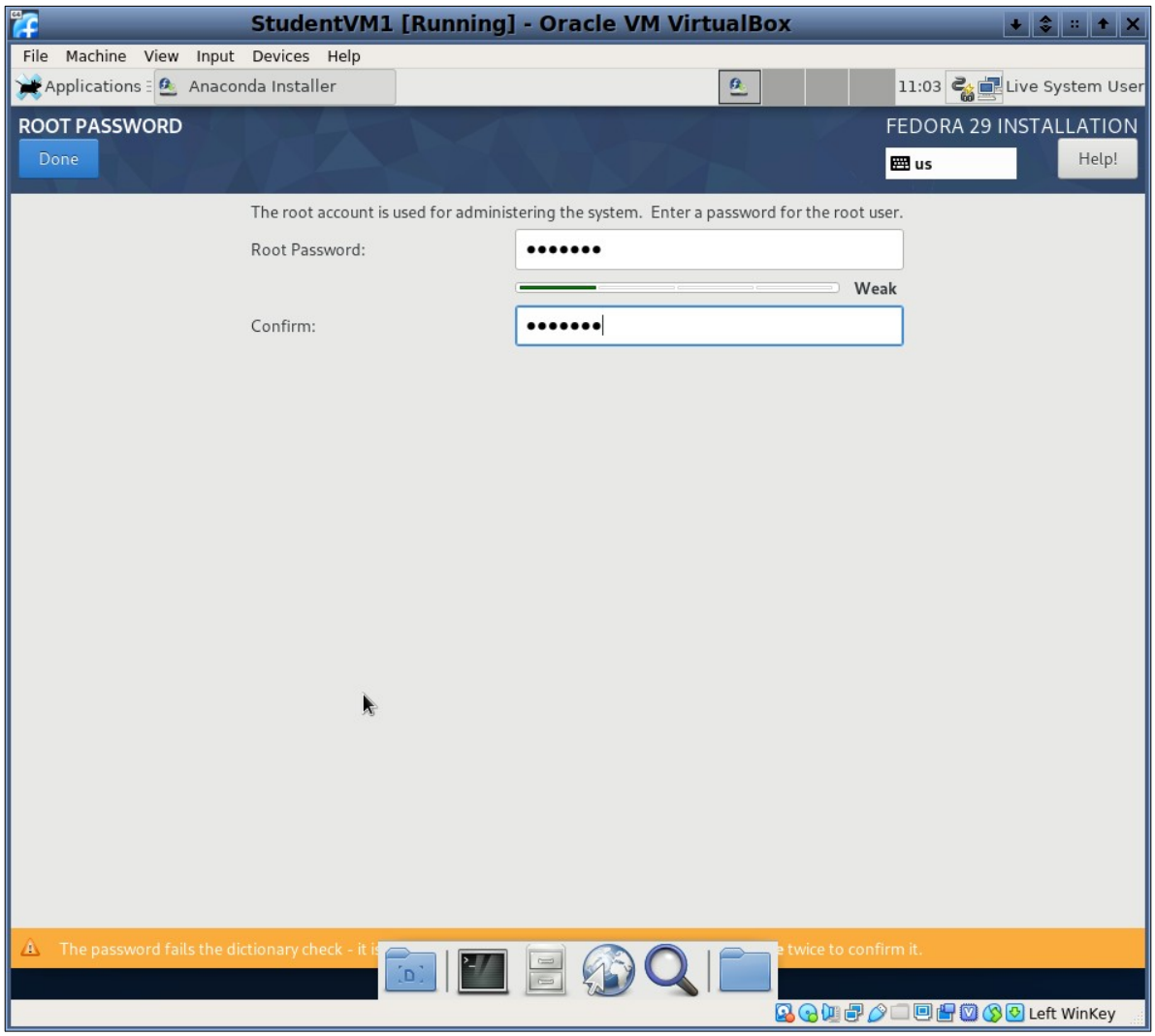

Figure 22: Setting the root password.

After setting the root password you will be back at the installation dialog as in Figure 21, and the Root Password item will no longer have a warning message.

Create the student user

Click on the User Creation icon and you will enter the User Creation dialog shown in Figure 23. Enter the data as shown and click the blue **Done** button.

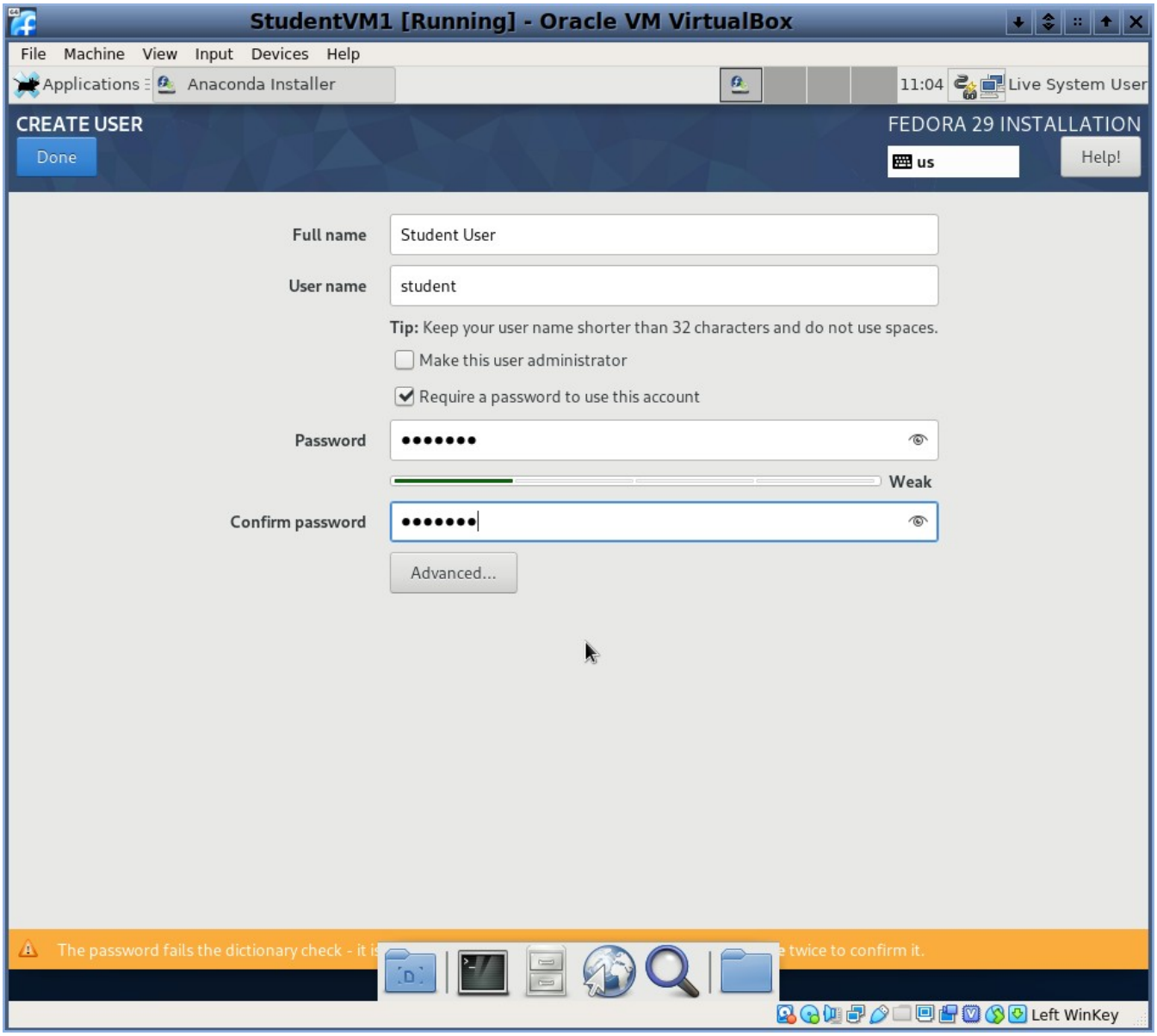

Figure 23: Creating the student user.

After specifying the user information you will be back at the main installation dialog. The installation may not be complete yet. If not, wait until it does complete as shown in Figure 5-18 and then proceed.

Finishing the installation

When completed, the Anaconda installer dialog will indicate “Complete” on the progress bar and the success message at the bottom right in Figure 24 will be displayed along with the blue **Quit** button.

Exit the installer

This terminology may be a bit confusing. **Quit** means to quit the Anaconda installer, which is an application running on the Live image desktop. The hard drive has been partitioned and formatted, and Fedora has already been installed. Click on **Quit** to exit the Anaconda installer.

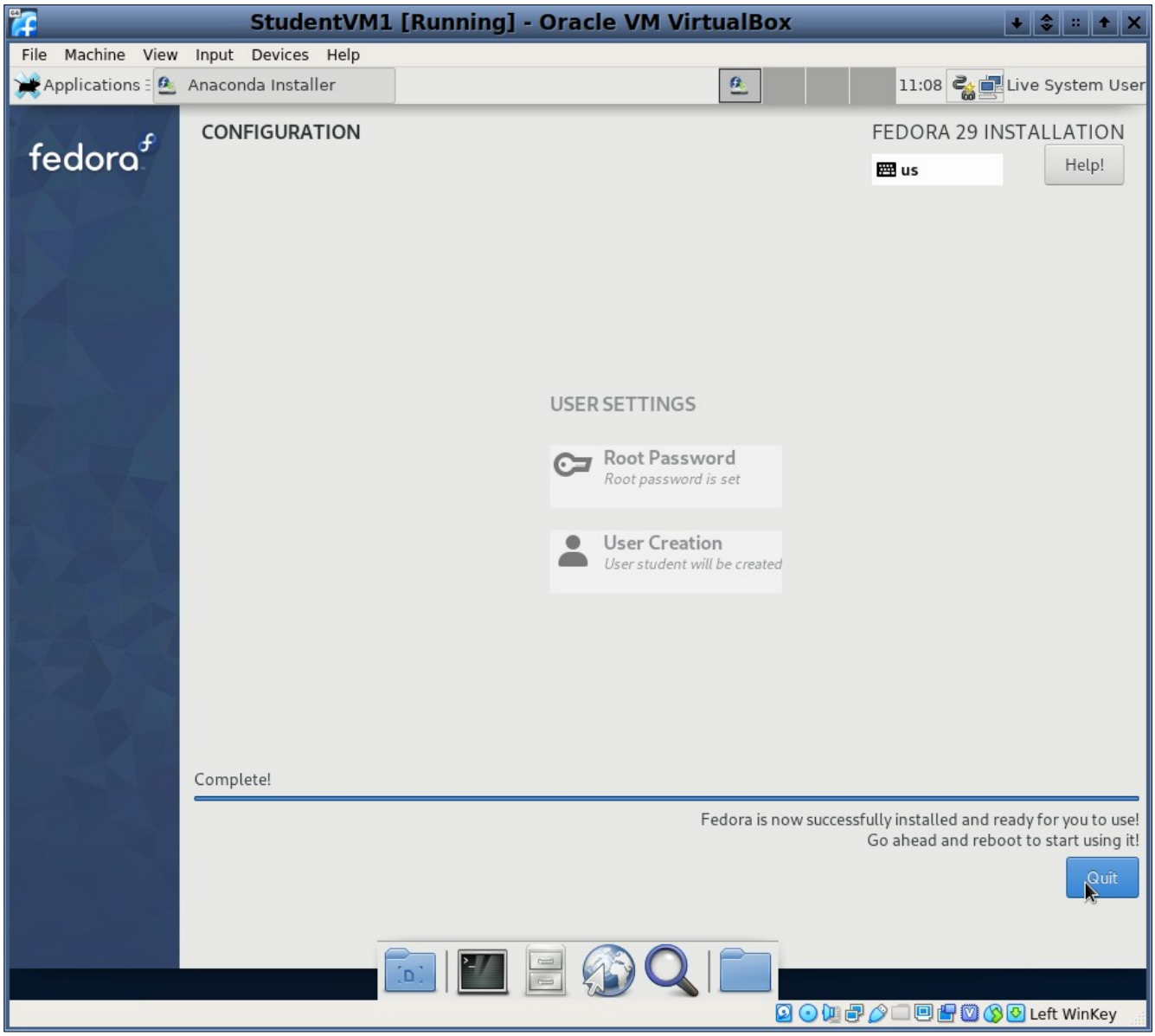

Figure 24: The installation is complete.

Shut down the Live system

Before we do anything else, look at the Live system Xfce desktop. It looks and works the same as the Xfce desktop you will use when we reboot the VM using its own virtual disk instead of the Live system. The only difference will be that of some of the Live filesystem icons will no longer be present. So using this desktop will be the same as using the Xfce desktop on any installed system.

Figure 25 shows how to shut down the Live system. The Xfce Panel across the top of the screen starts with the Applications launcher on the left, has space for the icons of running applications, a clock, the System Tray containing icons of various functions and notifications, and the User button on the far right which always displays the name of the current logged-in user.

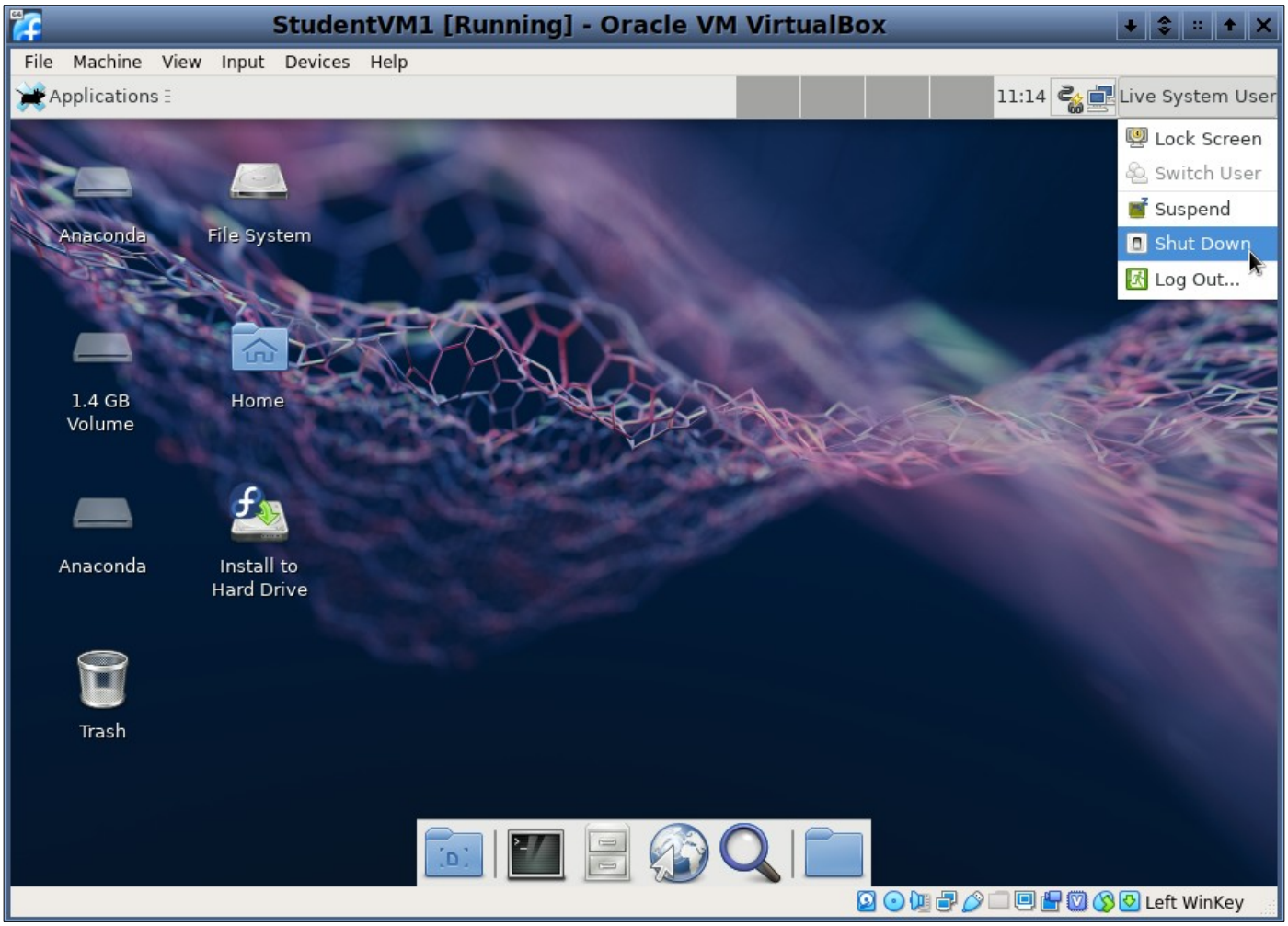

Figure 25: Shut down the VM after the installation is complete.

Click on the **Live System User** button and then click on the **Shut Down** action button. A dialog with a 30 second countdown will display. This dialog will allow you to shut down immediately or cancel the shut down. If you do nothing, the system will shut down when the 30 second timer counts down to zero.

This shutdown will power off the VM and the VM window will close.

Reconfigure the VM

Before rebooting the VM we need to reconfigure it a little by removing the Fedora ISO image file from the virtual optical drive. If we were to leave the ISO image inserted in the virtual drive the VM would boot from the image.

1. Open the **Settings** for Student VM1.
2. Click on **Storage**.
3. Select the Fedora Live CD which is under the IDE controller in the **Storage Devices** panel.
4. Click on the little **CD** icon on the Optical Drive line in the Attributes panel.
5. At the bottom of the list choose the menu option, **Remove disk From Virtual Drive**. The entry under the IDE controller should now be empty.
6. Click on the **OK** button of the Settings dialog.

The StudentVM1 virtual machine is now ready to run the experiments you will encounter in the rest of this course.

Create a snapshot

Before we boot the VM we want to create a snapshot that you can return to in case the VM gets borked up so badly that you cannot recover without starting over. The snapshot will make it easy to recover to a pristine system without having to perform a complete reinstallation.

Figure 26 shows the Snapshots view for the StudentVM1 virtual machine which we just created. To get to this view in the VirtualBox Manager, select the **StudentVM1** VM and then click on the meny icon on the right side of the StudentVM1 selection bar. This pops up a short menu with Snapshots in it. Click on the **Snapshots** view button in the icon bar. The Current State entry is the only one shown so there are no snapshots.

You can take many snapshots of the same virtual machine as you progress through this course which will make it easy to back up to a recent snapshot instead of going back all the way to the first one which we will create here. I suggest creating a snapshot at the end of each chapter if you have enough room on the hard drive where the Virtual Machine files are stored.

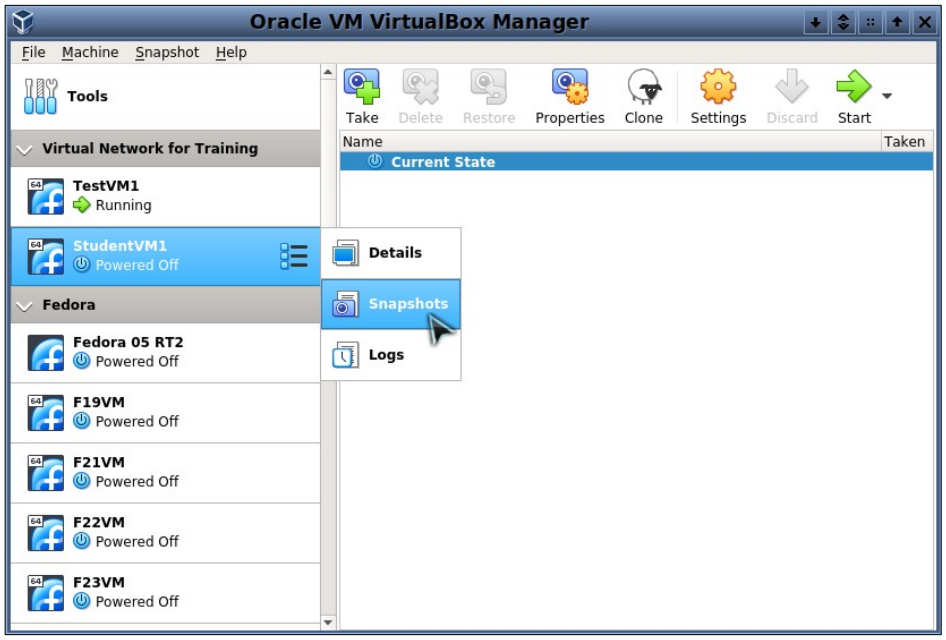

Figure 26: The Snapshots view of StudentVM1 before taking a snapshot.

To create a snapshot simply click on the **Take** button – the one with the green + sign. This opens the **Take Snapshot of Virtual Machine** dialog where you can change the default name to something else. There is also a Description field where you can enter any type of notes or identifying data that you want. I kept the name and just entered, “Before first boot” in the description field. Enter whatever you want in the description field but I suggest keeping the default snapshot names. The Snapshot view looks like Figure 27 after taking your first snapshot.

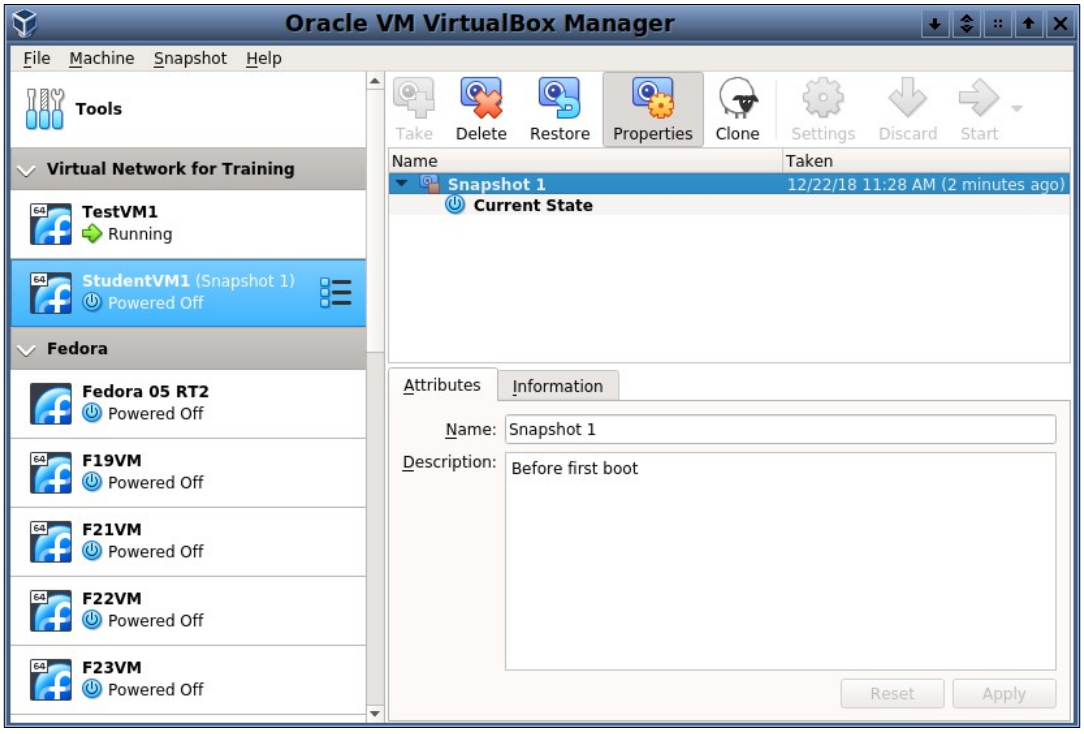

Figure 27: After taking the first snapshot of StudentVM1.

First Boot

It is now time to boot up the VM.

1. Select the StudentVM1 virtual machine.
2. Be sure that the **Current State** of the VM is selected in the Snapshots dialog.
3. Click on the **Start** icon in the icon bar of the VirtualBox Manager. You could also right-click on the VM and select **Start** from the pop-up menu.
4. The VM should boot to a GUI login screen like the one shown in Figure 28.

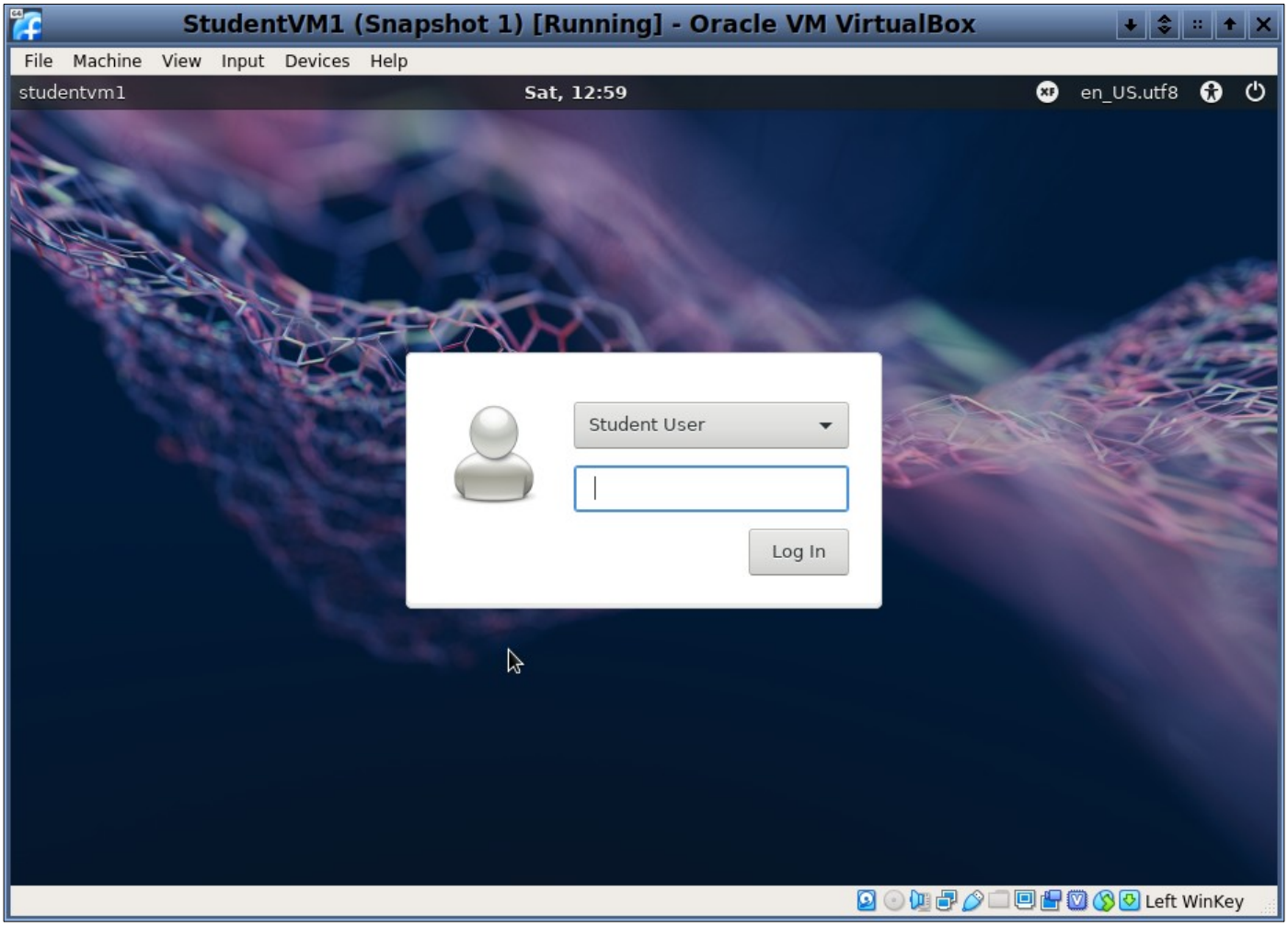

Figure 28: The Fedora 29 GUI login screen.

The script

This script is intended to perform all of the tasks required to configure the StudentVM1 virtual machine created in the sections above to one of two states. The first state is that required to begin with Volume 2 of this course. The second sets the configuration to that required at the beginning of Volume 3.

What it does

The script, quickstart.sh, performs the following general tasks when used with the -2 or -3 options. For the specifics you can read and analyze the script yourself.

- Verify that it is running as the root user.
- Verify that it is running on a recent version of Fedora X86_64, Fedora 29 or later.
- Verifies the network IP address range of 10.0.2.0/24.
- Verifies the presence and size of the specified hard drives.
- Verifies RAM and CPU configurations are correct as specified.
- Verifies the hostname of studentvm1.
- Applies all current updates for the installed version of Fedora.
- Creates partitions and filesystems appropriate to the starting state of the specified volume number.
- Create the student user and others, including any files and directories required in the home directories.
- Install administrative and system management tools appropriate to the specified volume.
- Create or modify various system configuration files.
- Install the RPMFusion repositories.
- Download files from the Apress GitHub repository.
- Changes firewall software and modifies firewall rules.
- Create a dummy printer.

  When used with the -c (clean) option, the script reverses and undoes almost all of the above tasks.

Installing the script

This script should have been part of the quickstart.zip package you downloaded from the Apress GitHub repository. Copy the script to the /root directory on the SudentVM1 virtual machine. Ensure that its permissions are set to 750.

Running the script

Ensure that the script is located in root's home directory, /root. and run it with -h to display the help page. The sample below is the help for version 1.0 of this script. You may have a later version and so the help text may have changed.

```
[root@studentvm1 ~]# ./quickstart.sh -h
################################################################################
#                              quickstart.sh                                   #
#                                                                              #
# This script is for use by students taking the "Using and Administering Linux #
# - Zero to SysAdmin" self-study course.                                       #
#                                                                              #
# This script is intended to enable the student to configure a brand new VM    #
# created using the Fedora Linux Xfce ISO image to the approximate state of    #
# the StudentVM1 virtual machine at the beginning of Volume 2 or Volume 3.     #
#                                                                              #
# This Bash script also verifies that the virtual machine host is configured   #
# properly and that Fedora release 29 or later is installed.                   #
#                                                                              #
################################################################################
# WARNING: THIS SCRIPT WILL DELETE OR OVERWRITE ALL PARTITIONS ON ALL STORAGE  #
#          DEVICES EXCEPT FOR /dev/sda. THIS WILL DELETE ALL OF THE DATA ON    #
#          THOSE DEVICES.                                                      #
#------------------------------------------------------------------------------#
# WARNING: THIS PROGRAM WILL ALSO DELETE ALL STUDENT USERS AND THEIR DATA, AS  #
#          WELL AS OTHER DATA AND PROGRAMS THAT MIGHT BE INSTALLED ON THIS     #
#          HOST.                                                               #
#------------------------------------------------------------------------------#
# WARNING: DO NOT USE THIS SCRIPT ON A PRODUCTION HOST OR VM!                  #
#------------------------------------------------------------------------------#
# WARNING: DO NOT USE THIS SCRIPT IF YOU ARE STARTING THIS COURSE WITH         #
#          VOLUME 1. IT IS NOT REQUIRED IN THAT CASE.                          #
################################################################################
#                                                                              #
# Syntax: quickstart.sh -v[h|g][2|3|c]                                         #
# 2     Configure StudentVM1 to the start of Volume 2.                         #
# 3     Configure StudentVM1 to the start of Volume 3.                         #
#       This option also sets the state for Volume 2.                          #
#                                                                              #
# c     Remove all software and filesystems to return this VM to a state       #
#       of the newly installed VM prior to running any experiments in          #
#       in Volume 1 of this course. Use this option only if you need to return #
#       the host to a pristine state.                                          #
#                                                                              #
# g     Print the GPL license notification.                                    #
# h     Print this Help to STDOUT and exit.                                    #
# v     Set verbose mode. Displays helpful messages to STDOUT and exit.        #
```

```
# V     Print the software version number to STDOUT and exit.                  #
#                                                                              #
################################################################################
```

Be sure to read the warnings. The bottom line is that you should create the VMs for this course on a test system and not a production system. The script will make significant changes to the VM on which it is run and it will delete data and programs that would be needed on a production host.

Use the following command to configure the newly created StudentVM1 to the state required to begin Volume 2 of this course.

```
[root@studentvm1 ~]# ./quickstart.sh -2
```

Use the following command to configure the newly created StudentVM1 to the state required to begin Volume 3 of this course.

```
[root@studentvm1 ~]# ./quickstart.sh -3
```