

*"The perfect way to understand both the technology and benefits of virtualization"* Simon Crosby, CTO, XenSource

# Virtualization

## FOR DUMMIES<sup>®</sup>

**A Reference  
for the  
Rest of Us!**<sup>®</sup>

FREE eTips at [dummies.com](http://dummies.com)<sup>®</sup>

**Bernard Golden, MBA**  
CEO of Navica, Inc. & expert blogger  
for CIO.com



Boost server  
utilization to  
maximize your  
IT ROI

# ***Virtualization For Dummies***<sup>®</sup>

## **Chapter 13: Implementing Fedora Virtualization**

**ISBN: 978-0-470-14831-0**



Copyright of Wiley Publishing, Inc.  
Indianapolis, Indiana

Posted with Permission

## Chapter 13

# Implementing Fedora Virtualization

---

### *In This Chapter*

- ▶ Getting a hold of Fedora 7 proper
  - ▶ Installing Fedora 7
  - ▶ Installing a guest virtual machine
  - ▶ Installing a guest operating system
- 

**I**n Chapter 12, I take VMware Server through its paces — definitely a great product. However, you might want to consider another alternative for any number of reasons. Perhaps the fact that VMware Server installs as an application on top of the machine's operating system gives you pause — that solution isn't particularly optimal with regard to performance potential, to be honest. Or perhaps you prefer the Linux operating system and would like to use a virtualization solution integrated with it. Or maybe you just want to experiment with something else to compare it with VMware Server.

Whatever your reason, this chapter is for you. In this chapter, I demonstrate how to use the Xen virtualization technology built into Fedora 7. By the chapter's end, you'll be able to create and run guest virtual machines to your heart's content.



If your company uses Red Hat Enterprise Linux (RHEL), this is a good chapter for you to pay attention to. Features that are going into the next version of RHEL typically first see the light of day in Fedora, where Red Hat can (literally) work the bugs out. The first implementation of Xen in RHEL came in the currently shipping RHEL5. However, the upcoming RHEL5.1 will offer many improvements in virtualization, and most of those improvements are already available in Fedora 7, which is why this chapter uses Fedora 7 as its basis.

So . . . get started!

## Obtaining Fedora 7

Unlike VMware Server, which you need to obtain separately from the host operating system, Fedora 7 comes with virtualization built in. So, this means your first task is to get Fedora 7 and install it.

Fedora 7 is Linux, which means it's available as a free download. The following steps walk you through the process:

**1. Point your browser to Fedora's main site at <http://fedora.project.org>.**

The Fedora home page appears on-screen.

**2. Click the Get Fedora link.**

You see a page with a number of options for obtaining Fedora.

**3. Pick a way to obtain Fedora:**

- *Download from BitTorrent:* BitTorrent is a peer-to-peer file-sharing mechanism; easy to use, but if you're not familiar with torrents already, this might not be the place to start. If you already have a few BitTorrent downloads under your belt, though, this is often the fastest method of downloading.
- *Download from Mirrors:* A large number of sites host copies of Fedora and make it available for download. If you choose this option, you're presented with a table containing all the Fedora versions; click Version 7, and the next table down lists all the places that mirror downloads of that version of Fedora.

When I did my own download, I chose <http://mirror.stanford.edu/fedora/linux/releases/7/Fedora/i386/iso/> because Stanford is just down the road, meaning the data throughput would be good. (Note that on the Fedora page, the link says `mirror.stanford.edu`, but that it actually goes to the longer address.)

- *Network Install:* The instructions read "recommended for advanced users only," and the Fedora folks know of what they speak. I recommend avoiding this option.

You also have two alternative options if you don't want to (or can't) download the product:

- *Purchase media:* This means you pay for someone to place the product on a DVD and send it to you. That way you can avoid all the hassle. Of course, you'll need to pay a fairly small fee to obtain physical media, and you'll have to wait for the disc to arrive.
- *Free media:* If you can't afford to purchase the media, the Fedora Free Media Program will send you a copy at no cost. You can't get fairer than that, can you?

#### 4. Do whatever you need to do to get the Fedora 7 files on a DVD.

If you purchased media or had a free copy sent to you, you already have everything on DVD. If you've downloaded the file, it will be in an `.iso` format (also known as an optical disc *image* format) that you'll need to burn onto a DVD yourself. But remember that you have to burn it with image-burning software.

A number of good image burners are available at no cost. One that I like is called DeepBurner, which is free and can be downloaded from `www.deepburner.com`. Of course, if you don't have a DVD burner, all the software in the world won't do you any good. You'll have to go the purchase media/get free copy route to get your own DVD.

When you have your DVD whether burned from a download or sent in the mail — you're ready to move on to installing Fedora and its virtualization capability.

## Installing Fedora 7

In this section, I walk you through the process of installing Fedora itself. Linux distributions have improved their installation processes enormously over the past few years, making Linux quite simple to install. If you've installed Windows, you'll be able to follow the Fedora installation quite easily.

The one tricky part about installing the Xen virtualization capability is that it isn't installed by default — you have to choose to install virtualization. But don't worry. The following steps give all the details:

#### 1. Boot the machine with the Fedora 7 DVD in the CD tray.

The first thing you see when the installation process starts is a Welcome splash screen.

#### 2. Use the arrow keys to select the Install or Upgrade an Existing System option and then press Enter.

The next screen you see indicates that the CD (in your case, the DVD) has been found in the CD tray. The screen also prompts you to test the aforementioned media. Testing the media confirms you have an undamaged DVD, but it takes quite a while to run through. I recommend you skip the media test.

#### 3. Click the Skip button.

Doing so brings up yet another Welcome screen with pretty graphics, as shown in Figure 13-1.

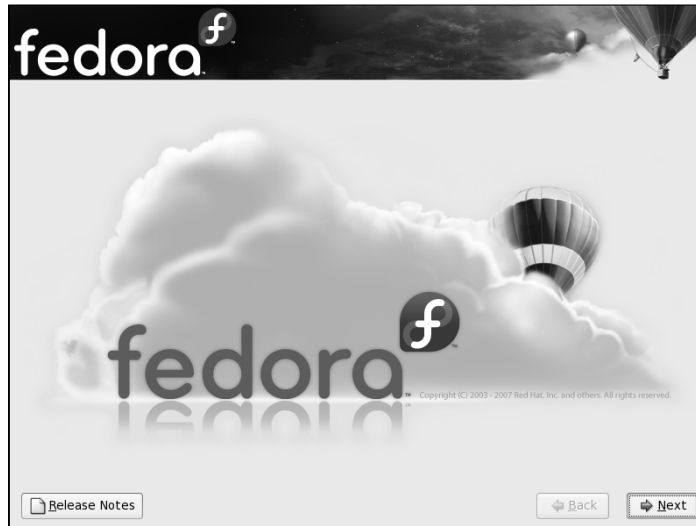
#### 4. Click Next in the new Welcome screen.

A wizard page appears, asking you to select the language you want to use during the installation process.

**5. Choose your preferred language and then click Next.**

In this example, I chose English as my install language.

Hard on the heels of the Install Language page comes the Keyboard layout page.



**Figure 13-1:**  
Nice  
graphics,  
Fedora!

**6. Make your keyboard choice and then click Next.**

I chose U.S. English as my keyboard layout.

**7. In the next screen (see Figure 13-2), you should either accept the default partitioning layout or create one of your own; then click Next.**

Unless you're experienced with Linux, I recommend you stick with the default offering.

Clicking Next calls up a Warning dialog box stating that you are going to remove existing partitions and data. Don't worry, this is fine.

**8. In the Warning dialog box, click the Yes button.**

Doing so calls up a Network Devices screen, which lets you define which network interface card (NIC) you want the system to use to talk to the network. You also have the opportunity to choose how to assign an IP address to the system. I recommend you accept the defaults.

**9. In the Network Devices screen, accept the defaults and then click Next.**

A new screen (see Figure 13-3) appears, allowing you to pick your time zone.

10. In the time zone page, use the cursor to navigate the world map or use the drop-down menu to choose your time zone and city; then click Next.

The next screen asks you to choose a password for the root account.



**Figure 13-2:**  
Choosing a  
partitioning  
layout.



**Figure 13-3:**  
You could  
choose  
Outer  
Mongolia if  
you wanted.

11. Type the password you've selected, reenter it to confirm — as shown in Figure 13-4 — and then click Next.



**Figure 13-4:**  
Setting your  
root  
password.



Don't forget whatever password you choose because otherwise you won't be able to log in after the install is complete! I recommend you write the password down.

The next screen (see Figure 13-5) is the only tricky part of the installation. The default installation of Fedora is pretty bare bones. As you can see from the list near the top, you have a choice of three types of software to install. All three are good, so I recommend you consider installing all three. But the tricky part is represented by the radio button at the bottom, which invites you to customize the install. Seems innocent and not very important, right? Wrong!

If you don't go through the customize workflow, Xen virtualization won't get installed, and you won't be able to use Fedora as a virtualization host. So it's vital you stay awake at this step and customize your install.

12. Click the **Customize Now** radio button and then click Next.

A new screen appears, offering six different aspects of the install you can customize, as shown in Figure 13-6. The important one from a virtualization standpoint is the Base System listing.



**Figure 13-5:**  
Pay attention to the Customize Now option.



**Figure 13-6:**  
Choosing the Virtualization option.



**13. Highlight the Base System entry in the left box, select the Virtualization option in the right box, and then click Next.**

Okay. You've gotten Xen virtualization set up to install. And, in fact, you've completed the entire initial configuration, so a new screen appears, informing you that all's ready for the actual installation of the software. (See Figure 13-7.)



**Figure 13-7:**  
Clicking  
Next here  
begins  
installation  
of Fedora.

#### 14. Click Next.

With all the preliminaries out of the way, the real work of installation kicks off.

It might take a while for the process to complete — coffee, anyone? — but eventually you get a splash screen congratulating you on completing the configuration process (see Figure 13-8) and inviting you to reboot the operating system.



**Figure 13-8:**  
Congrats!  
You have  
Fedora!

**15. Click the Reboot button in the Congratulations screen.**

A new screen appears, asking you to begin setting some operational configuration items (see Figure 13-9).

**16. Click Forward in the Setup screen.**

The next screen presents you with license information about Fedora 7. Assuming the license is okay by you, you can proceed.

**17. Click Forward in the License Information screen.**

Doing so brings up the Firewall screen, as shown in Figure 13-10. Linux contains firewall software (which, by default, is on) in order to protect the machine. This screen offers you the opportunity to allow certain services to “talk” through the firewall — services like ftp, http (Web server), ssh, and so on. I recommend you enable http and ssh, as they are widely used for remote access and system administration. I also recommend you leave the firewall enabled because it’s a good idea to keep the system protected.

**18. Select any services you want to have access through the firewall and then click Forward.**

The next screen offers you the ability to run SELinux.

**19. Choose either Enabled or Disabled for your SELinux setting and then click Forward.**

SELinux is a very sophisticated security mechanism, which I recommend you disable — you really won’t need the capability for this example.

The next screen offers you two different options for setting the time on the system you’re installing.



**Figure 13-9:** Booting up brings yet another setup screen.



**Figure 13-10:**  
The Firewall  
page.

**20. Make your choices in the Date and Time screen and then click Forward.**



I prefer and recommend NTP (Network Time Protocol), which uses a network of extremely accurate time servers that your system can ping to get the exact right time. If you choose this option, your system will ping one of the three sites listed in the NTP Servers box, although you can put your own entries into the box if you prefer to do so.

The next screen offers you the opportunity to provide information about your hardware to the Fedora community, which should enable it to understand its user base better. Depending on your preference, decide whether you'd like to provide your profile.

**21. Click the correct radio button in the Hardware Profile screen and then click Forward.**



The Create User screen appears, as shown in Figure 13-11.

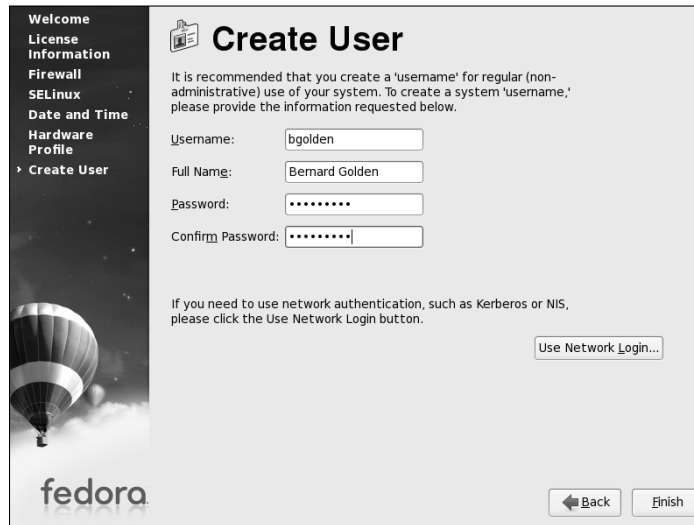
This user is different than the root user and should, generally speaking, be the primary way you interact with the system.

**22. Enter a username in Username field of the Create User screen, fill in the rest of the user information (including password info), and then click Finish.**

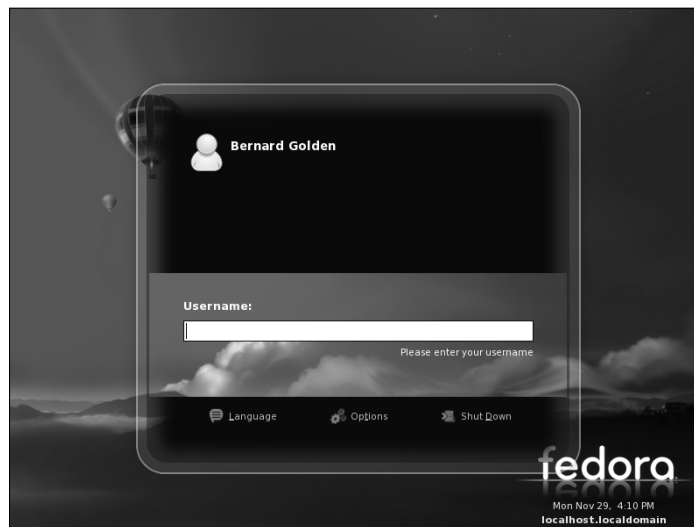
Congratulations! You're done!

The system now reboots and then comes up as a finished Fedora 7 system. You'll be offered two versions of Fedora to choose from. Select the Fedora Xen option to ensure the working system is ready to support virtualization.

After you select which version of Fedora that should run, you'll be presented with a login screen, as shown in Figure 3-12. Even though you've just created a user-level username, I suggest you log in as root with the root password (which you remember, right?) because you need to be root to create virtual machines and install guest operating systems.



**Figure 13-11:**  
The Create User screen.



**Figure 13-12:**  
The Fedora 7 login screen.

### 23. Log in to your Fedora 7 system as root.

After you log in, you see the Fedora 7 desktop, ready to begin working on your behalf (see Figure 13-13). I recommend you take a deep breath, get a cup of tea, and relax for a few minutes because you're now ready to begin using Fedora 7 as a virtualization platform.



**Figure 13-13:**  
A new  
Fedora 7  
desktop.

## Creating a Guest Virtual Machine

You have Fedora 7 up and running, including virtualization functionality. Time to install a guest:

### 1. With Fedora running, choose Start⇨System⇨Virtual Machine Manager, as shown in Figure 13-14.

The Virtual Machine Manager appears on-screen.

Fedora relies on the Virtual Machine Manager (VMM) to control all aspects of its virtualization functionality.

### 2. Review the current state of the Virtual Machine Manager.

The Virtual Machine Manager indicates all the virtual systems running on the host, as shown in Figure 13-15.

Wait a sec, you haven't yet installed a virtual machine, but there's already a listing for Domain-0. How did that get there? Remember, Xen works with the concept of a privileged guest that controls all network and storage

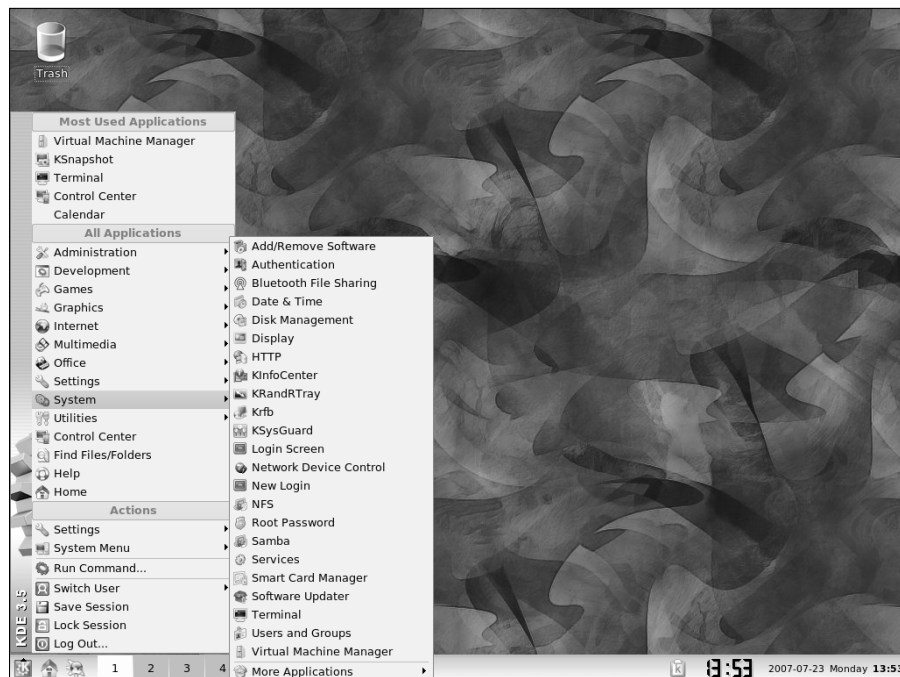


interaction. Basically, this means that Domain-0 runs as a guest but has privileges that allow it to directly access certain resources on the underlying hardware. Domain-0, then, is a regular operating system (Fedora 7, in this case) that has been modified to work on behalf of a guest operating system (called DomainU in Xen). (For more information on these Xen concepts, see Chapter 3.)

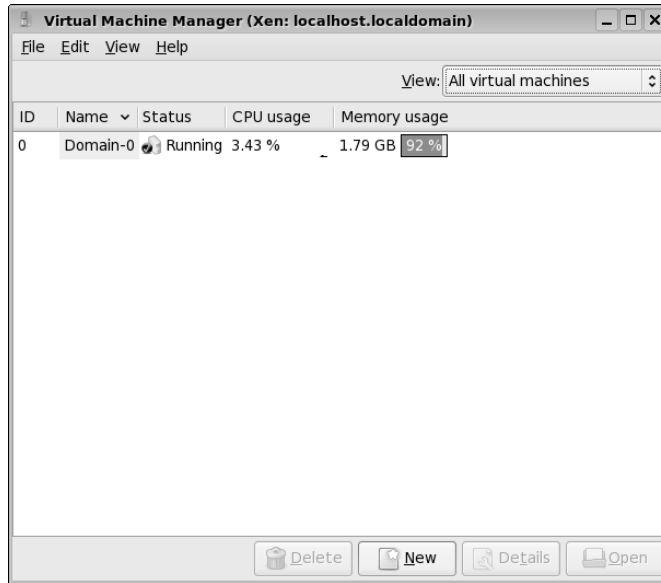
If you take another look at Figure 13-15, you'll notice that Domain-0 currently is allocated all the memory on the system (2GB, in this particular example). Xen doesn't allow the total memory allocated for all guests to be greater than the physical memory present on the system, which means that you'll need to reduce the memory allocated to Domain-0 before you install any other guest virtual machines.

### 3. Choose **Edit** → **Machine Details** from the **Virtual Machine Manager's** main menu.

Doing so brings up the Domain-0 Virtual Machine Details screen.



**Figure 13-14:**  
Launching  
the Virtual  
Machine  
Manager.



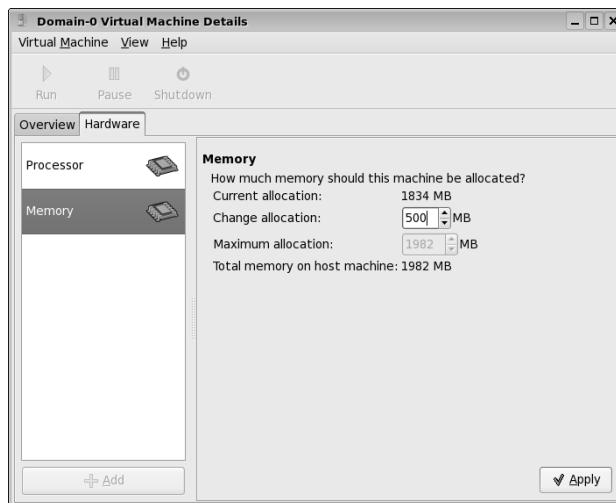
**Figure 13-15:**  
What's what  
on your  
VMM.

4. On the Hardware tab of the Domain-0 Virtual Machine Details screen, select Memory from the list on the left, use the Change Allocation spin box to adjust the memory allocated to Domain-0, and then click Apply.

You're brought back to the main Virtual Machine Manager screen.



I'd say you should adjust Domain-0's memory to 500MB, as shown in Figure 13-16. That should free up enough memory for you to begin the process of installing a new guest virtual machine.



**Figure 13-16:**  
Setting the  
memory to  
free some  
up for  
guests.



**5. Click the New button located at the bottom of the Virtual Machine Manager screen. (Refer to Figure 13-15.)**

The Virtual Machine Manager launches the Create a New Virtual System Wizard with a splash screen explaining what the virtual machine installation process entails, as shown in Figure 13-17.

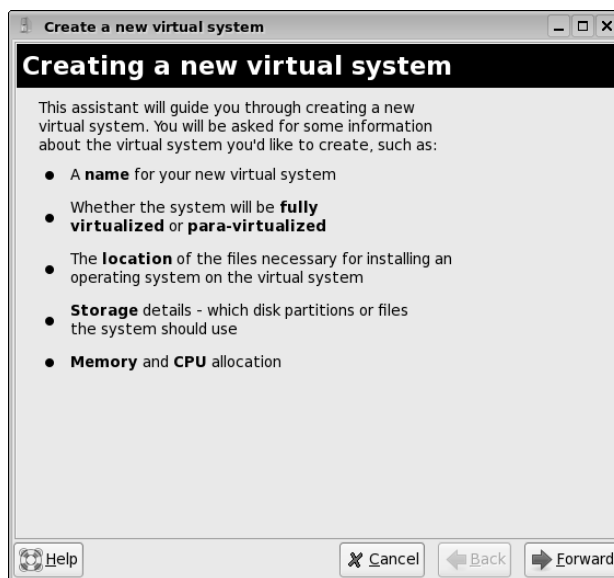
**6. Click Forward.**

The Naming Your Virtual System screen appears.

**7. Enter a name for your system in the System Name text box and then click Forward.**

For this example, you install an Ubuntu Linux Client system, so you should probably name it something wildly improbable — maybe UbuntuClient? (See Figure 13-18.) Of course, you could install a Fedora 7 guest as well. If you decide to do so, you'll follow the same steps up to the point where you begin installing the actual operating system.

If you're going to be installing a guest OS, you're going to need an OS install disc. If you don't have Ubuntu lying around, you can download all the Ubuntu install files from the Ubuntu site ([www.ubuntu.com](http://www.ubuntu.com)) and then burn the image on a CD — although Ubuntu will kindly send you a CD at no charge, too.



**Figure 13-17:**

The Welcome screen of the Create a New Virtual System Wizard.



**Figure 13-18:**  
Naming  
your new  
system.

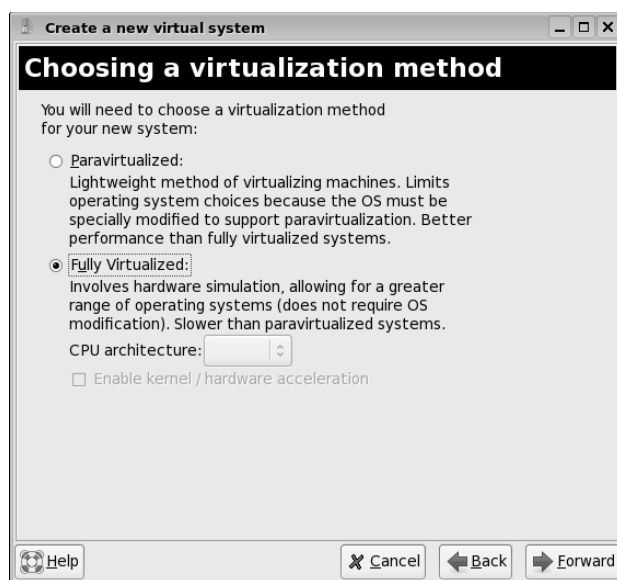
**8. In the next screen of the wizard, select either Paravirtualized or Fully Virtualized as your virtualization method for your guest virtual machine and then click Forward.**

You see the Fully Virtualized option only if you own a newer model PC with a virtualization-enabled CPU. (See Chapter 8 for more information on virtualization and hardware.) To keep things simple, I'd choose Fully Virtualized, as shown in Figure 13-19.



Paravirtualization refers to virtualization accomplished by modifying the guest operating system so that it can cooperate with the virtualization hypervisor. Paravirtualization offers very good performance, but has the drawback of needing to modify the operating system. With the new generation of virtualization-enabled chips, the Xen hypervisor can support unmodified guest operating systems. This is somewhat confusingly referred to as “full virtualization,” but it is still a paravirtualized version of virtualization. It's just that they wanted some way to differentiate between standard paravirtualization, which requires guest operating system modification, and paravirtualization operating on machines with virtualization-enabled chips, which does not require guest operating system modification. Unfortunately, they used the phrase “full virtualization” which seems to be something different than paravirtualization. It's not.

See Chapter 3 for more information on the difference between the two types of virtualization.



**Figure 13-19:**  
Choosing a  
virtualization  
method.

**9. In the Locating Installation Media screen of the Create a New Virtual System Wizard, choose the CD-ROM or DVD option.**

This is where that CD install disc I mentioned back in Step 7 comes into play. (By the way, you need to have the disc actually in the drive in order to choose this option, even though the OS installation will happen later in the process.)

**10. In the same screen, use the drop-down menus to specify your OS type as well as your OS variant; then click Forward.**

Because you're going the Linux route, you should definitely select Linux as your OS type, as shown in Figure 13-20. As for your OS variant, the wizard has a number of preidentified variants it supports, but it turns out Ubuntu isn't one of the defaults, so go ahead and choose the Generic 2.6.x Kernel option.

**11. In the next screen of the Create a New Virtual System Wizard, specify how you'd like to assign storage space on your "real" system for your "virtual" system and then click Forward.**

The wizard offers you two options: a Linux partition and a regular Linux file. Although a production virtual machine would be better placed in a separate partition, if you're just experimenting you should use the Simple File option.



**Figure 13-20:**  
Where did I  
put that  
disc?



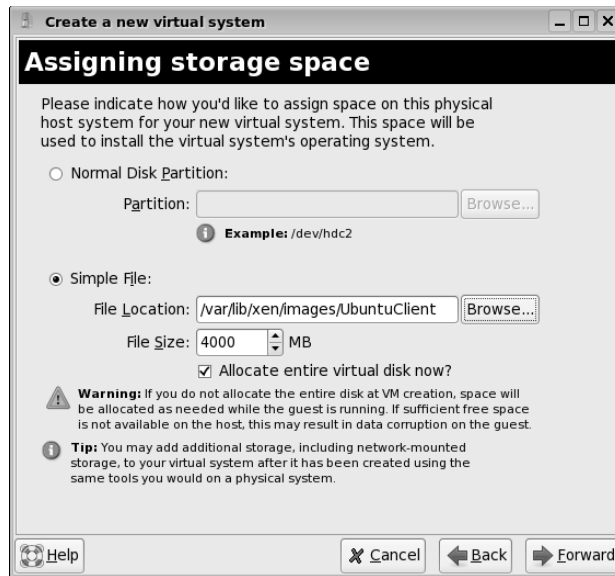
You need to specify a location for the file — using the File Location text box with its accompanying Browse button — and you also need to make sure that the file system has sufficient room for the amount of storage you assign for the virtual machine. The recommended location for simple file images is in the `/var/lib/xen/images` directory, which is where you'll place your virtual machine. Also keep in mind that the virtual machine requires a specific file for the image. I recommend using `Otent` with the virtual machine name itself. The default recommendation for file size is 4GB, which you should accept. (See Figure 13-21.)

**12. In the next screen of the wizard, specify how you plan to connect to the host network and then click Forward.**

The Virtual Network option is useful if you plan to have the machine disconnected from the rest of your network and don't need the virtual machine you're installing to talk to any other applications or systems. However, because you're likely to want to interact with other systems or the Internet, you should select the Shared Physical Device option, as shown in Figure 13-22.



If you have only one network card in your system (which is pretty typical for the type of machine you're likely to be using for this example; production servers, however, usually contain two or more network interface devices), you see only one option for the Device drop-down menu.



**Figure 13-21:**  
Deciding  
where to  
store your  
new virtual  
machine.



**Figure 13-22:**  
Determining  
your virtual  
machine's  
network  
connection.

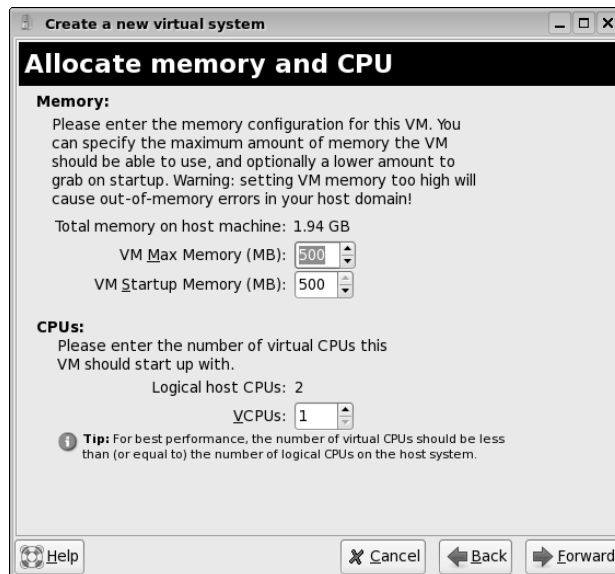
13. In the wizard's next screen, use the VM Max Memory spinner box to specify the maximum amount of memory your new virtual machine should be allowed to use, set the number of virtual CPUs you want, and then click Forward.

Remember how, in an earlier step, you reduced the amount of memory assigned to Domain-0? In this step of the wizard, you assign some of that reclaimed memory to your new virtual machine. For this example, choose 500MB as the amount of memory assigned to this virtual machine, as shown in Figure 13-23.

As for how many virtual CPUs you want to assign to this virtual machine, although it's true that Xen can handle multiple virtual CPUs (even more virtual CPUs than physical CPUs exist), for this example, stick with the default suggestion of one virtual CPU.

14. In the confirmation page that appears (see Figure 13-24), review all the choices you've made during the configuration process to ensure they reflect what you want to install. If what is displayed corresponds with your wishes, click Finish.

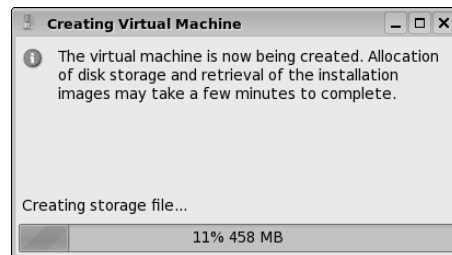
The Virtual Machine Manager starts creating your new virtual machine. You see a progress page indicating how the creation process is going, as shown in Figure 13-25. When this is complete, you'll have a new virtual machine just waiting for a new OS to be installed.



**Figure 13-23:**  
Allocating  
memory for  
your virtual  
machine.



**Figure 13-24:**  
Making  
a list,  
checking it  
twice.

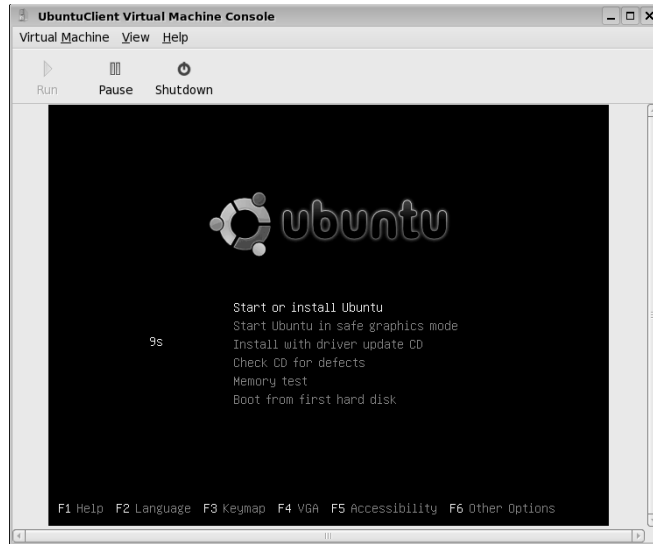


**Figure 13-25:**  
Creating  
your virtual  
machine.

## *Installing a Guest Operating System*

Okay, you have a brand-new virtual machine, but a machine — whether virtual or physical — won't do you much good without an operating system. Time to get some closure on this process and install the virtual machine's operating system. Luckily for you, the installation media for Ubuntu Client is sitting right there in your CD tray. (Remember placing it there earlier during the virtual machine creation process?)

So you're pretty much ready to go. Your Virtual Machine Manager has successfully created a new virtual machine, and your new machine has automatically powered up and is conveniently displaying the UbuntuClient Virtual Machine Console you see in Figure 13-26.



**Figure 13-26:**  
Your virtual machine displaying the first screen of the Ubuntu Client Virtual Machine Console.



Because the Ubuntu Client installation media is in the CD tray, powering up the virtual machine automatically begins the installation process — just as it would if you powered up a physical server with the Ubuntu Client CD in its CD tray. Here's the process in a nutshell:

- 1. Using the arrow keys, select the Start or Install Ubuntu option (refer to Figure 13-26) and then press Return.**

The Ubuntu Client installation process kicks into action just as it would on a physical server, asking you for information on what time zone you're located in, what language you want the OS to use, and so on.

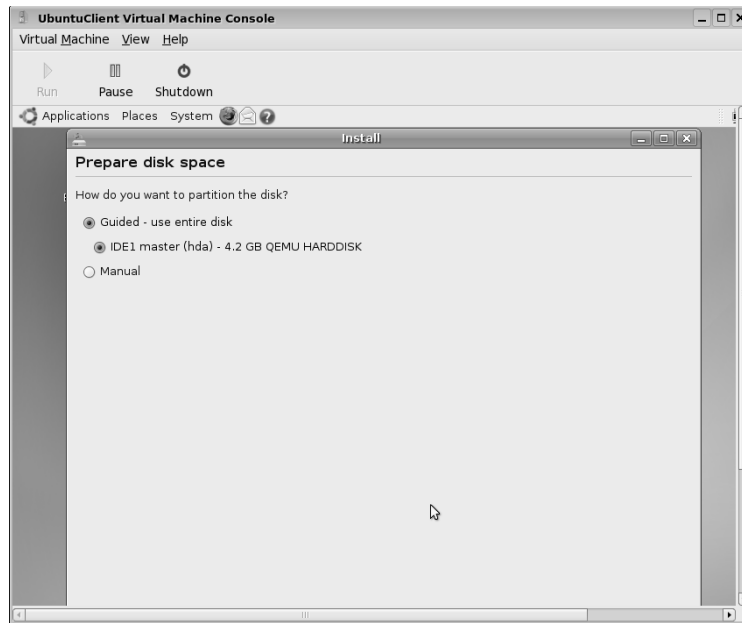
- 2. Make your way through the various install screens until you get to the Prepare Disk Space screen. (See Figure 13-27.)**

An Ubuntu installation is quite similar to the Fedora installation I detail earlier in the chapter, so you can review that discussion if one or two steps don't seem clear.



One part of the Ubuntu installation process might seem a bit troubling — the aforementioned Prepare Disk Space screen. The screen asks whether you want to partition the entire disk. You might be worried that this is going to wipe out the disk of the host Fedora system and ruin all your work. Don't worry. This is just asking whether you want to partition only that 4GB of disk space you assigned during the virtual machine creation process.





**Figure 13-27:**  
The Prepare  
Disk Space  
screen.

**3. Answer Yes in the Prepare Disk Space screen.**

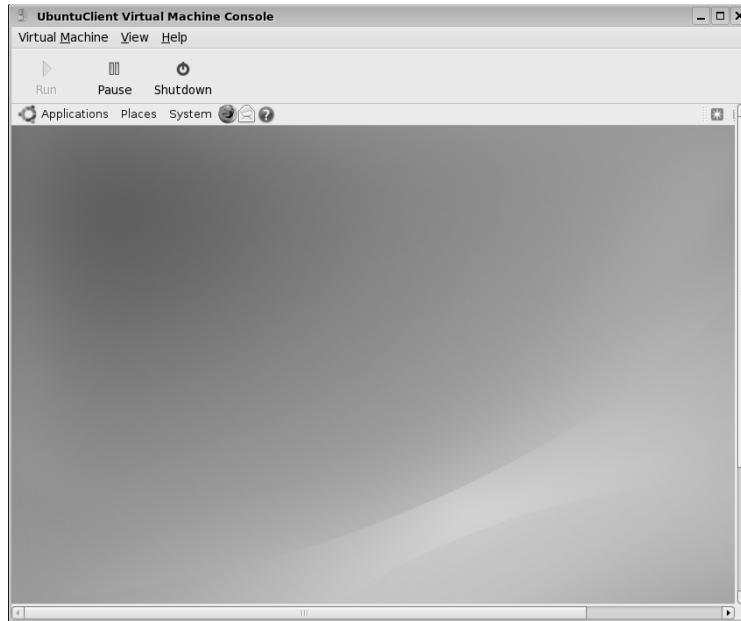
You might need to scroll down to find the Yes button.

**4. Make your way through the installation process until the wizard completes its work.**

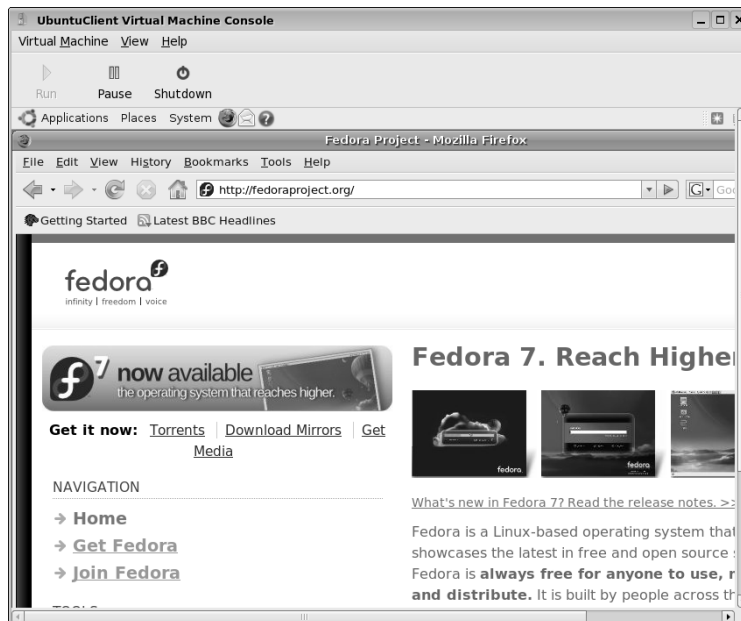
The installation program reboots the guest, and when it returns, you're greeted by a brand-new Ubuntu desktop, as shown in Figure 13-28. The installation process of the virtual machine operating system is complete. Ubuntu is now up and running in your virtual machine. Good work!

**5. Just to confirm that the new virtual machine is working properly, bring up the Firefox browser, type a URL in the address bar, and then press Enter.**

For this example, I chose the Fedora 7 Web site (see Figure 13-29), just to show the virtual machine is connected to the Web. Of course, to successfully connect, you would have had to have chosen the right option during the Connect to Host Network step in the Create a New Virtual System Wizard. (That was Step 12 in the list from the previous section in this chapter.)



**Figure 13-28:**  
A new  
Ubuntu  
desktop.



**Figure 13-29:**  
It's alive!