# Chapter 4

Virtualization Practicum

4.1 Chapter Overview

In this chapter, we are going to download and install the Sun VirtualBox product. Then, we will show you how to install and configure it. Next, we will add a virtual operating environment on top of your existing operating system. The beauty of virtualization solutions is that you can run multiple operating systems simultaneously on a single computer. To really understand how powerful an ability that is, you need to see it for yourself. The following illustration shows a draft version of this chapter being written on an Open-Solaris virtual guest operating system running on Windows XP host.
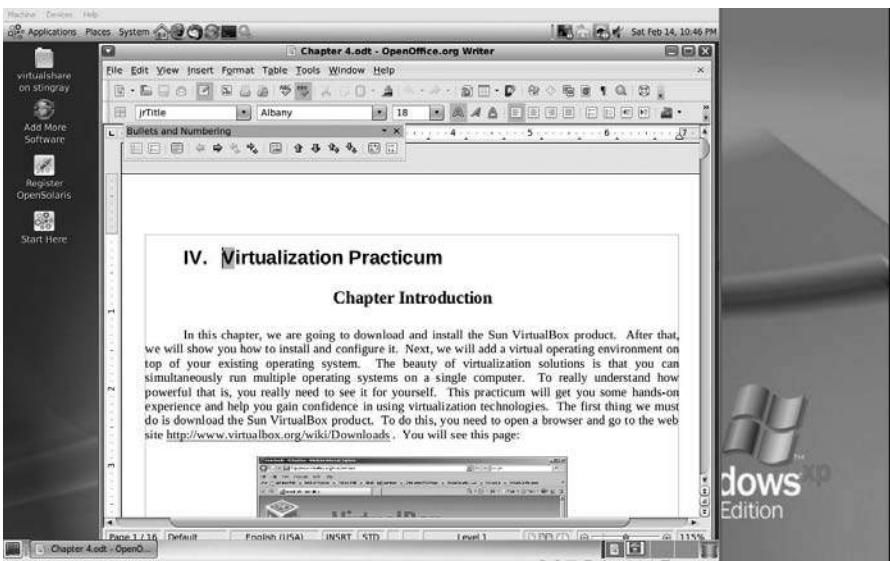
4.2   Downloading Sun xVM VirtualBox

This practicum will provide you with some guided hands-on experience and help you gain confidence in using virtualization technologies. To begin, the first thing to do is to **download the Sun VirtualBox product.** To do this, you need to open a browser and go to the web site

```
http://www.virtualbox.org/wiki/Downloads
```

where you will see this page:
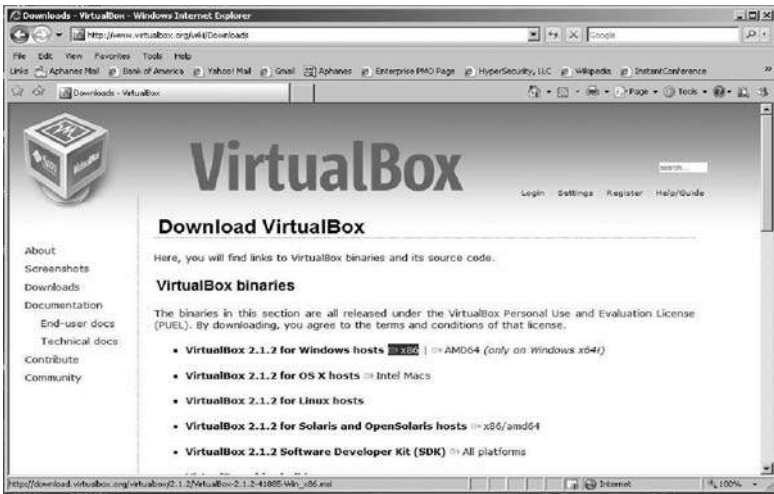
Choose the type of download file that is most suitable to the operating system you are using and download the product. Save the file—in Microsoft Windows, you will be prompted to save the file from the **File Download – Security Warning** dialog:
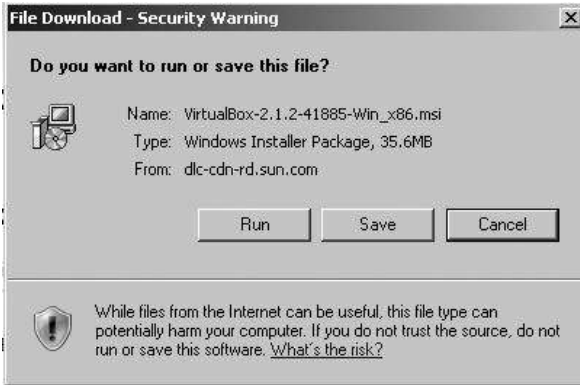
Choose **Save** and you will be shown a **Save As** file selection dialog to choose where you wish to save the downloaded file. The dialog box should look like this:
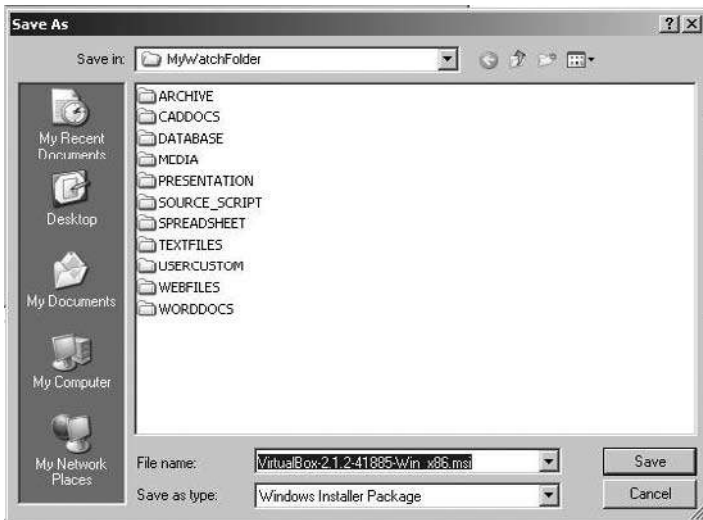
Select a location for the file to be saved to and click the **Save** button to continue. The download status dialog will appear:
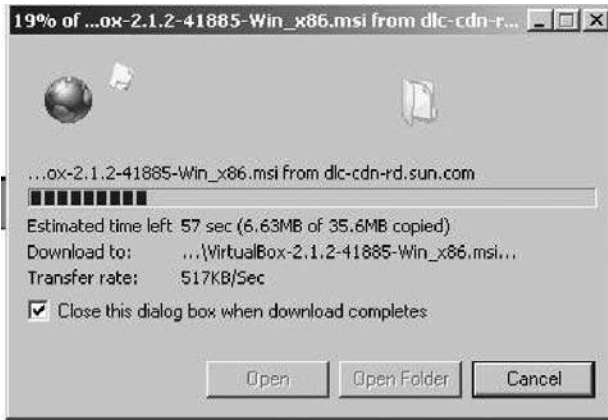
4.3   Installing Sun xVM VirtualBox

Once the download has completed, you must locate the file wherever you saved it and execute the installer. If you are not using a Microsoft operating system, the procedure for executing the installer will be slightly different than what is shown here. Regardless of which non-Microsoft operating system you may be using, launch the installer according to your specific operating system's instructions. The VirtualBox installation can be started from a Windows environment by double-clicking on its Microsoft Installer archive (MSI file) or by entering this command from the prompt of a command-line interface:

```
msiexec /i VirtualBox.msi
```

The figure below shows the highlighted selection of the Sun VirtualBox (Windows version) installer from the root of the D: drive.
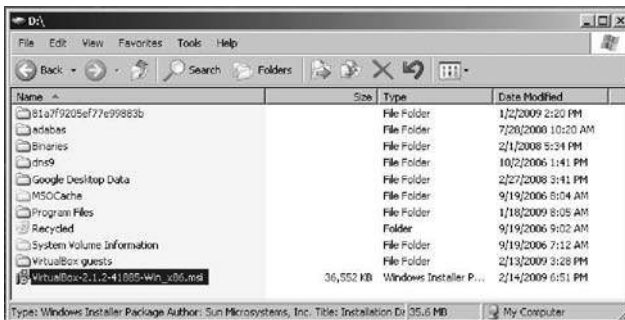
Using just the standard settings, VirtualBox will be installed for all users on the local system. If this is not what you want, it is necessary to invoke the installer from a command-line prompt as follows:

```
msiexec /i VirtualBox.msi ALLUSERS=2
```

Executing the installer in this fashion will install VirtualBox for the current user only.

Once the installer begins executing, the first thing you will see is the installation welcome dialog, which looks like this:

Click **Next >** to continue on to the **End-User License Agreement** (EULA), as shown below. In order to proceed, you must accept this agreement to use the product. Click the **Next >** button to continue.
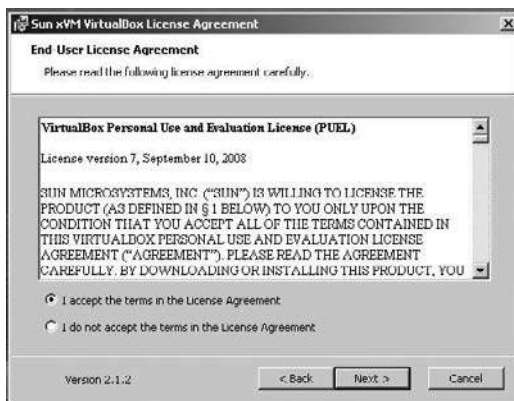
Once the EULA is accepted, the **Custom Setup** screen will appear, as shown below.
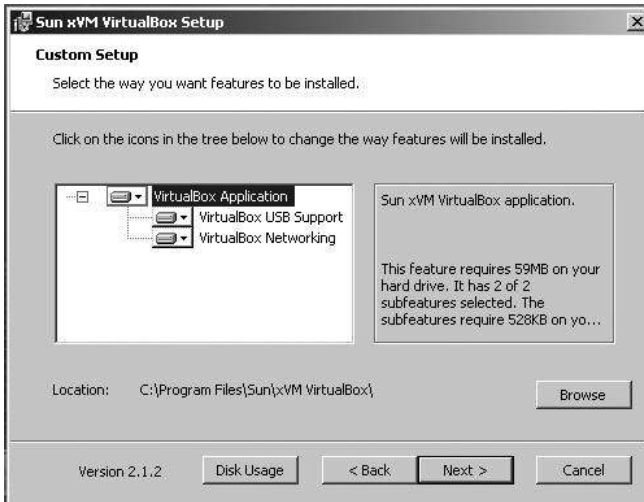

Here you can change the default settings, choosing where and how VirtualBox will be installed. Usually, the defaults are satisfactory for installation. If you choose this option, all features will be installed.

In addition to the VirtualBox application, the components for USB support and networking are available. These packages contains special drivers for your Windows host that VirtualBox requires to fully support networking and USB devices in your virtual machine (VM). The networking package contains extra networking drivers for your Windows host that VirtualBox needs to support Host Interface Networking (to make your VM's virtual network cards accessible from other machines on your physical network).

Depending on your Windows configuration, you may see warnings about "unsigned drivers" or similar messages. Select **Continue** on these warnings, because otherwise VirtualBox may not function correctly after installation. Click **Next >** to continue to the **Ready to Install** dialog box, shown below.
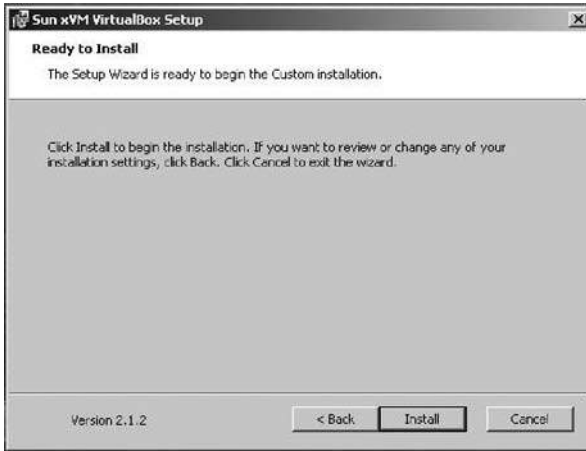
To start the installation process, just click **Install.** It may take a minute or so for the installer to complete, depending on your system's processor and memory resources. You will see an installation progress dialog, similar to this one:
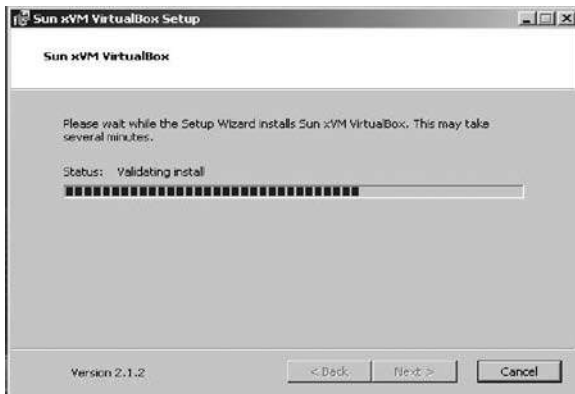
On Microsoft Windows operating systems, you may see the **Software Installation** dialog box shown below, warning you that the product you are installing has not passed Windows Logo testing to verify its compatibility with Windows XP. Click the **Continue Anyway** button to proceed.

You will be notified when the installation has completed, and given the opportunity to launch the application automatically. Be sure the box in the following dialog is checked:

Click **Finish** to complete the installation process and continue. The **VirtualBox Registration Dialog** will appear:

Registration is very simple, and it is recommended that you register your product. Just fill in your name and an email address. Once the registration form has been completed, a **Confirm** button will appear. You can choose to allow Sun to contact you or not by checking or unchecking the box above the **Confirm** button. Once you have clicked **Confirm,** instant kudos appear:
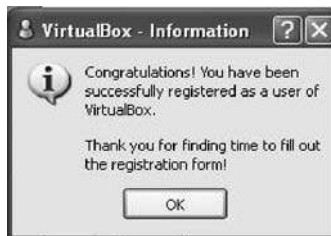
Click **OK** and you are rewarded with the initial display of the Sun xVM VirtualBox product. For Microsoft Windows-based systems, the installer will create a **VirtualBox** group in the Programs folder of the Start menu, which will allow you to launch the application and access its documentation. If you choose later to uninstall this product, VirtualBox can be safely uninstalled at any time by choosing the program entry in the **Add/ Remove Programs** applet in the Windows **Control Panel.** For non-Windows operating systems, you must uninstall according to your system's recommended procedures. However, let's not do that yet! The following

picture shows you what the opening screen looks like after you have installed and filled out the product registration form:

4.4   Adding a Guest Operating System to VirtualBox

VirtualBox allows you to run *guest operating systems* using its own virtual computer system, which is why it is called a "virtual machine." The guest system will run in its VM environment just as if it were installed on a real computer. It operates according to the VM settings you have specified (we will talk about settings a bit more later in this chapter). All software that you choose to run on the guest system will operate just as it would on a physical computer.

With the options available, you have quite a bit of latitude in deciding what virtual hardware will be provided to the guest. The virtual hardware you specify can be used to communicate with the host system or even with other guests. For instance, if you provide VirtualBox with the image of a CD-ROM in the form of an ISO file, VirtualBox can make this image available to a guest system just as if it were a physical CD-ROM. You can also give a guest system access to the real network (and network shares) via its virtual network card. It is even possible to give the host system, other guests, or computers on the Internet access to the guest system.

4.5   Downloading FreeDOS as a Guest OS

For our first guest, we will be adding an open source operating system called FreeDOS to the host machine. In order to do this, we must first go to the

Internet and download FreeDOS. Minimize the VirtualBox application for now and open a web browser. Go to

```
http://virtualbox.wordpress.com/images
```

When your browser has brought up the site, it should look similar to the figure below. You will see a list of virtual operating systems, with the sponsoring web site for each one in parentheses.

Towards the bottom of the page, you will find the FreeDOS entry. The reader is encouraged to go to the web site of each operating system and check it out before downloading a file. Click on the FreeDOS entry to start the download process. When you click on any of the operating system links, you will be taken to that system's download page. There, you are given the choice of which architecture (i.e., 32-bit or 64-bit) you want to install. What is important for almost every operating system displayed on this page is that you must *write down the passwords for the root user and default user*. An example similar to what you will see is shown below:

FreeDOSThere are several FreeDOS images available.

FreeDOS 1.0

Size (compressed/<u>uncompressed</u>): 82.3 MBytes / <u>394 MBytes</u>

Link: http://downloads.sourceforge.net/virtualboximage/freedos

Of course, FreeDOS is the exception to the rule above, since it does not require a root or user password. Click the link to download the image and save it to a location you will remember—later in this practicum, you will need to unzip this file and extract the images. We recommend that you choose to save the files on a drive with plenty of space available.

4.6   Downloading the 7-Zip Archive Tool

Next, you will need to download an open source product called 7-zip (it works on both Linux and Windows platforms), which can be accessed from

```
http://www.7-zip.org/download.html
```

Once the download is complete, perform the following steps *in sequence:*

1.   Pick a drive with plenty of spare room on it and create a folder named **VirtualGuests.**

2.   Download the **7-zip file** to the VirtualGuests folder and install it using the standard options.

3.   Once you have installed 7-zip, find the FreeDOS file you downloaded previously.

4.   Highlight the file and right-click on it—choose the **7-zip extraction** option to extract files.

5.   Extract the files to your VirtualGuests folder.

6.   Your VirtualGuests folder will now contain two folders, **Machines** and **VDI.** The virtualBox image for FreeDOS will be in the VDI folder.

4.7   Adding a Guest OS to Sun xVM VirtualBox

Now you will add the FreeDOS guest operating system to your virtualBox host. Start by clicking on the **New** button. The **New Virtual Machine Wizard** dialog box will appear:


The wizard is an easy-to-follow guided setup for installation of your guest operating system. Click **Next >** to continue and you will be presented with the **Virtual Machine Name and OS Type** dialog box:
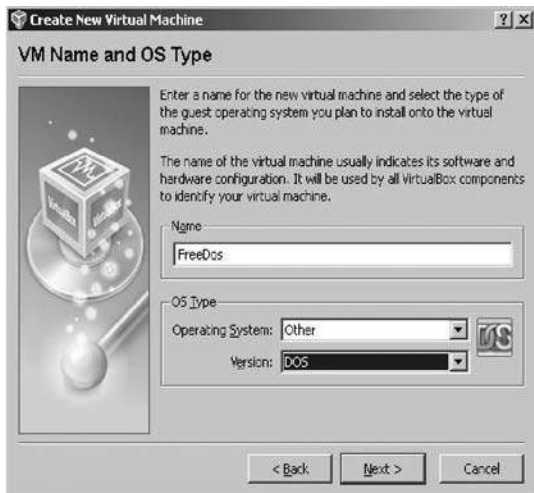
Type **FreeDOS** in the **Name** field. Select **Other** for the **Operating System,** and for the **Version** we will choose **DOS.** Click **Next >** to continue on to the dialog for memory configuration. In this part of the wizard, you have the option of increasing or decreasing the amount of memory that will be

used for the guest operating system. For those of us old enough to remember DOS, 32 MB of memory is plenty.
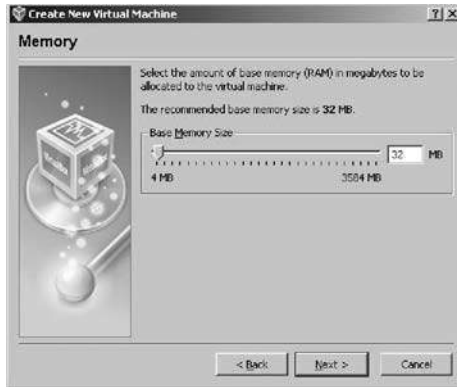

Just accept the default settings for now (you can always change them later) and click **Next >** to proceed to the next section of the wizard, the **Virtual Hard Disk** dialog box:

This dialog box allows you to select the virtual device image file (.vdi file) that was previously downloaded and saved to the VirtualGuests folder you created. What you see displayed in the dialog box is the name of the last image added. In this case, it was an image of Damn Small Linux (dsl). If no images have been installed on the host, the default selection will be similar to the one shown below:
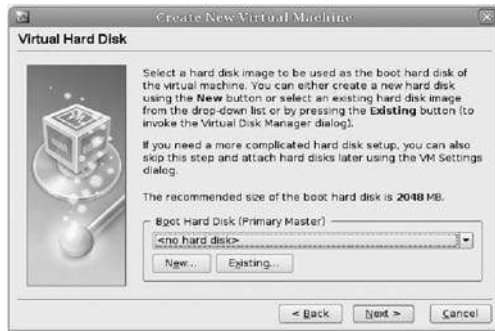
If you had previously created any virtual hard disks which have not been attached to other virtual machines, you could select from among those using the drop-down list in the Wizard window. Since we have downloaded and extracted a new image of FreeDos, it won't be in the list. Click the **Existing...** button to continue on to the **Virtual Media Manager.** In the figure below, FreeDOS is listed as an available selection. If it is not listed, then you need to add it by clicking on the **Add** button at the top of the dialog box.
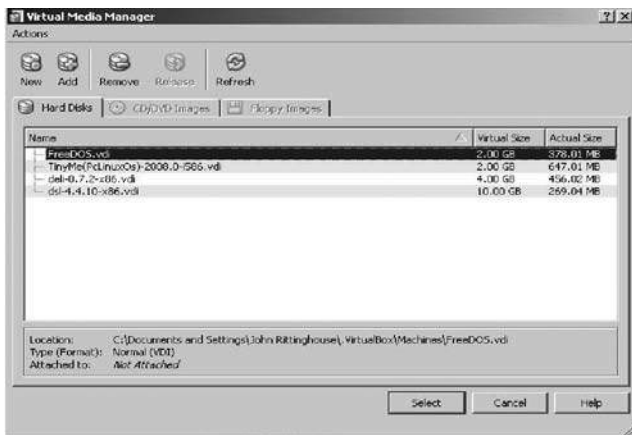

VirtualBox's Virtual Media Manager keeps an internal registry of all available hard disk, CD/DVD-ROM, and floppy disk images. This registry can be viewed and changed in the Virtual Disk Manager, which you can access from the **File** menu in the VirtualBox main window. The **Disk Image Manager** shows you all images that are registered with VirtualBox,

grouped in three tabs for the three supported formats. These are hard disk images, either in VirtualBox's own Virtual Disk Image (VDI) format or the widely supported **V**irtual **M**achine **D**is**K** (VMDK) format. CD and DVD images in standard ISO format are supported. There is support for floppy images in standard RAW format. As you can see in the figure below, for each image, the Virtual Disk Manager shows you the full path of the image file and other information, such as the virtual machine the image is currently attached to, if any.
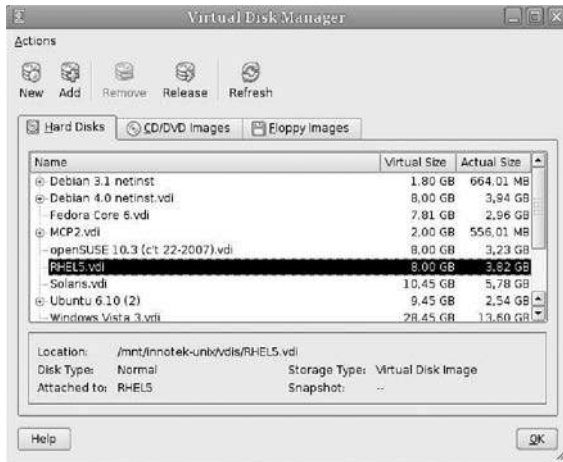

Clicking the **Add** button will bring you to the **Select a hard disk image file** dialog box, as shown below:
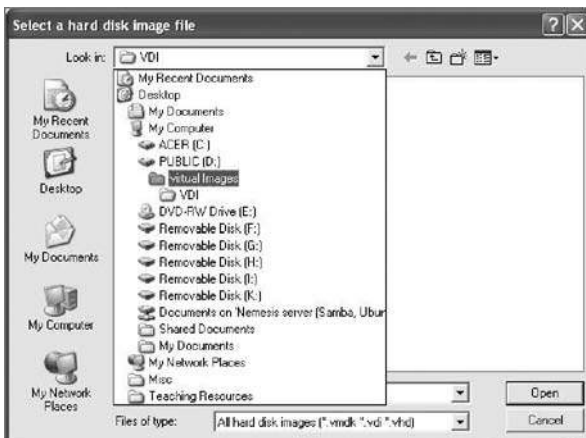
Using this file dialog, you must navigate to your VirtualGuests folder. In your VirtualGuests folder, open the **VDI** folder and highlight the **Free-DOS** .vdi file. Once you have it highlighted, simply click on the **Open** button. You are returned to the **Virtual Hard Disk** dialog box, where you earlier clicked the **Existing...** button:
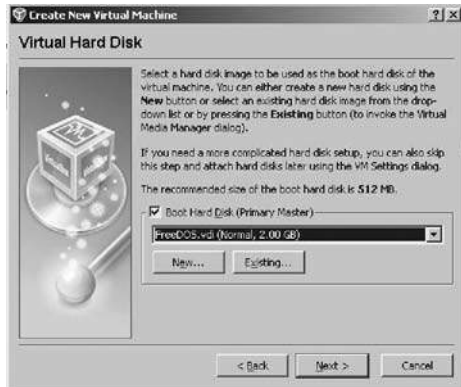

Click **Next >** to complete the addition of the FreeDOS virtual image. A summary screen, as shown below, will appear:
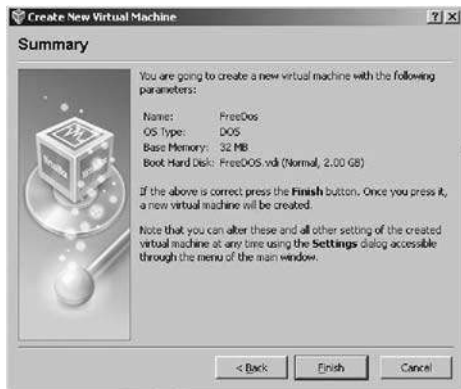
Here, simply click the **Finish** button and you will be returned to the Sun xVM VirtualBox main display. FreeDOS should be displayed in the left panel (it should be the only entry on your system) similar to the list shown in the following image:
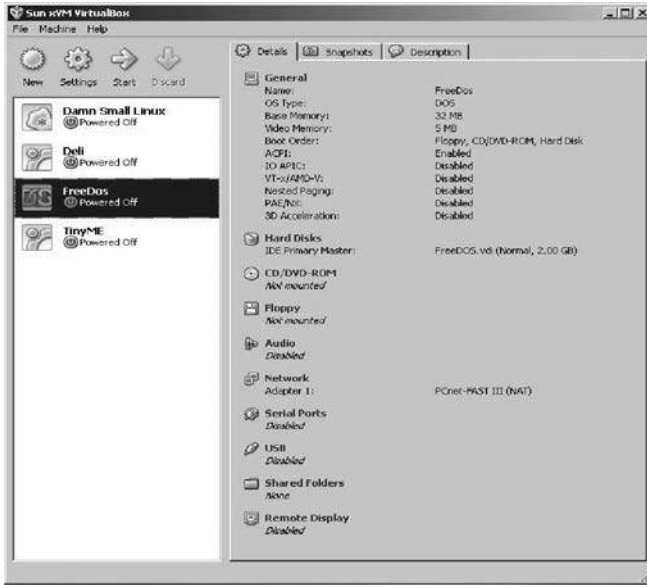
Before we explore the FreeDOS environment, it is a good idea to check the settings to ensure that the guest system will work the way you want. The **Settings** button (in the figure above, it looks like a gear) in the toolbar at the top of the VirtualBox main window brings up a detailed window where you can configure many of the properties of the VM that is currently selected:
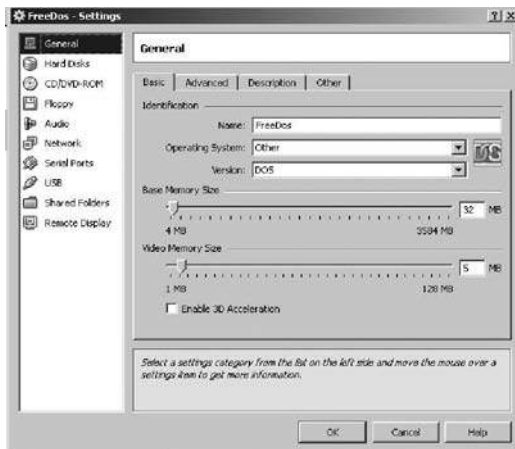
Click your desired settings—but be careful. Even though it is possible to change all VM settings after installing a guest operating system, certain changes after installation may prevent a guest operating system from functioning correctly.

Since you have just created an empty VM, you will probably be most interested in the settings in the **CD/DVD-ROM** section if you want to make a CD-ROM or a DVD-ROM available the first time you start Free-DOS, so that you can use it with your guest operating system. This will allow your VM to access the media in your host drive, and you can proceed to install from there. Check the box in the CD/DVD section if you want to use an optical device.
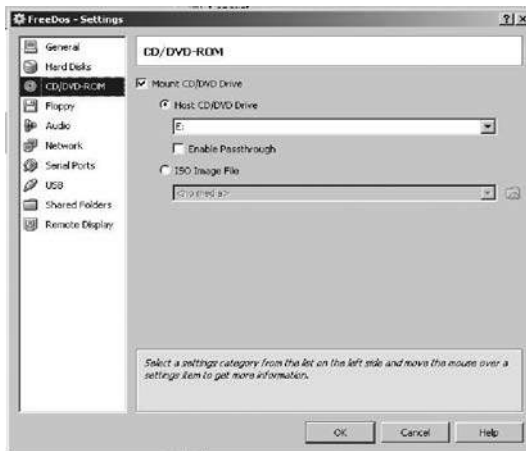

For now, that is all you need to do in Settings to prepare to run your virtual image. The next part of our practicum will take you inside the virtual guest system to use and and see for yourself that it is a real, functioning environment. We will show you how to set up a graphical user interface within the DOS environment using an open source product called Open-GEM. OpenGEM was modeled after GEM, one of the earliest GUI environments widely available on the DOS platform.

To start FreeDOS, highlight **FreeDOS** in the selections panel and click the green **Start** arrow as shown below.
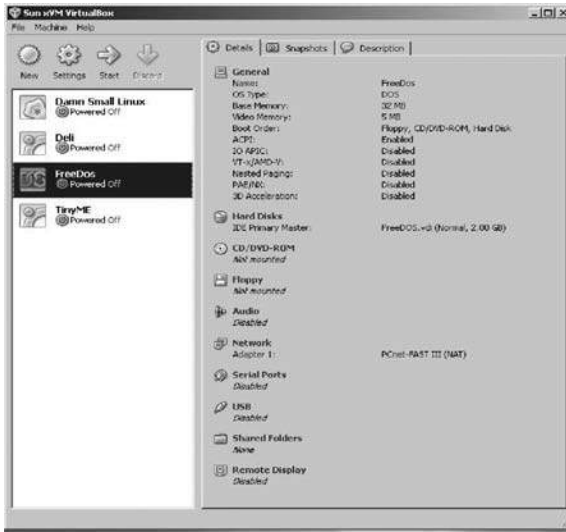
When you first start FreeDOS, you are presented with a "Load" menu, as shown below. Usually, the default selection best for your system is highlighted automatically. Choose the default option and press **Enter** (or just let the 5-second timer expire).
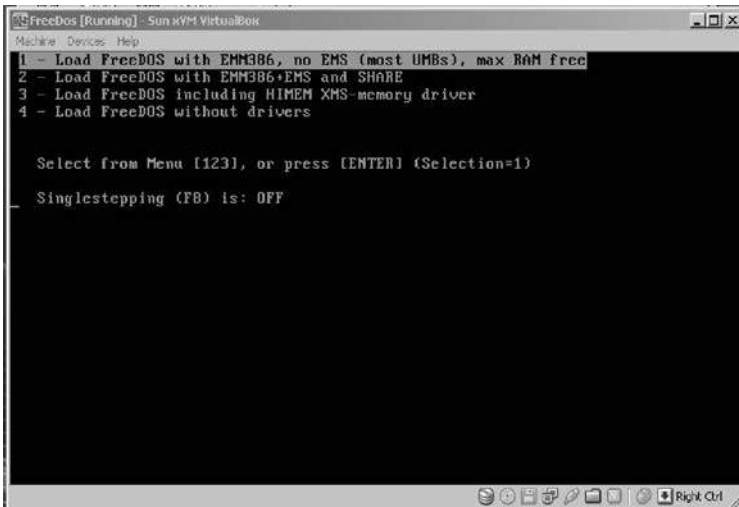
Since the operating system in the virtual machine does not "know" that it is not running on a real computer, it expects to have exclusive control over your keyboard and mouse. This is not so, however, since, unless you are running the VM in full-screen mode, your VM needs to share the keyboard and mouse with other applications and possibly other VMs on your host. This becomes evident when you look at the figure below, showing FreeDOS running on a Windows XP installation.
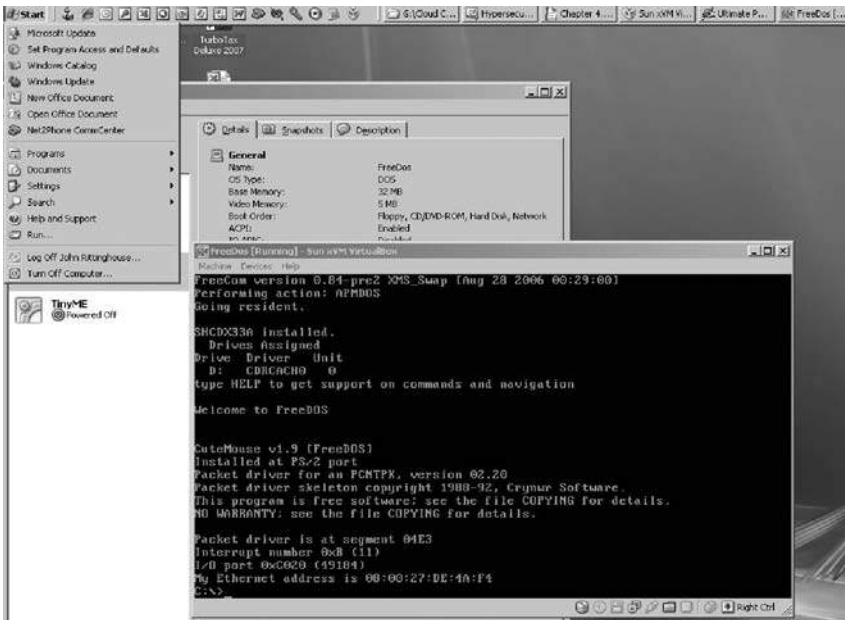
Only one of the two—either the VM or the host—can "own" the keyboard and the mouse at any one time. You will see a second mouse pointer, which will always be confined to the limits of the VM window. Basically, you activate the VM by clicking inside it. To return ownership of the keyboard and mouse to your host operating system, VirtualBox reserves a special key on your keyboard, called the **Host key,** for itself. *By default, this is the Control (CTRL) key on the right lower part of your keyboard.* You can change this default in the VirtualBox Global Settings if you wish. In any case, the current setting for the Host key is always displayed at the bottom right of your VM window in case you may have forgotten which key to use. If needed, click the mouse in the virtualized window to gain focus in the guest system. Press the Host key to give focus back to the host.

FreeDOS comes with a graphical user interface (GUI) called Open-GEM that is ready to install. We are going to install OpenGEM in the Free-DOS environment to show you that it is a fully functioning virtualized platform. At the **c:\>** command prompt, type

```
FDOS\OPENGEM\INSTALL
```

and press **Enter.** The following screen appears when the GEM installer starts:

Choose option **1** from the menu and press **Enter.** The next screen to appear is the OpenGEM license agreement. Here, you must accept the license agreement by once again choosing option **1** (Accept and Install OpenGEM) and pressing **Enter** to continue the install process.
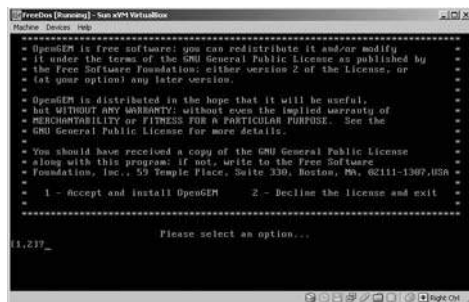
The installation will proceed and when it is completed, you will see the screen below:
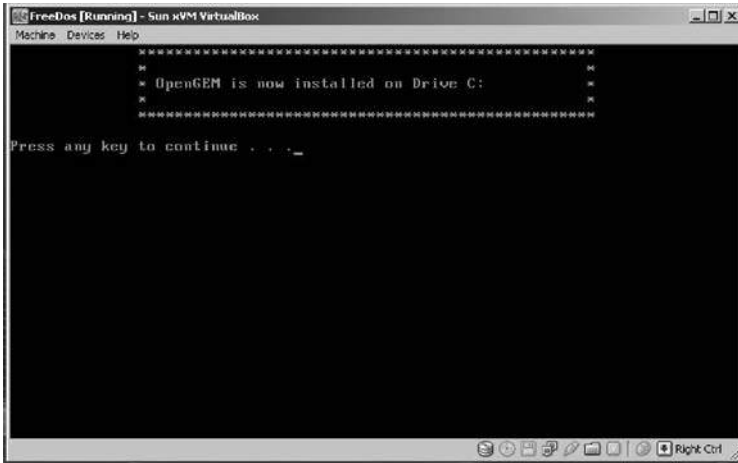
Press any key as instructed. You will then be shown an information screen and acknowledgment of your installation. Some basic information telling you how to start OpenGEM is displayed. Press any key again to continue.
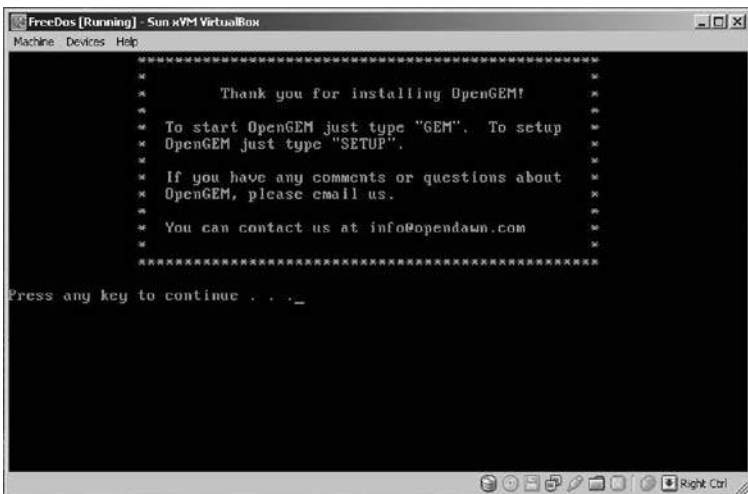
From the DOS command prompt <u>c:\</u>>, type **GEM** and press **Enter.** The GEM environment starts up and you should see something similar to the screen below.
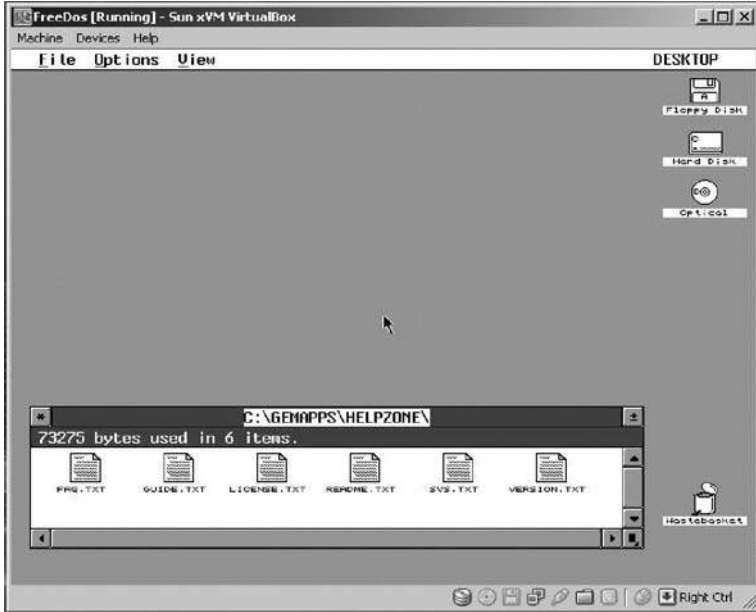
Play around with the environment and (for some of us) reminisce about the "good" old days. Once you are satisfied that everything works, you can exit GEM by using the **File |> Quit** option on the menu bar at the top. GEM will exit and show the following screen, where you are given the option to restart OpenGEM, return to DOS, reboot, or shut down.
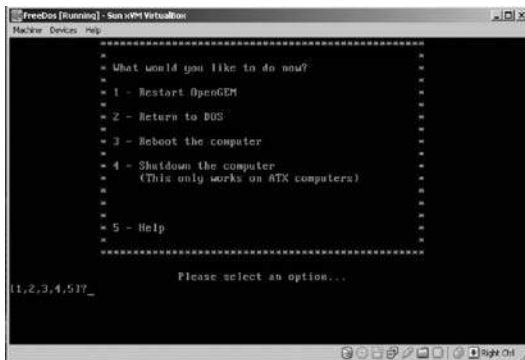
Choose option **4** and press **Enter.** You will be returned to the Sun xVM program. Note that FreeDOS is shown in a powered-off state.
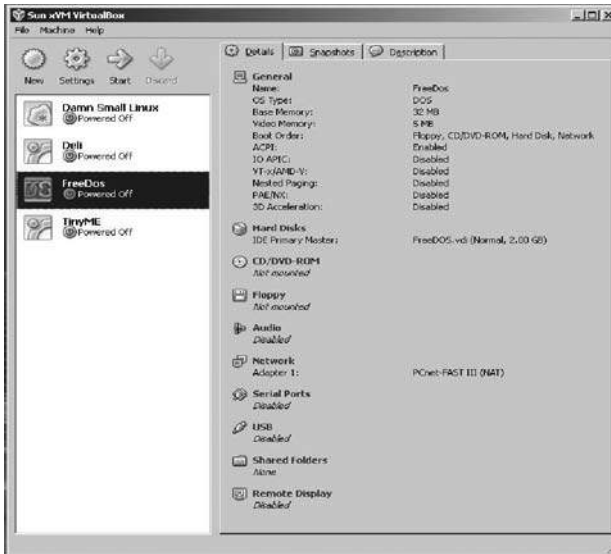
4.8   Chapter Summary

At this point, you have learned the basics of using the Sun xVM VirtualBox product and should have a pretty good idea of what virtualization is and how it can be used. The evolution to cloud computing has advanced rapidly over the last few years through such technological developments as service-oriented architectures, collaboration software, and virtualization, which you just experienced through this practicum. This advancement is creating a new corporate "edge" that has to consider the complex relationships and risks that exist on shared infrastructures. As a result of this loss of traditional perimeter boundaries, businesses are no longer operating from within the confines of a traditional corporate boundary, but rather as part of a global ecosystem of supply chains, strategic alliances, and partnerships. Increasingly ubiquitous connectivity, coupled with advances in mobile device capabilities and strategies, as well as new and exciting collaboration and remote service delivery paradigms, have all begun to erode traditional corporate perimeters and thinking that is fundamentally altering how we think about work, let alone how it is accomplished. This paradigm shift is forcing businesses to think beyond their over-reliance on Layer 2 and 3 perimeters and

begin to strengthen traditionally weak spaces revolving around identity, entitlement, and policy enforcement. Businesses must think about tiered perimeters without abandoning core infrastructure. This has also resulted in new security challenges that organizations did not have to face when critical resources and transactions were behind their firewalls or controlled partner networks. The glue that will make this work in the cloud computing environment is federated identity, presence, and privacy controls—all of which will be discussed in the next chapter. Their role will also be critical in providing a baseline for some of the security solutions required for cloud computing, to be discussed in Chapter 6.