Appendix A

Virtualization Practicum (Linux)

A.1 Overview

In this practicum, we will once again use the Sun VirtualBox product that you downloaded in Chapter 4. This time, we will show you how to install and configure it using a Linux-based .vdi operating system. Figure A.1 shows the Sun operating system named OpenSolaris running on top of Windows XP via VirtualBox. In this appendix, we will walk you through setting up a similar environment.

We will begin by starting the Sun xVM VirtualBox product. You may remember that for Microsoft Windows-based systems, the installer created a group called VirtualBox in the Programs folder of the Start Menu, which
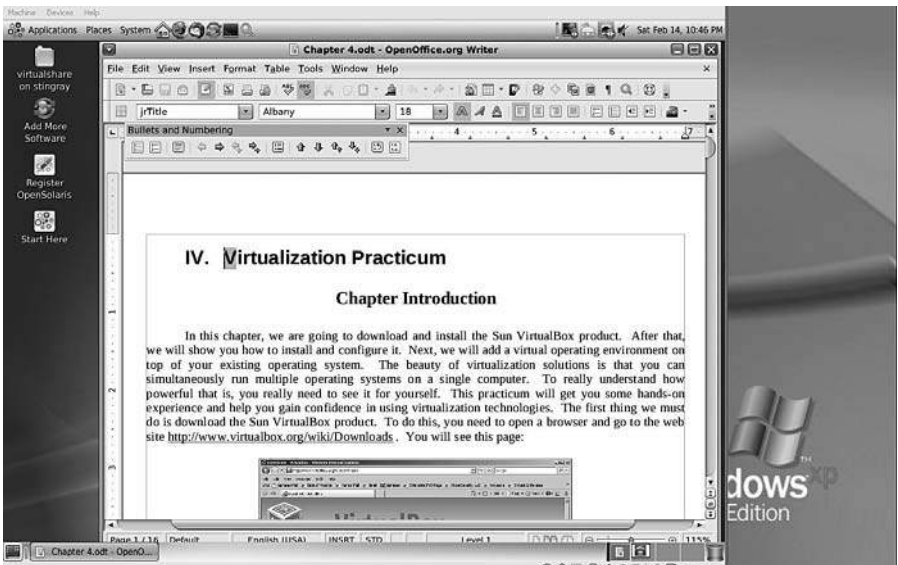

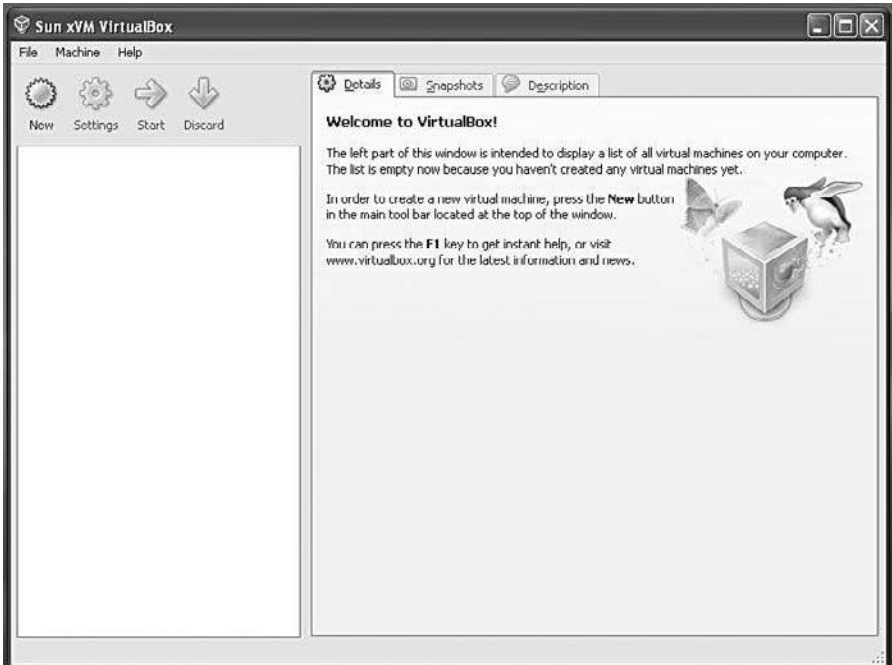Figure A.1   OpenSolaris running on top of Windows via VirtualBox.

Figure A.2   VirtualBox opening screen.

allows you to launch the application and access its documentation. Figure A.2 shows what the opening screen looks like after you have started Virtual-Box. If you have already installed the FreeDOS product as described in Chapter 4, your opening screen may look slightly different.

A.2   Adding a Linux-Based Guest Operating System to VirtualBox

As we pointed out in Chapter 4, VirtualBox allows you to run guest operating systems using its own virtual computer system, which is why it is called a *virtual machine* (VM). The operating system (OS) we will be working with is Sun Microsystems OpenSolaris, which is an open source product most often distributed under an approved open source license. The version of OpenSolaris we will be using in this practicum is OpenSolaris 2008.11, which offers technical support from Sun Microsystems. This release includes a network-based package management system, the GNOME desktop, and LiveCD technology supported on AMD64, Pentium, and Xeon

EM64T platforms. More information on OpenSolaris can be found at
http://opensolaris.org.

A.3   Downloading OpenSolaris as a Guest Operating System

In order to add OpenSolaris to our host machine as a guest OS, we must
first download it from the Internet. Minimize the VirtualBox application
for now and open a web browser. Go to the site

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

Once your browser has brought up the site, your screen should look
similar to Figure A.3. You will see a list of virtual operating systems, with
the sponsoring web site for each OS shown in parentheses.

Toward the bottom of the page you will find the entry for Indiana
under the GNU/OpenSolaris heading. You should go to the web site for
each operating system in which you are interested, and check it out before
downloading a file.

Figure A.3   VirtualBox Images page.

OpenSolaris

Images for several OpenSolaris versions are available.

1. OpenSolaris 2008.05 *(with GNOME desktop environment)*
   Size (compressed/<u>uncompressed</u>): 763.4 MBytes / <u>3.50 GBytes</u>
   Link: http://downloads.sourceforge.net/virtualboximage/opensolaris-2008.05-x86.7z
   Active user account(s) (username/password): opens/reverse
   Notes: Guest Additions not installed
2. OpenSolaris 2008.11 *(with GNOME desktop environment)*
   Size (compressed/<u>uncompressed</u>): 674.7 MBytes / <u>3.07 GBytes</u>
   Link: http://downloads.sourceforge.net/virtualboximage/opensolaris-2008-11-x86.7z
   Active user account(s) (username/password): root/toortoor, opens/reverse
   Notes: Guest Additions not installed
   Screenshot: Click here

Figure A.4   OpenSolaris image options.

Click on the **Indiana** 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 will be given the choice of which architecture (32-bit or 64-bit) you want to install. For almost every operating system displayed on this page, it is important to *write down the passwords for root user and default user.* An example of what you will see is shown in Figure A.4.

Next, click the link to download the image (in our case, link 2 in Figure A.4) 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 save the files on a drive with plenty of space available, since it will take up at least 650 megabytes just to save the file.

A.4   Using the 7-Zip Archive Tool

Next, we will need to use the open source product named 7-zip (which works on both Linux and Windows platforms), which we downloaded in Chapter 4. If you have removed it, it can be obtained again from this location:

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

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

1.   Pick a drive with plenty of spare room on it and locate (or create) the 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 OpenSolaris 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 the VirtualGuests folder.

6. The VirtualGuests folder will now contain two folders, Machines and VDI. The VirtualBox image for OpenSolaris will be in the VDI folder.

A.5   Adding the OpenSolaris Guest OS to Sun xVM VirtualBox

Now, we will add the OpenSolaris guest operating system to our VirtualBox host. We start by clicking on the **New** button. The New Virtual Machine Wizard dialog will appear, as shown in Figure A.5.

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 shown in Figure A.6.

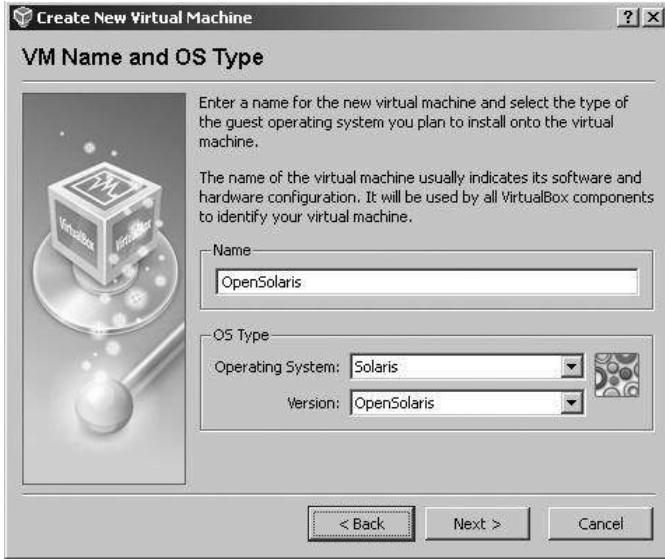Figure A.5   The New Virtual Machine Wizard dialog.

Figure A.6   The VM and OS Type dialog.

Type **OpenSolaris** in the Name field. Select **Solaris** for the Operating System, and for the Version, choose **OpenSolaris.** Click **Next >** to continue with to the dialog to choose a memory configuration. In this part of the wizard, as shown in Figure A.7, you have the option to increase or decrease the amount of memory that will be used for the guest operating system. For our purposes, the default, 512 megabytes of memory should be fine.
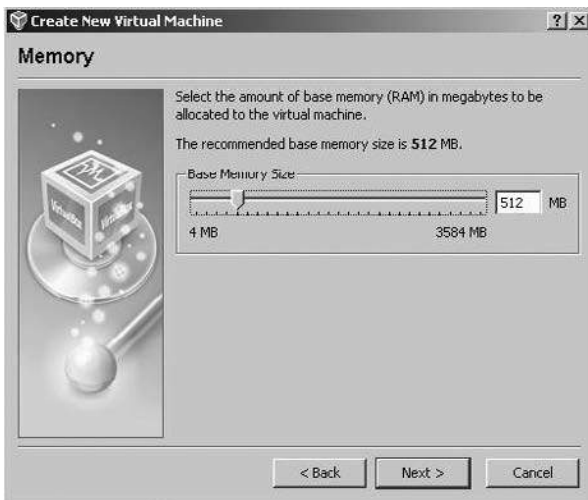

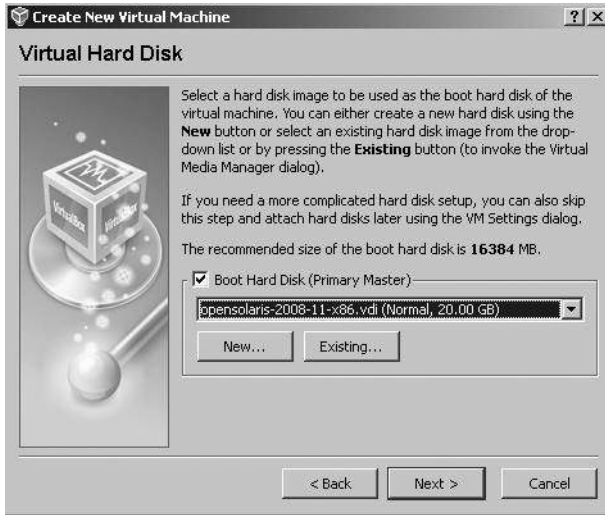Figure A.7   Choosing memory size.

Figure A.8   The Virtual Hard Disk dialog.

Click **Next >** to proceed to the next section of the wizard, the Virtual Hard Disk dialog, which is shown in Figure A.8.

The Virtual Hard Disk dialog allows you to select the virtual device image file (.vdi file) that you previously downloaded and saved to the VirtualGuests folder. What you see displayed in Figure A.8 is the name of the last image that was 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 would look similar to the one shown in Figure A.9.

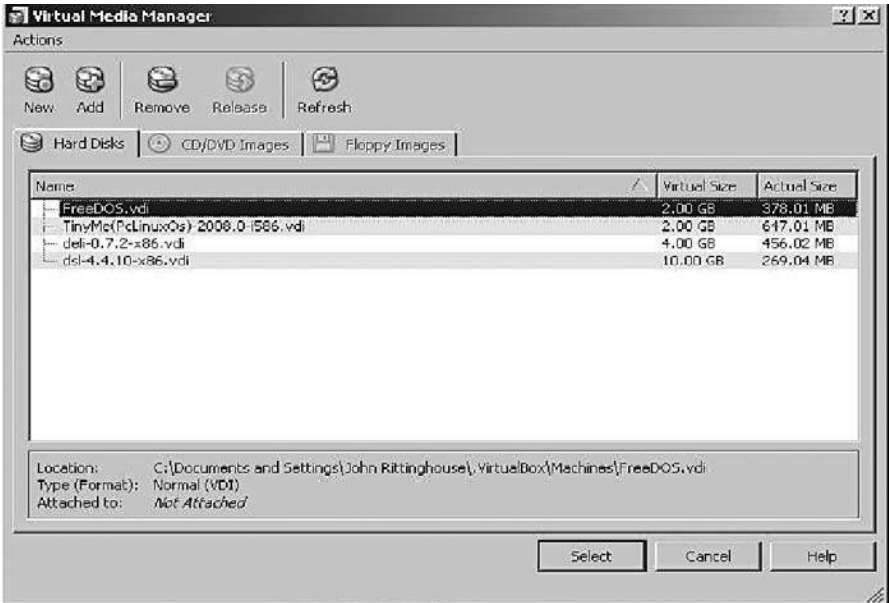Figure A.9   Default display in the Virtual Hard Disk dialog.

Figure A.10   The Virtual Media Manager.

If you previously created any virtual hard disks which have not been attached to other virtual machines, you can select from among those using the drop-down list in the Wizard window. Since we have downloaded and extracted a new image of OpenSolaris, it will not be included in the list. Click on the **Existing...** button to continue on to the Virtual Media Manager, as shown in Figure A.10. In this figure, OpenSolaris is not listed as an available selection. Since it is not listed, we need to add it by clicking on the **Add** button at the top of the dialog.

The 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 will show 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 in the widely supported Virtual Machine DisK (VMDK) format. CD and DVD images in standard ISO format are also supported. There is support for floppy images in standard RAW format. As shown in Figure A.11, for each image, the Virtual Disk Manager shows the
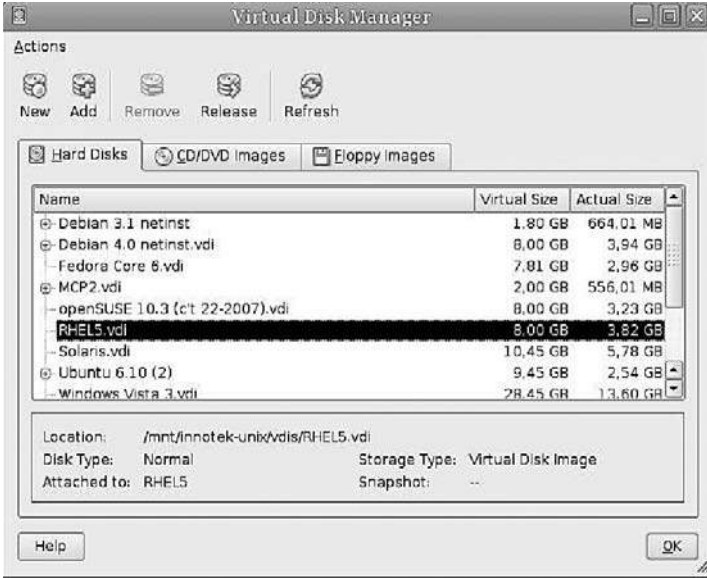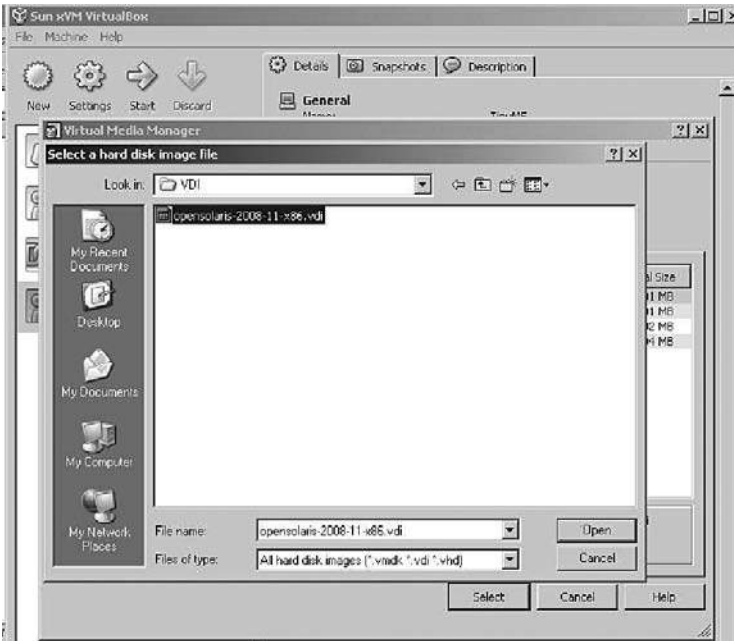
Figure A.11

Figure A.12   The **Select a hard disk image** file dialog.

Figure A.13   Back to the Virtual Hard Disk dialog.

full path of the image file and other information, such as the virtual machine to which the image is currently attached, if any.

Clicking the **Add** button will bring you to the **Select a hard disk image file** dialog, as shown in Figure A.12. Use this file dialog to navigate to the VirtualGuests folder.

In the VirtualGuests folder, open the **VDI** folder and highlight the **OpenSolaris.vdi** file. Once you have highlighted it, simply click on the **Open** button to continue. You will be returned to the Virtual Hard Disk dialog where you earlier clicked on the **Existing...** button (see Figure A.13).

Click **Next >** to complete the addition of the OpenSolaris virtual image. A summary screen will appear, as shown in Figure A.14.

Now, simply click the **Finish** button and you will be returned to the Sun xVM VirtualBox main display. OpenSolaris should be displayed in the left panel (it should be the only entry on your system), as in the list shown in Figure A.15.

Since you have just created an empty VM, the first thing you will probably want to do is make a CD-ROM or a DVD-ROM available to use with your guest operating system. In the main menu, click on **Settings** and then **CD/DVD-ROM,** which will bring up the screen shown in Figure A.16. Here you can tell the VM to access the media in your host drive, and you
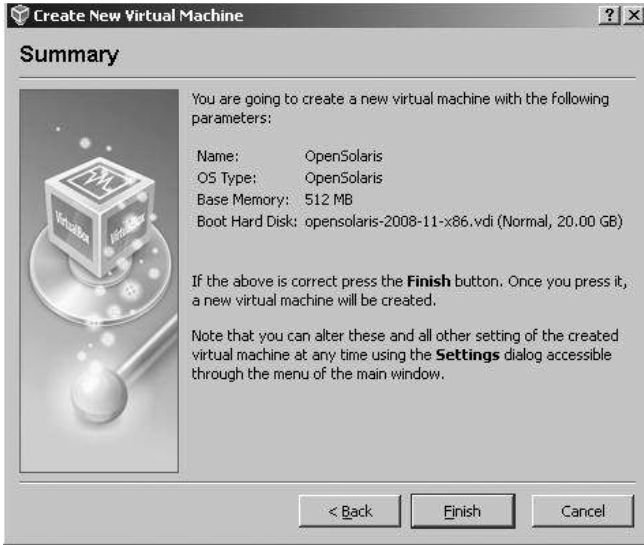
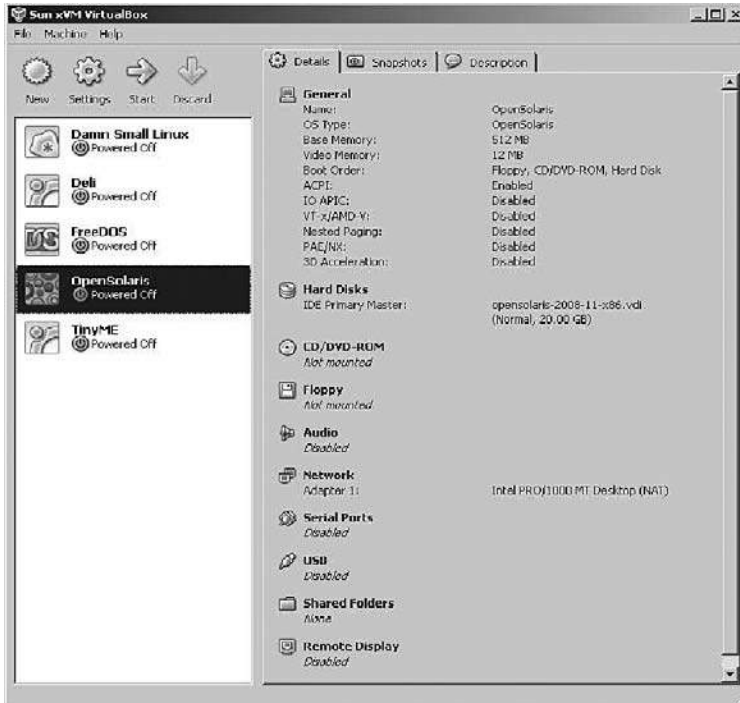Figure A.14 Summary screen for the Create New Virtual Machine wizard.
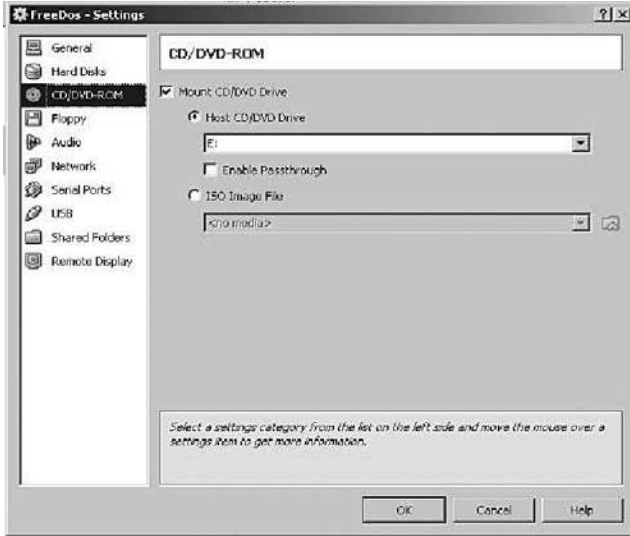

Figure A.15 VirtualBox main display.

Figure A.16

Figure A.17   Starting OpenSolaris.

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 this practicum will take you inside the virtual guest system to use and see for yourself that it is a real, functioning environment. Returning to the main menu, highlight the entry in the selections panel and click on the green **Start** arrow, as shown in Figure A.17, to start OpenSolaris.

When you first start OpenSolaris, you will be presented with a "loader" menu. Usually, the default selection best for your system is highlighted automatically. Choose the default option as shown in Figure A.18 and press **Enter** (or just let the timer expire).

Once OpenSolaris completes the initial loading process, you will be presented with the Username screen to log onto the system. The default
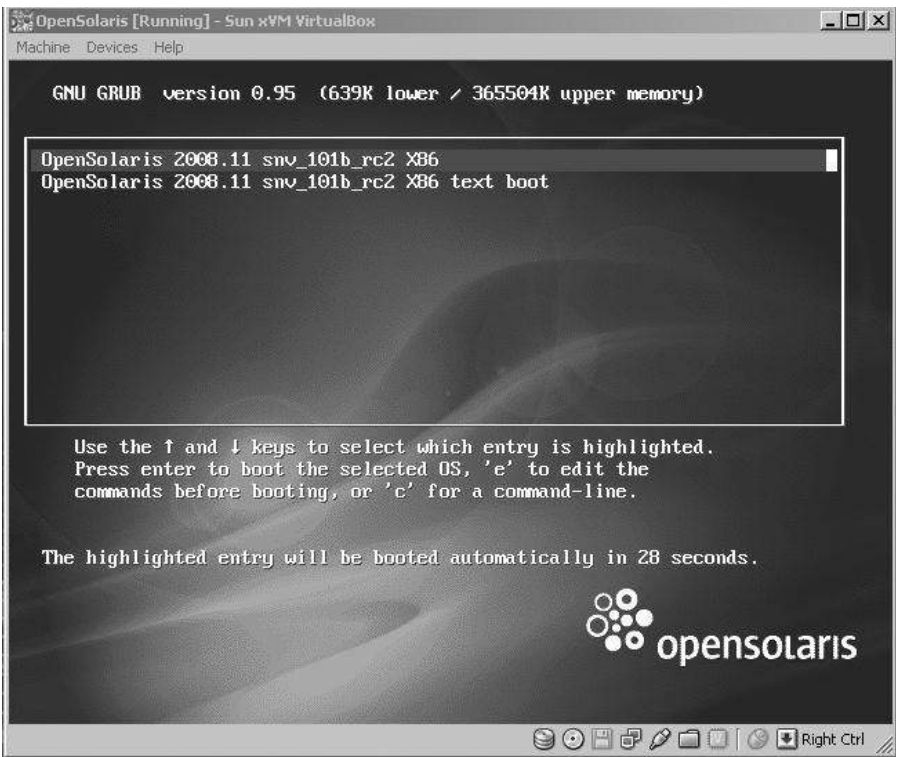

Figure A.18   The OpenSolaris "loader menu."

Figure A.19   The OpenSolaris Username screen.

Username is **opens,** so for your first time, type that into the box as shown in Figure A.19.

Next, the password (which is **reverse**) is required. Go ahead and fill that in, as shown in Figure A.20.

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 actually the case, however, since,

Figure A.20   The OpenSolaris Password screen.

Figure A.21   OpenSolaris running on a Windows XP installation.

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 will be evident if you look at Figure A.21, which shows OpenSolaris running on a Windows XP installation.

Only one OS—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 this window. To return ownership of the keyboard and mouse to the host operating system, VirtualBox reserves for itself a special key on the keyboard, called the **Host Key.** *By default, this is the* **Control** *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.

OpenSolaris comes with a basic set of applications, but to have a fully functioning office capability, you must use the Package Manager and

Figure A.22   The Package Manager.

install your product on the new system. We will install OpenOffice 3.0 in the OpenSolaris environment to show you that it is a fully functioning virtualized platform. In the OpenSolaris desktop, click on the **Add More Software** icon. The Package Manager will open up as shown in Figure A.22. All the software distributed by Sun as part of OpenSolaris is released in package format.

Packages are the preferred way of distributing software on OpenSolaris specifically because it enhances uniform package installation and removal interfaces and provides users with the ability to see exactly which versions of a package are installed (pkgchk -l). The ability to verify the integrity of the contents of the package (pkgchk -p -l) and to specify package dependencies and/or incompatibilities (depend, compver) is a also significant benefit. Being able to specify additional space requirements for a package (space) or to create custom, dynamic package installation and removal scripts is also a significant feature that makes package distribution very popular.

On the left side of the Package Manager, scroll down to the **Office** section, where you will see which office applications are available for downloading and installation on the right side of the display. Choose **Office**, as
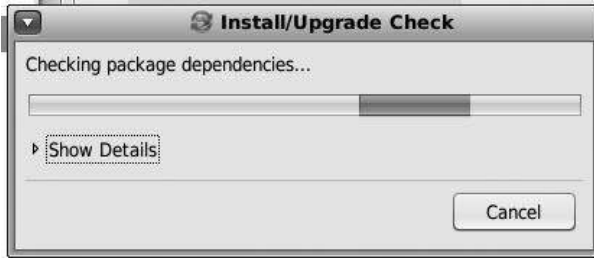
Figure A.23   The Install/Upgrade Check screen.

shown in Figure A.22, and check the box for **OpenOffice** on the right side. Next, click on the **Install/Update** button to continue. This action will bring up the screen shown in Figure A.23.

The process may take a minute or two to complete. Once dependency checks have completed, you will see the Install/Update Confirmation dialog shown in Figure A.24, which will inform you that installing the selected package may affect other packages (and usually will). Simply click on **Next** to continue.
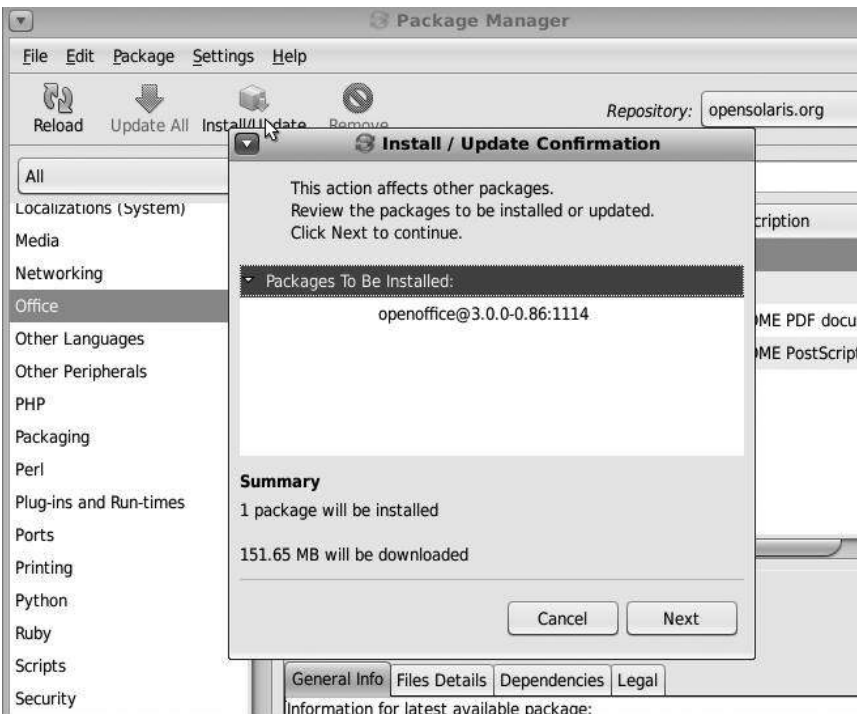

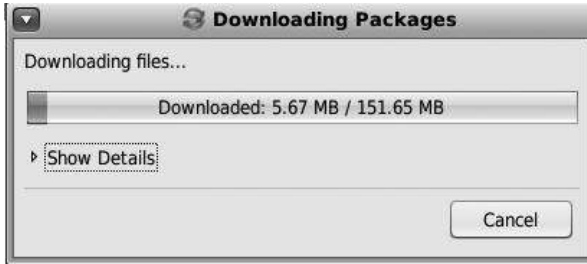Figure A.24   The Install/Update Confirmation dialog.

Figure A.25   The Downloading Packages dialog.

You should then see the dialog box shown in Figure A.25, informing you that downloading has started.

Once the download has completed, package installation will begin automatically. You should see the screen shown in Figure A.26.
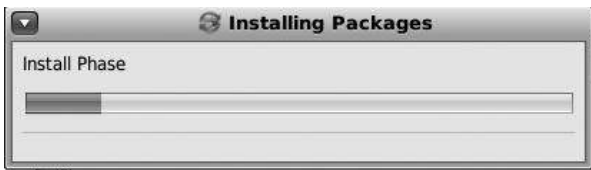

Figure A.26   Installing packages.

When the install phase has completed, a package index will be created, as indicated in Figure A.27.

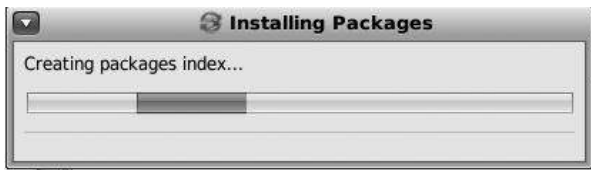Figure A.27   Creating packages index...

When the process has been completed, you will be returned to the Package Manager main screen. Now all you need to do is click on the **Close** button in the upper right corner and you will be back to the Open-Solaris desktop.

Next, we will go to the **Applications** menu at the very top left of the desktop, select the **Office** menu, and choose the submenu item

Figure A.28   Getting to OpenOffice Writer.

OpenOffice.org 3.0 Writer, which is the word processing application in OpenOffice. See Figure A.28.

The splash screen for OpenOffice appears, as shown in Figure A.29.

Figure A.29   Splash screen for OpenOffice.

Figure A.30   Registering OpenOffice: step 1.

Since this is the first time OpenOffice is being invoked, you will be asked to complete a simple, three-step registration process. Figure A.30 shows the first screen. Click **Next** to continue.

You will advance to the second screen, shown in Figure A.31, where you can fill in your personal information.

Figure A.31   Registering OpenOffice: step 2.

Figure A.32   Registering OpenOffice: step 3.

Click **Next** to continue. The final screen, shown in Figure A.33, will ask you to register your product. For now, click on the "I do not want to register" radio button and click **Finish**. You can always register your product later if you so choose.

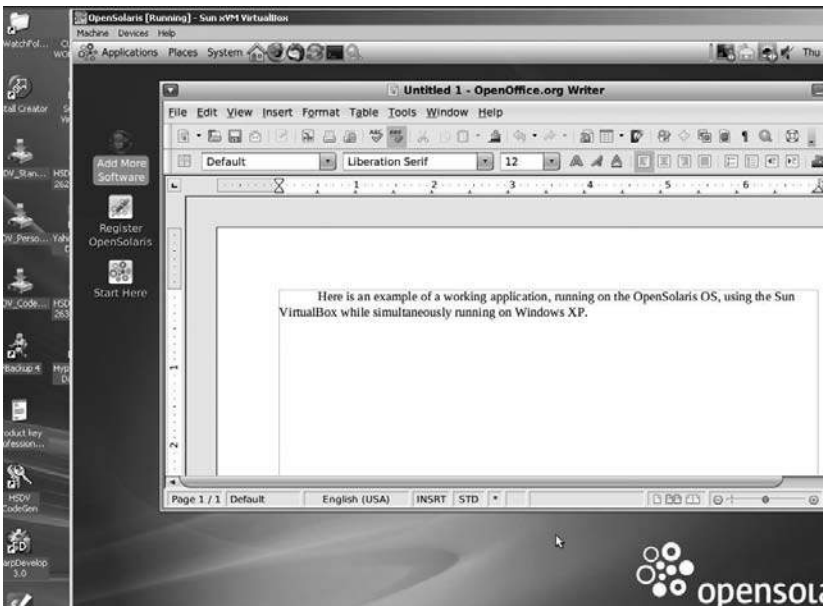The OpenOffice Writer desktop, shown in Figure A.33, will appear.

Figure A.33   The OpenOffice Writer desktop.

That's it; you can now start working in Writer.

A.6   Summary

This practicum has walked you through setting up another instance of a virtual operating system using the Sun xVM VirtualBox. The process for installing any .vdi file is nearly identical. You should, by now, have enough confidence in using the VirtualBox to install any or all of the files that are available for download from the VirtualBox web site at http://virtualbox.wordpress.com. We encourage you to try some other operating systems to get an appreciation for what each may be able to provide in terms of setup and management of a virtual environment. The ability to virtualize can go from a single host running multiple operating systems to a cluster of hosts being managed through a single front-end product. Clustering pools of resources (forming computing grids) enables more efficient use of physical assets, increasing the overall computing availability for users and providing resources that would otherwise not be available. So, you may be asking, what next? How do I use this VirtualBox in a realistic setting?

There are several cloudlike ("Infrastructure-as-a-Service") technologies, such as Eucalyptus or Globus Nimbus, that expose remote interfaces for provision of virtual machines with customized software environments. These components provide open source alternatives to commercial interfaces such as Amazon EC2. One such product is OpenNebula,[1] an open source distributed VM manager that enables the dynamic placement of VMs on a pool of physical resources. OpenNebula extends the benefits of virtualization platforms from a single physical resource to a pool of resources, decoupling the server from the physical infrastructure and the physical location where it resides. OpenNebula is focused on the efficient, dynamic, and scalable management of VMs within data centers (i.e., private clouds) that involve a large number of virtual and physical servers. OpenNebula can interface with a remote cloud site, being the only tool able to access on demand to Amazon EC2 in order to scale out a locally managed infrastructure. OpenNebula is collaborating with the most relevant cloud projects in order to promote its integration as an alternative cloud back-end product.[2]

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1.   http://www.opennebula.org/doku.php?id=start.
2.   Ibid.

OpenNebula's latest release, version 1.2, supports Xen and KVM virtualization platforms and also features support for image transfers, cloning, and virtual network management. The OpenNebula web site provides additional information about tools for extending the functionality provided by OpenNebula, such as the Haizea[3] lease management system. Haizea is a product that, in combination with the OpenNebula virtual infrastructure manager (VIM), can be used to manage a Xen or KVM[4] cluster, allowing you to deploy different types of leases that are instantiated as virtual machines. KVM allows you to run multiple virtual machines (running unmodified Linux or Windows images), where each virtual machine has private virtualized hardware (a network card, disk, graphics adapter, etc).

Another open source product, libvirt,[5] supports the management of virtual machines, virtual networks and storage. libvirt is a toolkit that is used to interact with the virtualization capabilities of recent versions of Linux (and other operating systems). It provides remote management using TLS encryption and x509 certificates, supports user authentication with Kerberos and SASL, manages local access control using PolicyKit, supports zero-conf[6] discovery using Avahi multicast-DNS,[7] and touts a portable client API for Linux, Solaris, and Windows. We hope you take time to explore these solutions further.

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3.   http://haizea.cs.uchicago.edu.
4.   http://kvm.qumranet.com/kvmwiki.
5.   http://libvirt.org/index.html.
6.   Zero configuration (zero-conf) is a set of techniques that automatically creates a usable IP network without configuration or special servers. The specifications for zero-conf are managed by the IETF.
7.   Avahi is a free zero-conf implementation, including a system for multicast DNS/DNS-SD service discovery. It allows programs to publish and discover services and hosts running on a local network with no specific configuration.