Microsoft Virtual PC for VFP Developers

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Microsoft Virtual PC is a free utility that lets you create separate virtual machines on your Windows desktop, each of which virtualizes the hardware of a physical computer. You can use virtual machines to run different operating systems, such as different versions of Windows. Virtual PC is perfect for testing application installs, presentations, legacy application support, training, and to avoid "polluting" your main system. This session introduces Virtual PC and covers topics including setting it up, installing different operating systems, managing your virtual machines, and using Virtual PC to solve typical problems VFP developers encounter.

Introduction

There are lots of times when you need to do something on a computer but don't want to do it on your main system: installing demo applications you may not want to keep, beta testing operating systems like Windows 7, testing updated applications such as Office without the risk of data conversion of your production files, and so forth. Who wants the unproductive time of undoing changes to your system, especially ones that may be somewhat dangerous or difficult to remove?

In the past, I've handled this in a variety of ways:

- Have a machine dedicated for testing. This isn't a great solution for several reasons. I'd need to have one machine for each different operating system I want to work with. In addition to the cost, there's also the space factor; I have a nice big desk but don't want it cluttered with hardware I don't use very often. Also, what happens if someone else wants to use it at the same time I am? Another downside is restoring the hard drive to a known "clean" state without having to "Freeman" the drive and reinstall the operating system.
- Replacement hard drive. My previous laptop's hard drive was in an easily accessible bay, so it was easy to remove it and plug a different one in. I had a hard drive I specifically used for testing, so I'd shut my machine down, replace the drive with the testing one, and restart. Cost is again a factor here, as is the time required to shut down and restart and the issue of restoring the drive to a clean state.
- Using a restore utility. Norton Ghost can clone a hard drive, so you can create a backup copy, mess with your machine, and then restore it from the backup. Although we purchased a copy of Ghost, we didn't use it much because it just seemed like too much work.

Someone at a conference several years ago mentioned Microsoft Virtual PC as a solution to this problem, but I was a little nervous to try something that seemed to have a big impact on my machine. However, I finally bit the bullet and gave it a shot, and haven't looked back since. Hopefully after reading this document, you'll feel the same way.

Microsoft Virtual PC

Microsoft Virtual PC 2007 (VPC) is a free software virtualization utility that lets you run multiple guest operating systems (OS) within virtual machines (VMs) on a single physical computer. A guest OS doesn't have to be the same as the host OS. For example, my laptop has Windows Vista Business, but I have VMs using Windows XP Home, Windows XP Professional, Windows Vista Ultimate, and Windows 7. You can even install non-Windows OS, such as IBM OS/2 or Linux, in a VM, although they may not be officially supported. The Wikipedia article on VPC (http://en.wikipedia.org/wiki/Microsoft_Virtual_PC) has a chart showing which OS are supported as host and guest OS.

VPC emulates the following environment:

- A virtualized host processor (albeit only 32-bit even if the host processor is 64-bit) with an Intel 440BX chipset.
- AMI BIOS.
- S3 Trio 32/64 PCI VESA 2.0 graphics card with 8 MB video RAM. Because of limitations in this card, Aero Glass is disabled for Windows Vista or Windows 7 as a guest OS.
- Creative Labs Sound Blaster 16 ISA Plug and Play sound card.
- DEC 21140A 10/100 Ethernet network card.

Note that USB is not supported in VPC 2007. The biggest impact this has is likely with USB memory sticks. Windows Virtual PC ("Microsoft" is changed to "Windows"), the next release targeted for Windows 7, adds USB support.

A VM running within a host system is like having a completely different PC. When you start a VM, it goes through a complete boot process, include BIOS and OS boot. Although there can be some interaction between the VM and the main system (for example, you can copy files from one to the other), think of them as separate computers that happen to share a keyboard, mouse, and monitor.

Figure 1, taken from the Microsoft Web site, shows how virtualization works.

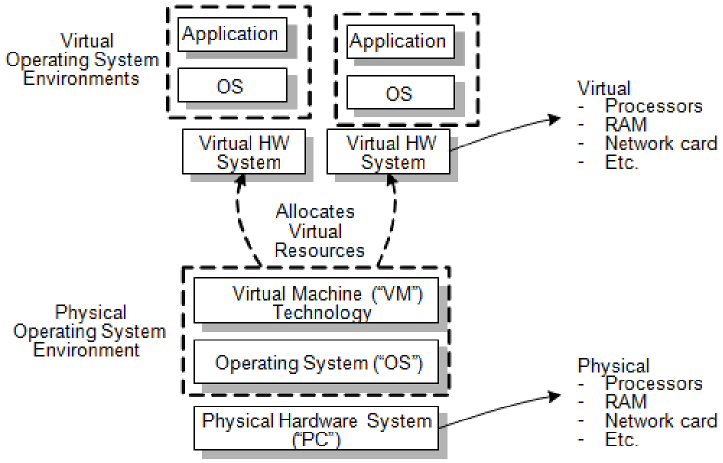


Figure 1. How virtualization works.

VPC keeps the files installed on a VM separate from the main system's files by using a virtual hard disk. A file on the physical computer's hard drive is internally formatted as if were a hard drive itself. When you start a VM, VPC opens the file, virtualizes it as a hard drive, and then "boots" from it. As you may expect, virtual hard drives can get quite large, because they contain an operating system, applications, and so on. In fact, the smallest virtual drive file I've seen is about 2 GB, and that's with just Windows XP Home and nothing else installed. I have some virtual drive files that are more than 10 GB in size once I installed things like VFP, Visual Studio, and SQL Server.

One interesting thing about virtual hard drives is that they're portable just like any other file is. For example, I can copy a virtual drive to a memory stick (assuming it's big enough), then take that memory stick to a different physical computer and launch a VM from it. I usually keep my VM files on an external USB hard drive, not only because it saves space on my main system's drive but also because I can take the external drive home and work on VMs on my home system. Of course, there are OS licensing issues, so that subject is addressed later in this document.

One of the most useful things about VPC is that, if configured properly, writes to the VM's hard drive are actually written to an "undo disk" file rather than the virtual drive file. When you shut down the VM, you have the choice of writing the changes back to the virtual drive file so they're permanent or discarding the changes. If you choose the latter, the undo disk is deleted and nothing is written to the virtual drive. As a result, it's like you did nothing to the VM in that session, and the next time you start it, it's in the same state as it was before.

Because VPC virtualizes resources on your system, it obviously takes some of those resources away from the main system, the biggest one being memory. I recommend using a fast machine with as much RAM as possible (minimum of 2GB) for the best performance.

Uses for virtual machines

VMs have a lot of uses. Here are some of the things I and others at Stonefield use them for:

- Application testing
- Beta testing
- Demos and presentations
- Running legacy applications

Although we don't currently do this, I know some developers who do all of their development work solely on VMs.

I'll discuss these and other uses in more detail later in this document.

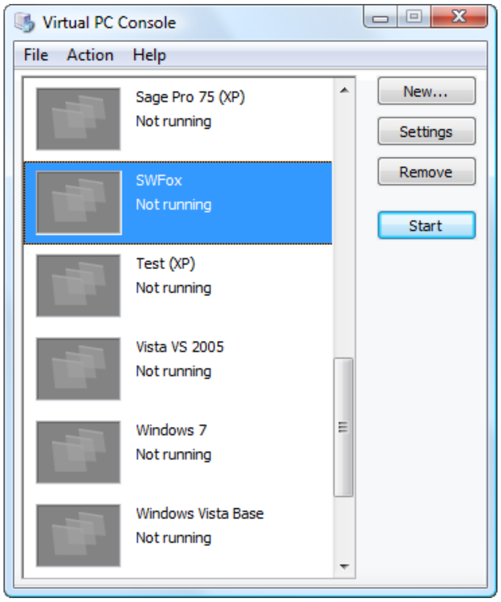
Installing Microsoft Virtual PC

I think one of the things that stops most developers from using VPC (besides human inertia) is the scary feeling that it will somehow screw up your machine. It won't, since in fact that's the whole reason for using it. The only scary part is when you install an operating system onto a VM the first time; you wonder whether it's overwriting the OS on your main system. It doesn't, but I remember feeling that slight "what if this screws up" feeling too.

The thing to keep in mind with a VM is that it creates a file on your hard drive and treats it like it's a complete hard drive itself. In that one file is an OS, applications, etc. There are actually two files: one small one (with a VMC extension) which just contains configuration information and a big one (with a VHD extension) which is the virtual hard drive.

VPC is really easy to set up. Start by downloading and installing it. You can currently get it from http://www.microsoft.com/downloads/details.aspx?FamilyId=04D26402-3199-48A3-AFA2-2DC0B40A73B6&displaylang=en but Google "download Microsoft Virtual PC" to find the most recent location.

After installation, run it. The Virtual PC Console, shown in **Figure 2**, appears. The console displays a list of the VMs you've registered and provides functions to run or manage them. Since you don't have any VMs yet, the list is empty.



Sage Pro 75 (XP)
Not running

SWFox
Not running

Test (XP)
Not running

Vista VS 2005
Not running

Windows 7
Not running

Windows Vista Base
Not running

Figure 2. The Virtual PC Console displays the VMs you've created and allows you to run or manage them.

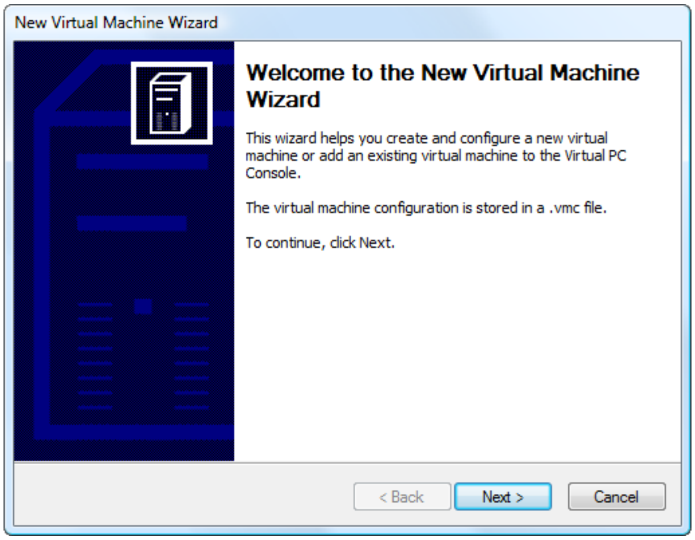
Creating a "base" virtual machine

VPC allows you to create as many VMs as you wish. However, as I'll discuss later, a VM is initially like a new PC with an empty hard drive. You need to install an OS on it in order to use it. As you likely know, installing an OS can take some time. To avoid having to install an OS on every VM you create, create a "base" VM that contains a particular OS, then use that base to create working VMs. You can create one base VM for each OS (such as Windows XP and Windows Vista) or other common environments you want (for example, Windows XP with SQL Server and VFP installed as a starting point).

Creating a base virtual machine involves four steps: creating the VM using the provided wizard, installing an OS, installing Virtual Machine Additions, and finalizing the VM.

Using the wizard

Click New to bring up the New Virtual Machine Wizard (**Figure 3**). Click Next.



Welcome to the New Virtual Machine Wizard

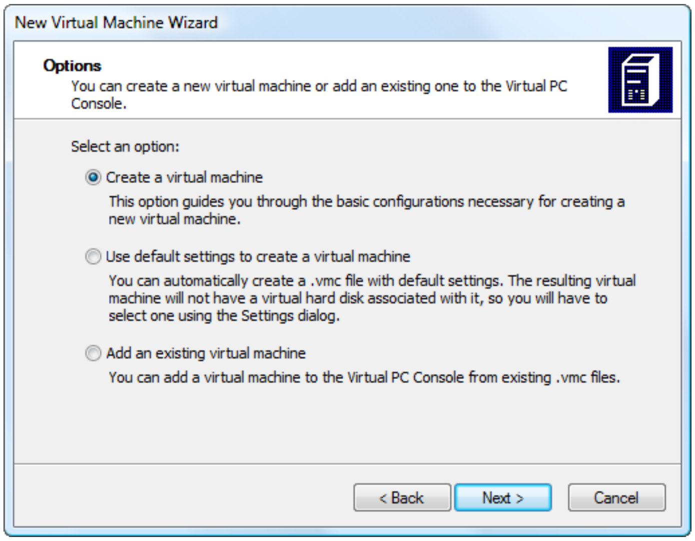
This wizard helps you create and configure a new virtual machine or add an existing virtual machine to the Virtual PC Console.

The virtual machine configuration is stored in a .vmc file.

To continue, click Next.

Figure 3. The New Virtual Machine Wizard leads you through the process of creating a VM.

In the Options step shown in **Figure 4**, leave the default "Create a virtual machine" selected. The second option, "Use default settings to create a virtual machine," isn't used often and we'll see a use for the last one, "Add an existing virtual machine," later.



Options

You can create a new virtual machine or add an existing one to the Virtual PC Console.

Select an option:

● Create a virtual machine

This option guides you through the basic configurations necessary for creating a new virtual machine.

○ Use default settings to create a virtual machine

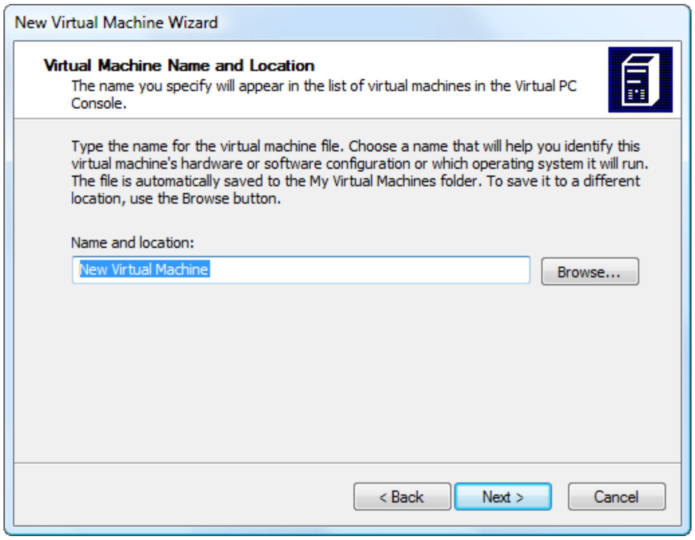
You can automatically create a .vmc file with default settings. The resulting virtual machine will not have a virtual hard disk associated with it, so you will have to select one using the Settings dialog.

○ Add an existing virtual machine

You can add a virtual machine to the Virtual PC Console from existing .vmc files.

Figure 4. In the Options step, choose between creating a new VM and adding an existing one to VPC.

The next step (**Figure 5**) allows you to specify the name and path for the VMC file. As noted in the dialog, if you don't specify a path, it'll go into a subdirectory, with the name you specify, of the My Virtual Machines subdirectory of your Documents folder. If you have an external drive available, I recommend storing VMs on it because they can chew up a lot of disk space (at least 2 GB and more like 8-10 GB once you start installing a lot of stuff on them), plus it's more portable. I like to name VMs with the OS as part of it; for example, "Windows XP VM." For VMs that contain just an OS and are used as the starting point for other VMs (which I'll discuss later), I also add "Base" to the name, such as "Windows XP Base VM."


New Virtual Machine Wizard

Virtual Machine Name and Location

The name you specify will appear in the list of virtual machines in the Virtual PC Console.

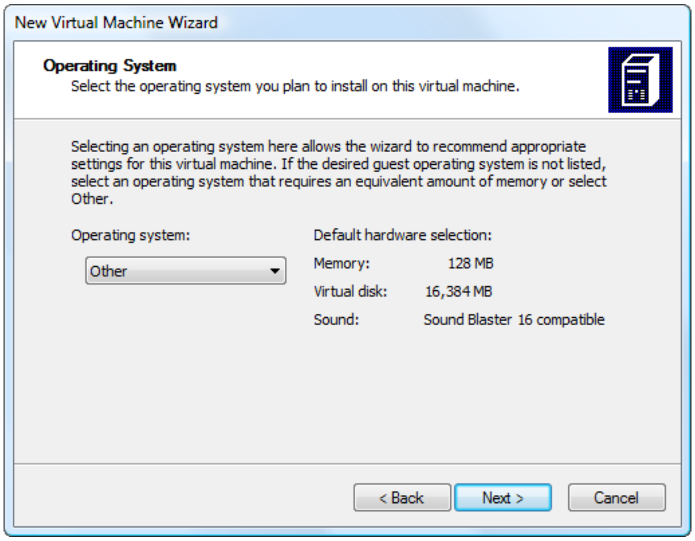
Type the name for the virtual machine file. Choose a name that will help you identify this virtual machine's hardware or software configuration or which operating system it will run. The file is automatically saved to the My Virtual Machines folder. To save it to a different location, use the Browse button.

Name and location: New Virtual Machine

Figure 5. Specify the name and location for the VM.

Tell VPC which OS you intend to install in the Operating System step (**Figure 6**). Note that this doesn't actually install an OS; your choice is simply used to determine the values of certain settings, which you can later override if necessary. For Windows 7, choose "Microsoft Vista."

One important tip: normally VPC creates virtual machines with an ISA Sound Blaster 16 sound card. This works with most OS, except Windows Vista, which no longer supports ISA. Selecting Windows Vista in the Operating System step tells VPC to use a Vista-compatible sound card. If you choose something else but install Vista, you'll have no sound.


New Virtual Machine Wizard

Operating System

Select the operating system you plan to install on this virtual machine.

Selecting an operating system here allows the wizard to recommend appropriate settings for this virtual machine. If the desired guest operating system is not listed, select an operating system that requires an equivalent amount of memory or select Other.

Operating system: Other

Default hardware selection:

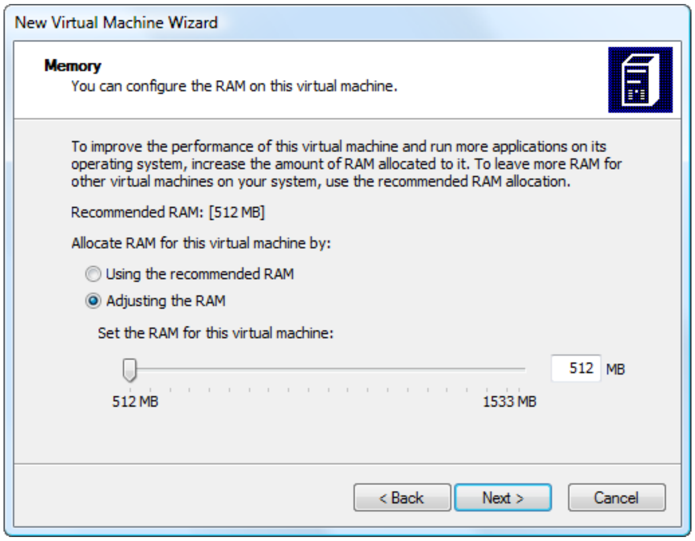
Memory: 128 MB

Virtual disk: 16,384 MB

Sound: Sound Blaster 16 compatible

Figure 6. Specify which operating system you intend to install.

You can change the recommended memory setting in the next step, shown in **Figure 7**. If your system has enough RAM, I suggest increasing the VM's memory for better performance. I often change it to 1 GB on my 2 GB system. However, if you don't change it now, you can easily change it later.


New Virtual Machine Wizard

Memory

You can configure the RAM on this virtual machine.

To improve the performance of this virtual machine and run more applications on its operating system, increase the amount of RAM allocated to it. To leave more RAM for other virtual machines on your system, use the recommended RAM allocation.

Recommended RAM: [512 MB]

Allocate RAM for this virtual machine by:

○ Using the recommended RAM

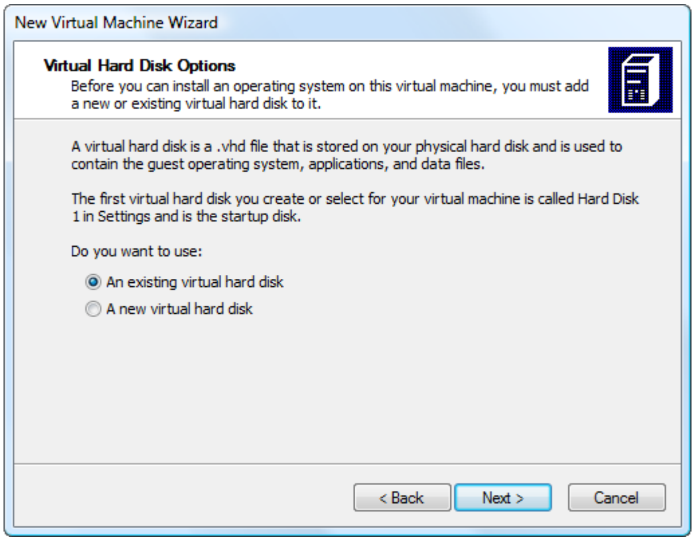
● Adjusting the RAM

Set the RAM for this virtual machine:

512 MB

Figure 7. You can adjust the memory setting if necessary.

Since you don't have a virtual hard drive yet, choose "A new virtual hard disk" in the next step (**Figure 8**).


New Virtual Machine Wizard

Virtual Hard Disk Options

Before you can install an operating system on this virtual machine, you must add a new or existing virtual hard disk to it.

A virtual hard disk is a .vhd file that is stored on your physical hard disk and is used to contain the guest operating system, applications, and data files.

The first virtual hard disk you create or select for your virtual machine is called Hard Disk 1 in Settings and is the startup disk.

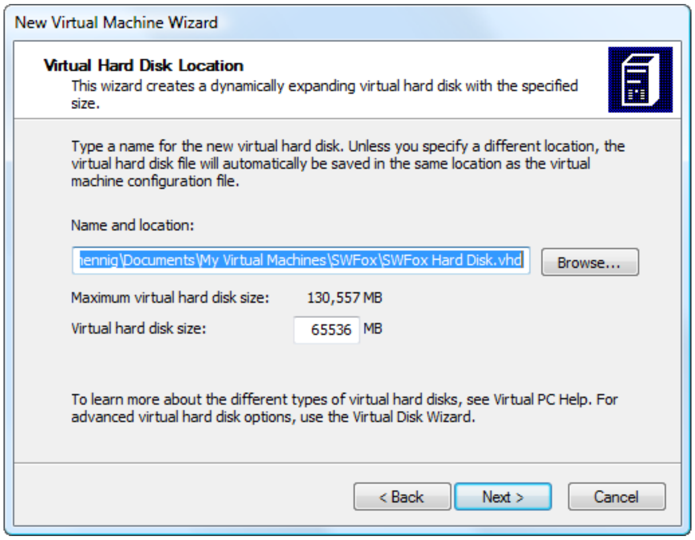
Do you want to use:

● An existing virtual hard disk

○ A new virtual hard disk

Figure 8. Since this is our first VM, we'll create a new virtual hard drive.

In the Virtual Hard Disk Location step, shown in **Figure 9**, specify the name and location of the new virtual hard drive. The default is the same name and path as the VMC file with "Hard Disk" added as a suffix and an extension of "VHD." Since that's a reasonable name, I suggest leaving it alone. You can also change the size of the drive. Note that the VHD file isn't created at the specified size; rather, it starts off as a small file and dynamically expands as you add more to it (installing an OS, creating documents, etc.). The size you specify here is the maximum size for the file.



Virtual Hard Disk Location

This wizard creates a dynamically expanding virtual hard disk with the specified size.

Type a name for the new virtual hard disk. Unless you specify a different location, the virtual hard disk file will automatically be saved in the same location as the virtual machine configuration file.

Name and location: ɪennig\Documents\My Virtual Machines\SWFox\SWFox Hard Disk.vhd

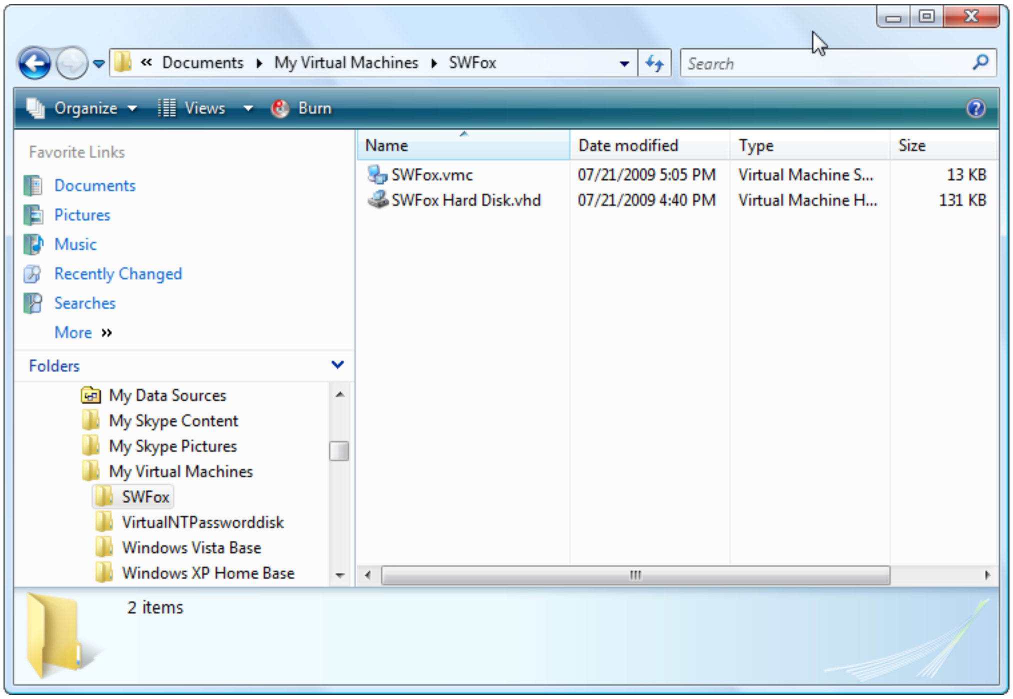
Maximum virtual hard disk size: 130,557 MB

Virtual hard disk size: 65536 MB

To learn more about the different types of virtual hard disks, see Virtual PC Help. For advanced virtual hard disk options, use the Virtual Disk Wizard.

Figure 9. Specify the name, location, and size of the virtual hard disk for the VM.

That's it! Click Finish to create the VMC and VHD files and add the VM to the list in the VPC Console. **Figure 10** shows the folder and two files the Wizard created.



Name	Date modified	Type	Size
SWFox.vmc	07/21/2009 5:05 PM	Virtual Machine S...	13 KB
SWFox Hard Disk.vhd	07/21/2009 4:40 PM	Virtual Machine H...	131 KB

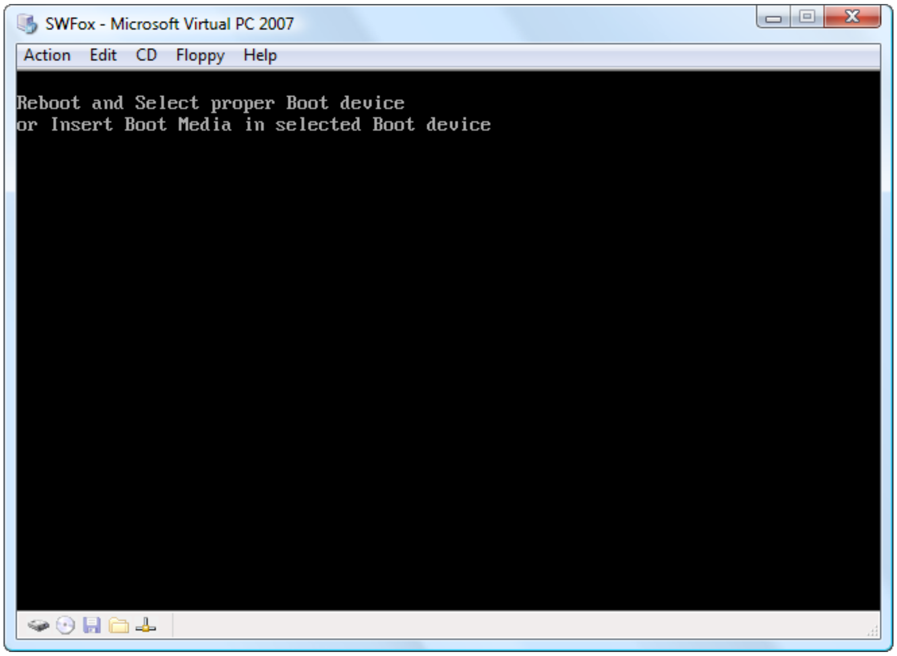
2 items

Figure 10. The Virtual Machine Wizard creates VMC and VHD files.

Installing an operating system

The VM you created is like a brand new PC with an empty hard drive. The next step is to install an OS on it. First, start the VM by selecting it in the VPC Console and clicking Start.

The VM starts in its own window (**Figure 11**). Of course, since there's no OS, the "computer" can't boot.



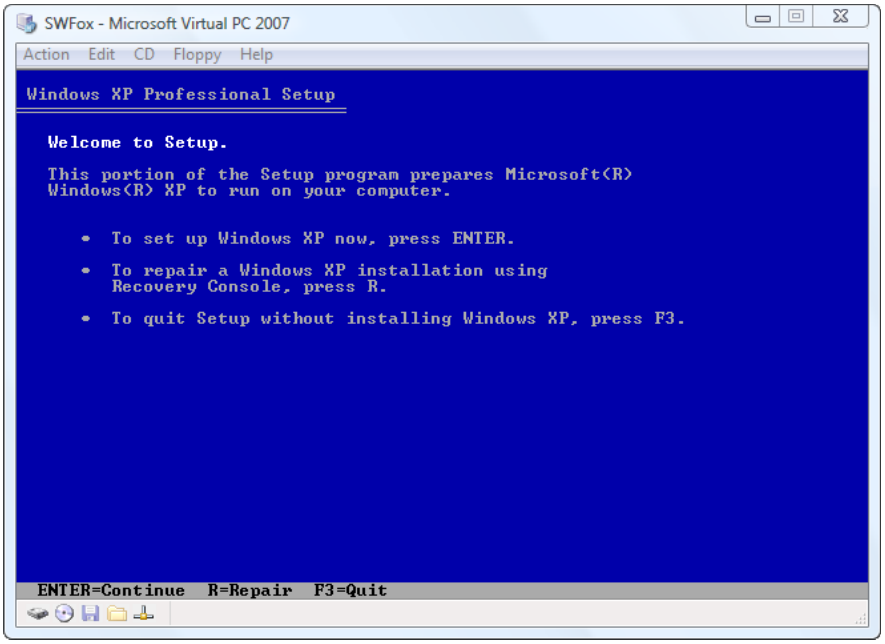
```
Reboot and Select proper Boot device
or Insert Boot Media in selected Boot device
```

Figure 11. The new VM starts in its own window but has no operating system yet.

To install an OS, do one of the following:

- If you have an OS CD, choose "Use Physical Drive" from the CD menu and insert the CD.
- If you have an ISO file for the OS, choose "Capture ISO Image…" from the CD menu and navigate to the location of the ISO file.

In either case, press Enter and the OS installation screen appears. Now this is a scary part: it'll go through the normal OS installation process, including formatting the "hard drive," but remember that this is on a VM and it does *NOT* do anything to your main system other than updating the two VM files. **Figure 12** shows the Windows XP Professional setup screen inside the VM window.



```
Windows XP Professional Setup

  Welcome to Setup.

  This portion of the Setup program prepares Microsoft(R)
  Windows(R) XP to run on your computer.

      •  To set up Windows XP now, press ENTER.

      •  To repair a Windows XP installation using
         Recovery Console, press R.

      •  To quit Setup without installing Windows XP, press F3.

 ENTER=Continue  R=Repair  F3=Quit
```

Figure 12. Installing Windows XP Professional on the new virtual machine.

One thing you may notice while installing the OS is that once your mouse pointer is in the VM window, there doesn't seem to be any way to get it back out again so you can do things on your main system while the OS installs. We'll see how to fix that in a moment, but for now, hold down the right Alt key while moving the mouse pointer to "release" it from the VM window. Clicking on something back in the VM window doesn't register the mouse click on the object you clicked; it just re-captures the mouse, so you need to click again to actually click the object.

Installing Virtual Machine Additions

After installing the OS, install Virtual Machine Additions. Virtual Machine Additions improves the integration between the VM and your main system, including:

- **Integrated mouse**: you no longer have to use right Alt to release the mouse pointer.
- **Dragging and dropping files**: a convenient way to transfer files from your main system to the VM and vice versa.
- **Folder sharing**: you can map a folder on your main system's drive to a drive letter in the VM.
- **Clipboard sharing**: data on the clipboard of one OS can be pasted into applications on the other
- **Time synchronization**: the system date and time on the guest OS is kept in sync with the host system.
- **Resizing the VM window**: the VM automatically adjusts the size and resolution of the OS desktop when you resize the window.

To install Virtual Machine Additions, select Install or Update Virtual Machine Additions from the Actions menu (remember to right-Alt drag the mouse to release it from the VM) and follow the dialogs. You have to restart the OS in the VM for the changes to take effect.

Finalizing the base virtual machine

After completing these tasks, shut down the VM and mark the VMC and VHD files as read-only. You don't want to have to go through the whole OS installation process again the next time you need a new VM, so I like to create clean VMs with each OS and make them read-only so I don't accidentally use them for anything other than a starting point for other VMs. In fact, since it's really the virtual hard drive we're interested in, you can even delete the VMC file if you wish.

I created one VM for each major OS I'm interested in working with: Windows XP, Windows Vista, and the Windows 7 Release Candidate. You could even create VMs for specific versions, such as Windows XP Home and Windows XP Professional, and different service packs.

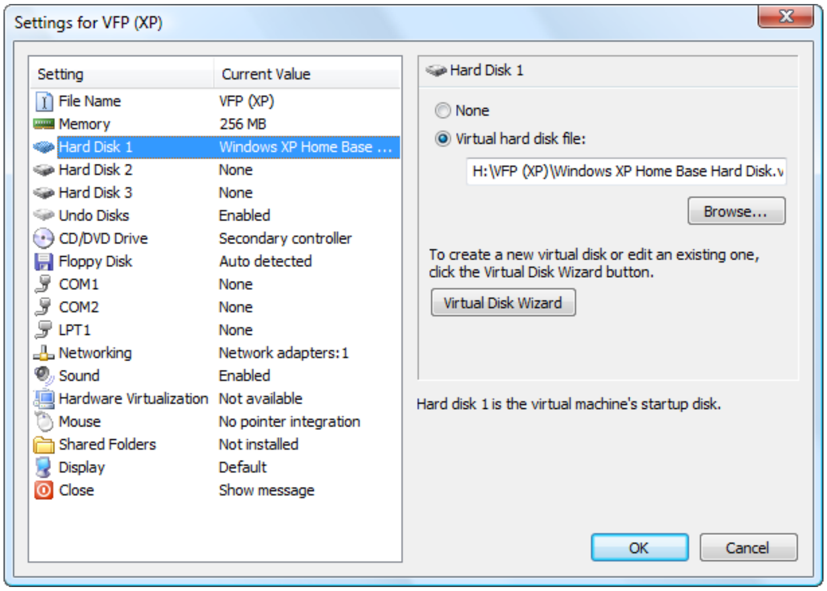
Creating a working virtual machine

There are a couple of ways you can create a working VM (that is, one you'll install applications onto): cloning a base VM or creating a differencing disk from a base VHD.

Cloning a base virtual machine

If your base VM has a VMC file, create a new folder, copy the two VM files for the base OS to it, turn off the read-only status, and rename them to something indicating what the VM will contain (for example, "VS2008 on XP.VMC" and "VS2008 on XP Hard Disk.VHD"). Start Virtual PC and click New to create a new VM but choose "Add an existing virtual machine" in the Options step and select the new VMC file in the next step. Be sure to leave "When I click Finish, open settings" turned on in the last step because you need to change at least one thing (the virtual hard disk). Click Finish to add the copy to the list of VMs in the console.

The settings dialog then appears (**Figure 13**). Change the virtual hard disk file setting for Hard Disk 1 to the name and path of the copied VHD file. You can also change any other settings you wish, such as the amount of memory. Click OK and your new VM is ready for you to start installing applications on.



Settings for VFP (XP)

Setting	Current Value
File Name	VFP (XP)
Memory	256 MB
Hard Disk 1	Windows XP Home Base ...
Hard Disk 2	None
Hard Disk 3	None
Undo Disks	Enabled
CD/DVD Drive	Secondary controller
Floppy Disk	Auto detected
COM1	None
COM2	None
LPT1	None
Networking	Network adapters: 1
Sound	Enabled
Hardware Virtualization	Not available
Mouse	No pointer integration
Shared Folders	Not installed
Display	Default
Close	Show message

Hard Disk 1

○ None

● Virtual hard disk file:

H:\VFP (XP)\Windows XP Home Base Hard Disk.v

To create a new virtual disk or edit an existing one, click the Virtual Disk Wizard button.

Hard disk 1 is the virtual machine's startup disk.

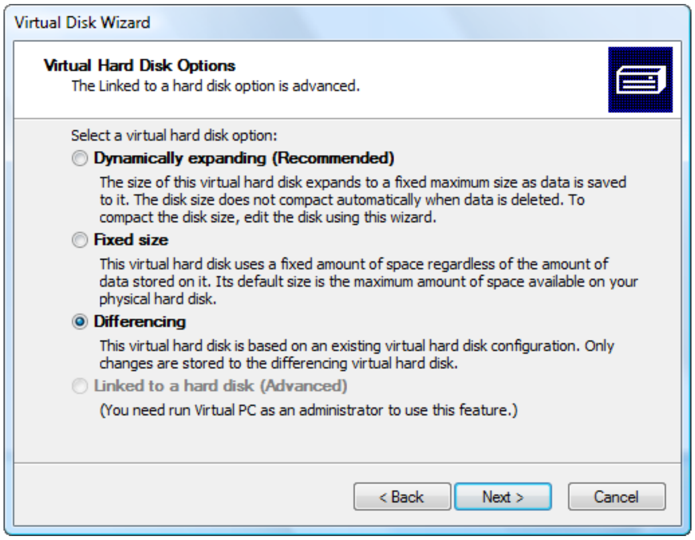
Figure 13. Change the virtual hard disk file setting for the copied VM.

If your base VM doesn't have a VMC file because you deleted it, the instructions are similar, but instead of adding an existing VM to VPC, you'll create a new one, and select the copied VHD file for the virtual hard drive.

Creating a differencing disk

A differencing disk stores only the differences between a base virtual drive and another VM. Think of it like a base class (the base virtual drive) and a subclass that inherits from it (the differencing disk).

To create a differencing disk, choose Virtual Disk Wizard from the File menu of the VPC Console. In the Disk Options step, choose "Create a new virtual disk." In the Virtual Disk Type step, choose "A virtual hard disk." In the Virtual Hard Disk Location step, specify the name and path for the new VHD file. In the Virtual Hard Disk Options step, shown in **Figure 14**, select "Differencing." In the Differencing Virtual Hard Disk step, specify the name and path for the base VHD file. Finally, click Finish to create the differencing disk file.



Virtual Hard Disk Options

The Linked to a hard disk option is advanced.

Select a virtual hard disk option:

○ **Dynamically expanding (Recommended)**

The size of this virtual hard disk expands to a fixed maximum size as data is saved to it. The disk size does not compact automatically when data is deleted. To compact the disk size, edit the disk using this wizard.

○ **Fixed size**

This virtual hard disk uses a fixed amount of space regardless of the amount of data stored on it. Its default size is the maximum amount of space available on your physical hard disk.

● **Differencing**

This virtual hard disk is based on an existing virtual hard disk configuration. Only changes are stored to the differencing virtual hard disk.

○ Linked to a hard disk (Advanced)

(You need run Virtual PC as an administrator to use this feature.)

Figure 14. Choose "Differencing" in the Virtual Hard Disk Options step of the Virtual Disk Wizard.

Next, create a VM that uses the differencing disk. Click New in the VPC Console and go through the same steps outlined earlier to create a VM, but in the Virtual Hard Disk Options step (**Figure 8**), choose “An existing virtual hard disk,” and select the differencing disk in the next step.

After you’ve finished, check the size of the VHD file for the differencing disk. It’ll be a fraction of the size of the base VHD file, but grows as you install applications or create files.

One issue to watch out for with differencing disks is that you can’t make any changes whatsoever to the base disk or you’ll destroy the connection between the two. That means, for example, not applying updates or service packs, not updating anti-virus software, and so on. You’ll have to make all of those changes to the differencing disk instead. (In this regard, it’s the same as it is with cloned disks: you have to make the same changes to each VM individually.) The safest way to remember not to touch the base VM is to make it read-only and never start it in VPC.

Interestingly, you can create a differencing disk from a differencing disk. For example, as he outlines in a blog entry (http://www.andrewconnell.com/blog/articles/UseVirtualPCsDifferencingDisksToYourAdvantage.aspx), Andrew Connell has a base VM with an OS, two VMs differenced from that one (one with Visual Studio 2005 and SQL Server 2005 and the other with VS 2003 and SQL Server 2000), and VMs differenced from those two that he actually uses as working VMs.

Maintaining working virtual machines

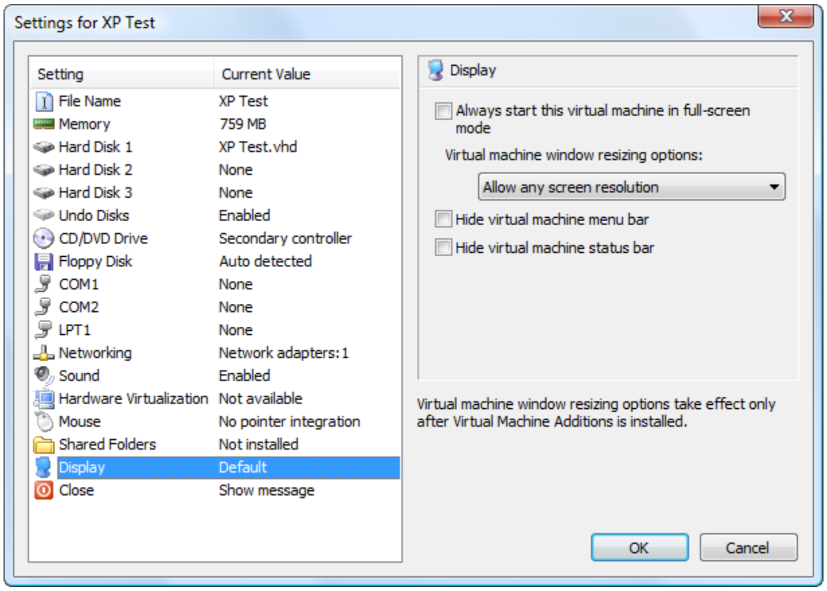
Remember that a VM is like a real PC, so you should keep it current with updates, service packs, anti-virus software, etc. and if you install a lot of applications or files on it, regularly defragment the drive just like you would with your main system. Regardless of whether you use differencing disks or clone base VMs, you still have to perform these tasks on each individual working VM just as you have to with each physical computer you have. In the case of base VMs that you create differencing disks from, you should never touch them, so don't start them in VPC (they either won't appear in the VPC Console if you deleted the VMC file or you'll get an error if you try to start it since you made the VMC file read-only). If you use cloned VMs instead, you can update the base VMs or apply service packs (remember to turn off the read-only status before applying changes and turn it back on afterward) but those changes only apply to new VMs you clone from the base afterward; you need to make those changes to each existing VM.

Virtual machine settings

Let's look at the settings for VMs. You can change settings either by choosing the VM in the Virtual PC Console and clicking the Settings button or by starting the VM and choosing Settings from the Edit menu. Note that many of the settings are disabled if the VM is running.

- **File Name**: changing the file name setting renames the VMC file but not the folder it's in or the VHD file.
- **Memory**: you can either type the amount of RAM for the VM or drag the slider.
- **Hard Disk 1**: this represents the VM's startup drive. You can choose the VHD file associated with the VM or click the Virtual Disk Wizard button to create a new virtual hard drive.
- **Hard Disk 2** and **Hard Disk 3**: just as a real computer can have multiple drives, you can have multiple virtual drives for a VM. For example, you could have a VHD of applications or documents and use that as the second drive of a VM. Either select a virtual hard disk file or create a new one using the Virtual Disk Wizard.
- **Undo Disks**: ensure "Enable undo disks" is turned on. This is the secret to being able to shut down a VM without saving any changes to the virtual drive. See the next section, "Starting, using, and closing a virtual machine," for information on how undo disks work.
- **CD/DVD Drive**: the "Attach CD or DVD drive to secondary IDE controller" should normally be turned on but if that causes problems with the VM, try turning it off to use the primary controller instead.
- **Floppy disk**: "Automatically detect floppy disk" should be turned on so the VM can detect when you insert the disk into the main system's floppy drive.
- **COM1** and **COM2**: these allow you to configure serial ports for the VM. The choices are: "None" (no COM port available), "Physical serial port" (select the physical serial port to use for this VM COM port), "Named pipe" (enter the name), or "Text file" (choose the text file to read from and write to as if it's a serial port).
- **LPT1**: if you want a parallel port available to the VM, select "Physical parallel port" and choose the physical port to use.

- **Networking**: indicate how many network adapters you want available to the VM and for each one, select the physical network adapter to connect to.
- **Sound**: turn on "Enable sound card" if you want the VM to use sound.
- **Hardware Virtualization**: if your system includes hardware-assisted virtualization, you'll get better performance if you turn this option on.
- **Mouse**: if you installed Virtual Machine Additions, "Use pointer integration" is automatically turned on. Strangely, the list at the left of the settings dialog displays "No pointer integration" if you edit settings from the console rather than in the VM.
- **Shared Folders**: if you installed Virtual Machine Additions, this option allows you to map a folder on your main system's hard drive to a drive letter on the VM. Note that you can only use this option when the VM is running. Click the Browse button to display a dialog where you can choose the folder, select the drive letter to map it to, and indicate whether you want this mapping to persist or only be available for this session.
- **Display (Figure 15)**: "Always start this virtual machine in full-screen mode" does what it suggests: the VM window is full-screen and you can't see your main system's desktop. For "Virtual machine window resizing options," choose "Allow any screen resolution" to permit you to resize the window to any size (for example, 963 x 751), "Only use standard screen resolutions" to force the window to standard sizes like 800 x 600 and 1024 x 768, or "Use guest operating system screen resolution" to prevent you from resizing the window. If you turn on "Hide virtual machine menu bar," the menu doesn't appear in the VM window. Similarly, "Hide virtual machine status bar" controls whether the VM window has a status bar at the bottom or not.



Settings for XP Test

Setting	Current Value
File Name	XP Test
Memory	759 MB
Hard Disk 1	XP Test.vhd
Hard Disk 2	None
Hard Disk 3	None
Undo Disks	Enabled
CD/DVD Drive	Secondary controller
Floppy Disk	Auto detected
COM1	None
COM2	None
LPT1	None
Networking	Network adapters: 1
Sound	Enabled
Hardware Virtualization	Not available
Mouse	No pointer integration
Shared Folders	Not installed
Display	Default
Close	Show message

Display

□ Always start this virtual machine in full-screen mode

Virtual machine window resizing options:

Allow any screen resolution

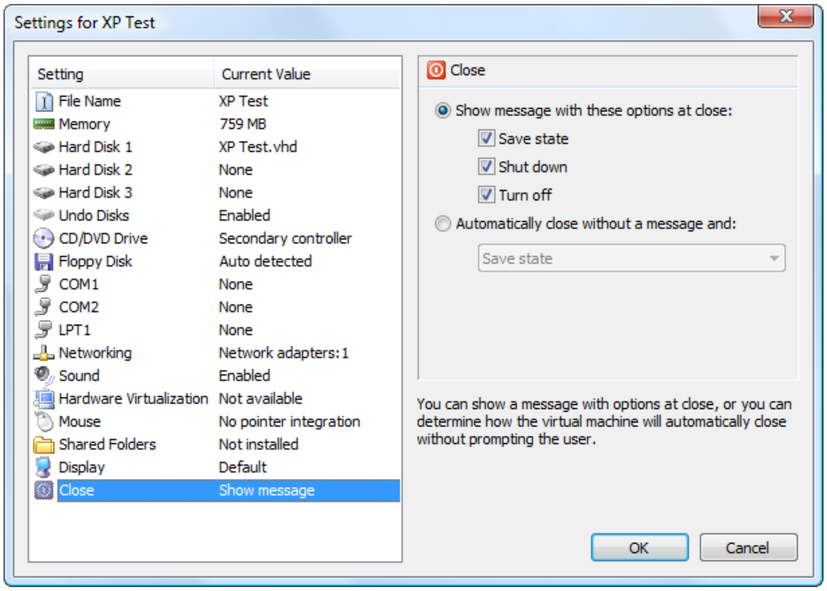
□ Hide virtual machine menu bar

□ Hide virtual machine status bar

Virtual machine window resizing options take effect only after Virtual Machine Additions is installed.

Figure 15. The Display options for a virtual machine.

- **Close (Figure 16)**: you can choose what happens when you close the VM. If you wish to be prompted, select "Show message with these options at close" and specify which choices are available to you. “Save state” saves the state of the VM to a VSV file and shuts down the VM; the next time you start the VM, it skips the OS startup process and instead immediately restores its former state. “Shut down” shuts down the OS properly, while “Turn off” acts like you’ve pulled out the power plug. If you’d rather have a particular action always taken rather than being prompted, select “Automatically close without a message and” and choose which action to take: “Save state,” “Shut down,” “Turn off,” or “Turn off and delete changes.” See the next section, “Starting, using, and closing a virtual machine,” for more information on closing a VM and how the various options work.



Setting	Current Value
File Name	XP Test
Memory	759 MB
Hard Disk 1	XP Test.vhd
Hard Disk 2	None
Hard Disk 3	None
Undo Disks	Enabled
CD/DVD Drive	Secondary controller
Floppy Disk	Auto detected
COM1	None
COM2	None
LPT1	None
Networking	Network adapters: 1
Sound	Enabled
Hardware Virtualization	Not available
Mouse	No pointer integration
Shared Folders	Not installed
Display	Default
Close	Show message

Close

● Show message with these options at close:

☑ Save state

☑ Shut down

☑ Turn off

○ Automatically close without a message and:

Save state

You can show a message with options at close, or you can determine how the virtual machine will automatically close without prompting the user.

Figure 16. The Close settings for a virtual machine.

Starting, using, and closing a virtual machine

To start a VM, select it in the Virtual PC Console and click Start. The VM starts and boots its OS. You can then use the VM just as you would a physical computer: install and run applications, create files, browse the Internet, etc. Note that if there isn’t enough memory available, VPC displays an error message and not start the VM.

When you start a VM that has the Undo Disks option enabled, VPC creates an “undo disk,” a file in the VM’s folder with a VUD extension. All changes you make to the VM (installing applications, creating files, deleting files, etc.) are written to the undo disk, not the VM’s virtual drive. We’ll see the impact of that when I discuss closing a VM.

In addition to the usual computer things, there are several other things you can do with a running VM:

- To copy files from your main system to a VM or vice versa, you have a couple of choices. The easiest way to do it is drag a file from one to the other, either to the Desktop or into a folder. You can also map a drive letter on the VM to a folder on the physical hard drive (see the “Virtual machine settings” section for details) and then copy files to and from that drive on the VM.

- You can resize the VM window. That automatically resizes the OS desktop. Conversely, changing the screen resolution for the OS automatically resizes the window.
- The status bar at the bottom of the VM window shows reads from and writes to the hard drive, CD, floppy disk, shared folders, and the network.
- You can go into full-screen mode by pressing Right Alt + Enter or choosing “Full-Screen Mode” from the Action menu. Press Right Alt + Enter again to restore the VM window.
- Pausing a VM by choosing Pause from the Action menu or pressing Right Alt + P freezes the VM, freeing CPU cycles for the host system or other VMs. The client area of the VM window goes dim to visually indicate the VM is paused. You can resume by choosing Resume from the Action menu or pressing Right Alt + P again.
- Pressing Ctrl + Alt + Delete invokes the usual action on your physical computer even if the VM window is selected. To press Ctrl + Alt + Delete on the VM, press Right Alt + Delete or choose “Ctrl + Alt + Delete” from the Action menu.

There are several ways you can close a VM:

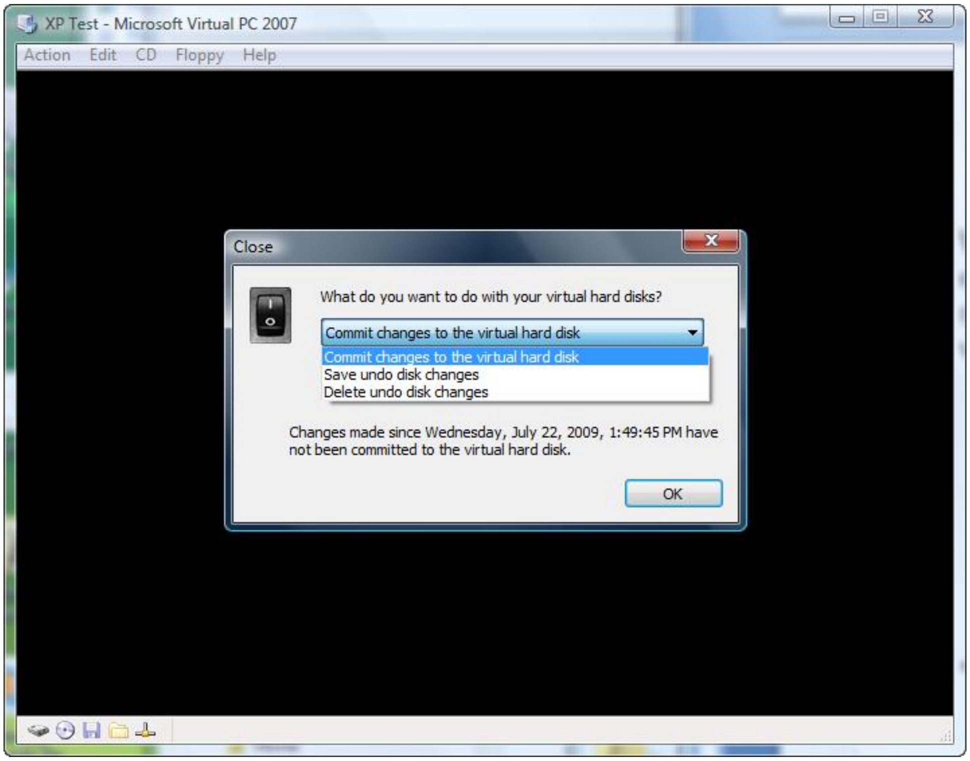
- Shut down the OS as you would on a physical machine (such as Start, Turn off computer).
- Click the Close box of the VM window.
- Choose Close from the Action menu or press Right Alt + F4.
- Choose Reset from the Action menu or press Right Alt + R. This closes the VM without saving any changes you made and then restarts it again.
- Click the Close command button in the VPC Console.

What happens when you close a VM depends on how you closed it, whether Undo Disks is enabled, and how the Close settings are configured (see the “Virtual machine settings” section for details). The following discussion assumes Undo Disks is enabled and Close is configuring to prompt you with all options, the settings you’ll normally want to use.

If you shut down the OS, you have the options shown in **Figure 17**:

- “Commit changes to the virtual hard disk” writes changes made during your session to the virtual drive and deletes the undo disk.
- “Save undo disk changes” doesn’t write changes to the virtual hard disk but doesn’t delete the undo disk, so the next time you start the VM, you’ll still see your changes because they still exist in the undo disk. However, if you then choose one of the options that deletes the undo disk, the changes are lost since they weren’t committed to the virtual drive.

- "Delete undo disk changes" doesn't write changes to the virtual hard disk and deletes the undo disk so the changes are lost.


XP Test - Microsoft Virtual PC 2007
Action Edit CD Floppy Help
Close

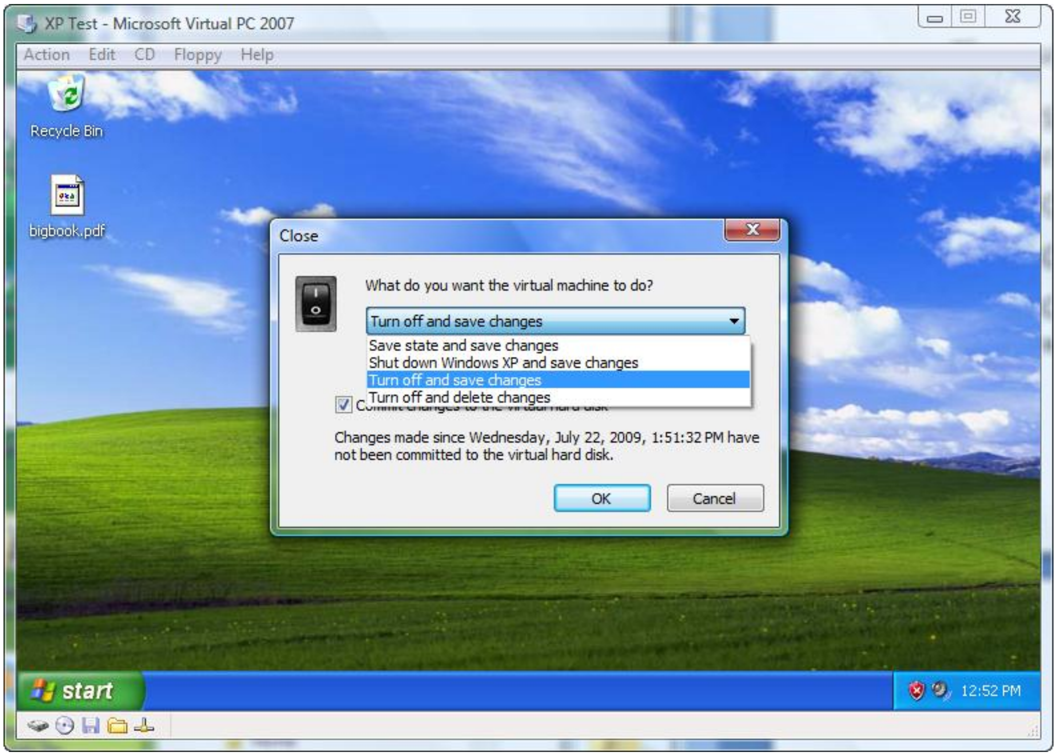
What do you want to do with your virtual hard disks?

Commit changes to the virtual hard disk
Commit changes to the virtual hard disk
Save undo disk changes
Delete undo disk changes

Changes made since Wednesday, July 22, 2009, 1:49:45 PM have not been committed to the virtual hard disk.

Figure 17. These options are available when you shut down the operating system.

Closing the VM results in the options shown in **Figure 18**. Note that most of the options have "save changes" in their names, so why is there a "Commit changes to the virtual hard disk" checkbox? The way to understand this is to realize that "save changes" means keeping the undo disk file. For example, suppose you create a file. If you choose "Turn off and delete changes," the undo disk is deleted so the file isn't there the next time you start the VM. If you choose "Turn off and save changes" but turn off "Commit changes to the virtual hard disk," the file is there the next time you start the VM but only because it still exists in the undo file, which wasn't deleted. It wasn't written to the virtual disk, so if you later choose "Turn off and delete changes," the file no longer exists since the undo file was deleted and the virtual drive never updated.



What do you want the virtual machine to do?

Turn off and save changes

- Save state and save changes
- Shut down Windows XP and save changes
- Turn off and save changes
- Turn off and delete changes

☑ Commit changes to the virtual hard disk

Changes made since Wednesday, July 22, 2009, 1:51:32 PM have not been committed to the virtual hard disk.

Figure 18. These are the options when you close the VM.

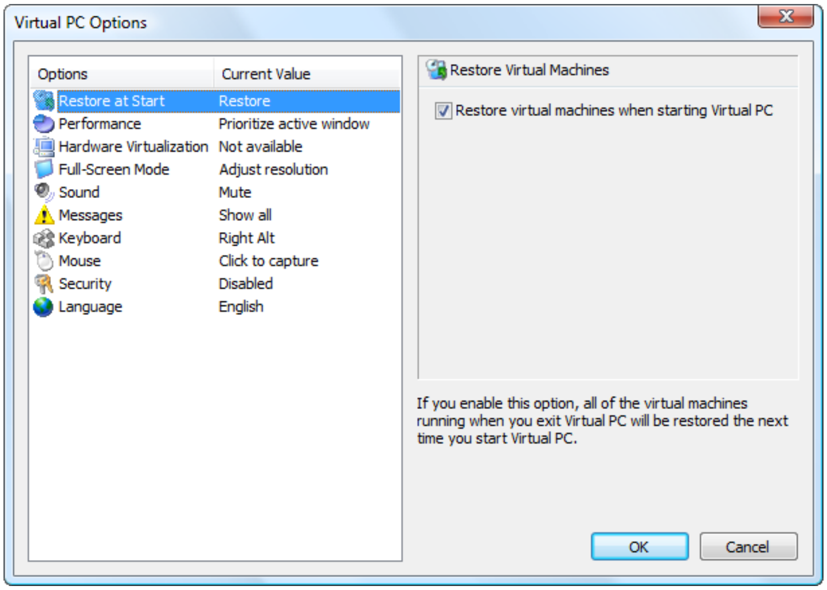
- "Save state and save changes" saves the state of the VM to a VSV file and shuts down the VM. The next time you start the VM, it skips the OS startup process and instead immediately restores its former state. This is a very fast way to restart a VM, similar to Sleep mode of Windows Vista.
- "Shutdown and save changes" shuts down the OS. This option only appears if you've made any changes.
- "Turn off and save changes" acts like pulling the power plug on a physical machine: it doesn't have a chance to shutdown properly and save data, so files can be damaged.
- "Turn off and delete changes" acts like pulling the power plug, doesn't write changes to the virtual drive ("Commit changes to the virtual hard disk" is disabled), and deletes the undo disk. This is the fastest way to close a VM and leave it as it was before you started the VM.

Because the variety of options can be confusing, I recommend using one of two approaches to closing a VM:

- If you want to save changes, shut down the OS and choose "Commit changes to the virtual hard disk."
- If you want to discard changes, close the VM window and choose "Turn off and delete changes."

Configuring Virtual PC

Although you likely won't change VPC's configuration settings from their defaults, they are available in case you need to. Choose Options from the Virtual PC Console's File menu to bring up the dialog shown in **Figure 19**.



Options	Current Value
Restore at Start	Restore
Performance	Prioritize active window
Hardware Virtualization	Not available
Full-Screen Mode	Adjust resolution
Sound	Mute
Messages	Show all
Keyboard	Right Alt
Mouse	Click to capture
Security	Disabled
Language	English

Restore Virtual Machines

☑ Restore virtual machines when starting Virtual PC

If you enable this option, all of the virtual machines running when you exit Virtual PC will be restored the next time you start Virtual PC.

Figure 19. The Options dialog allows you to configure VPC.

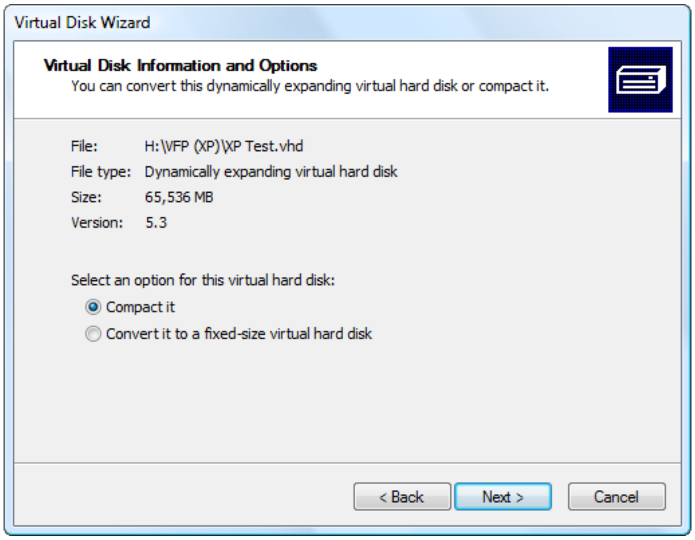
- **Restore at Start**: if "Restore virtual machines when starting Virtual PC" is turned on, any VMs you have running when you exit VPC are automatically restored the next time you run VPC.
- **Performance**: this page allows you to configure how CPU time is allocated: all VMs get equal CPU time, the active VM gets more CPU time (the default), or VMs in inactive windows are paused. You can also control whether processes on the host OS are given priority or not.
- **Hardware Virtualization**: the "Hardware virtualization" setting for VPC provides the default value for that setting for VMs.
- **Fill-Screen Mode**: if the "Adjust screen resolution so that the host operating system is the same as the guest operating system" setting is turned on (the default), putting a VM into full-screen mode changes the screen resolution of the host to match the VM's.
- **Sound**: this page allows you to determine if the sound for VMs in inactive windows is muted (the default) or not.
- **Messages**: this page allows you to determine whether error and information messages are displayed or not, and to reset the "don't show this message again" choice.

- **Keyboard**: you can specify which key releases the mouse from a VM (the default is Right Alt) and whether key combinations including the Windows key are directed to the guest OS, the host OS, or the guest OS only when in full-screen mode.
- **Mouse**: this page allows you to specify whether the VM window captures the mouse pointer when you click in it (the default) or simply move the mouse pointer into it.
- **Security**: you can configure VPC so administrative permissions are required to access the Options, Settings, New Virtual Machine Wizard, and Virtual Disk Wizard dialogs.
- **Language**: the "Language" setting affects the language used for the VPC Console, not VMs.

Compressing a virtual drive

Like zipping a file, compressing a virtual drive can save a lot of disk space. Start a VM, choose "Capture ISO Image…" from the CD menu, navigate to C:\Program Files\Microsoft Virtual PC\Virtual Machine Additions, and choose Virtual Disk Precompactor.ISO. When asked if you want to prepare the virtual hard disk for compaction, choose Yes. This step takes several minutes.

Next, shut down the OS the usual way (for example, Start, Turn off computer, and save changes to the virtual drive). From the Virtual PC Console's File menu, choose Virtual Disk Wizard and select "Edit an existing virtual disk." In the next step, select the VHD file for the VM. In the Virtual Disk Information and Options step, shown in **Figure 20**, choose "Compact it." The last step allows you to specify whether the VHD file should be overwritten or a new file created; I usually overwrite but you could create a new file for safety. Compacting the virtual drive also takes several minutes, but once it's done, the VHD should be significantly smaller. On my system, a fresh Windows XP Professional VM with nothing else installed went from 2,142,862 MB to 1,978,982 MB, a savings of almost 164 MB. Compacting drives that have more installed on them results in much larger savings, often several GB.


Virtual Disk Wizard

Virtual Disk Information and Options

You can convert this dynamically expanding virtual hard disk or compact it.

File: H:\VFP (XP)\XP Test.vhd

File type: Dynamically expanding virtual hard disk

Size: 65,536 MB

Version: 5.3

Select an option for this virtual hard disk:

● Compact it

○ Convert it to a fixed-size virtual hard disk

Figure 20. The Virtual Disk Wizard can compact virtual hard disks to save space.

Practical uses for Virtual PC

Earlier in this document, I discussed some of the ways I and other Stonefield staff use VPC. I expand on those uses in this section. Notice many of these uses take advantage of the two main features of a VM: it's a separate system from your main system so changes to it don't affect your production system, and you can turn off the machine without saving changes to quickly revert it to the state it was in when you started it.

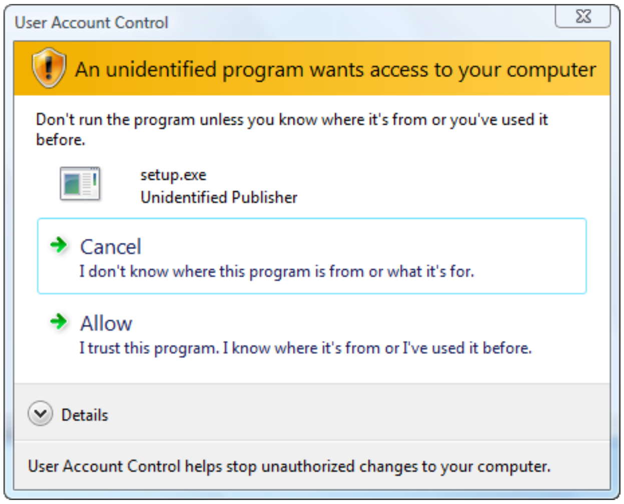
Installation testing

While you can (and should) test your application thoroughly on your own system, remember that your system isn't typical of an end-user's: it has the development version of VFP, lots of ActiveX controls, and many other components installed.

Have you ever had this happen? You test an application on your machine, then deploy it to a customer's machine and all kinds of error messages appear when you run it. One of the reasons it works on your machine and not their's is failure to install and register dependent files. For example, we all know you need to install the VFP runtimes and their associated files in order for a VFP application to work, but if you use ActiveX controls such as the Microsoft TreeView control, you need to install those as well. Also, some files, such as ActiveX controls, COM DLL and EXE files, and TLB files, need to be registered in the Windows Registry to work properly. One common problem I see on VFP online forums is that pressing F1 brings up the help file on the developer's system but not the user's. That usually means the developer neglected to install the FoxHHelp files or didn't run FoxHHelp9.EXE from their installer with "/RegServer" as a parameter.

To see an example of this, run the DemoApp.EXE that accompanies this document on your system. Assuming you installed the VFP development environment, it should work just fine. Then start a VM with nothing more than Windows XP installed, copy Setup.EXE, which installs DemoApp.EXE and the VFP runtimes, to the VM and run it to install the application. After installation, run DemoApp.EXE and notice that a dialog appears asking you to locate MSCOMCTL.OCX. That message appears because the main form in the application uses the Microsoft TreeView ActiveX control, which is located in MSCOMCTL.OCX, but that file doesn't exist on a Windows XP system with nothing else installed and Setup.EXE didn't install it. That's not an application error, it's an installation error you'd only see by testing on a clean OS.

Windows Vista and Windows 7 add new requirements to application installers. First, User Access Control (UAC) requires installers elevate to administrator privileges, even if you're logged in as an administrative user. As you can see in **Figure 21**, installers that aren't digitally signed display as "unidentified publisher" in the UAC dialog that appears when the user runs the installer, which may be disconcerting to your users. If you develop under Windows XP as an administrator, you wouldn't realize that the user gets the UAC dialog and see this message unless you specifically test it on a Vista machine or VM.



User Account Control

An unidentified program wants access to your computer

Don't run the program unless you know where it's from or you've used it before.

setup.exe
Unidentified Publisher

Cancel
I don't know where this program is from or what it's for.
Allow
I trust this program. I know where it's from or I've used it before.
Details

User Account Control helps stop unauthorized changes to your computer.

Figure 21. The Vista UAC dialog can be disconcerting if your application installer isn't digitally signed.

Application testing

This is similar to installation testing, but goes further into the application than just ensuring dependent components are installed. You can specifically look at differences between your development system and the customer's system, including:

- **Memory**. You likely have a powerful, fast machine with lots of RAM. How does the application perform on a more limited system? You can easily set up a VM with, say, 256 MB of RAM and see how the application runs.
- **Network connection**. Although it's rare these days, some users running older hardware may not have a network card installed. It's unlikely that'll impact your application, but I have seen instances where it does make a difference, so it might be worthwhile to set the number of network adapters for a VM to 0 and test the effect it has on your application.

- **Regional settings**. If you have customers in other countries, it’s a good idea to change your regional settings to other values and test your application. You’ll quickly discover whether you made bad assumptions in your code, such as that the month is always the first two digits of a date. The two settings that caught me until I learned to deal with them are date and currency formats. The user may have their dates configured as M/D/YY, so June appears as “6” rather than “06,” or they may use DD/MM/YYYY; this impacts CTOD() and DTOC() or code parsing dates converted to strings. Some countries use the comma as a decimal separator and the period as a thousands separator, so “1,234.56” in the US is displayed as “1.234,56” in Germany, which can affect code parsing for commas or decimals. We found a bug in XFRX (a great VFP add-on that outputs reports to many file formats such as PDF) that displayed currency values incorrectly when the currency symbol is set to “£” (British Pound). While you can change the regional settings on your main system, I don’t like to do that because it affects all running applications, so I prefer to do it in a VM and test there.

Testing different operating systems

Developers developing on Windows XP are often in for a nasty surprise when their users run their application on Windows Vista. In addition to UAC mentioned earlier, a lot of other things can cause a VFP application to not working properly in Vista. For example, the Program Files folder is now read-only, so writes to files in that folder (such as DBFs maintained by the application) either fail or are redirected to files in another folder. If you use VFP 9 SP1 or earlier, you may find that the borders of fixed-dialog windows either don’t appear at all or “smear” when you move the windows around.

Conversely, suppose you develop on Windows Vista and like the look of the new Segoe UI system font, so you use it for all of your forms and reports. If you then install the application on Windows XP, which doesn’t have that font unless you specifically install it, forms and reports won’t look as they should.

The only way to find out about these issues is to test your application on all of the operating systems your users could potentially run it on. VPC is perfect for this, because you can have one (or more) VMs for each OS and test your application on every one.

Curious about whether a VFP application has any issues on the new Windows 7? Create a VM and try it.

Testing different languages

This is similar to the previous section, but with a twist. We had a customer who complained that something didn’t work right in our application on the Chinese version of Windows. We quickly created a Chinese VM, duplicated his problem, found what caused the error, fixed it, and tested to make sure the problem was fixed and didn’t cause problems on non-Chinese systems. Another user got a C5 error when outputting reports on the Thai version of

Windows. Again, we were able to duplicate it, fix it, and confirm the fix worked by creating a VM with the Thai version of Windows.

Keeping your system clean

To improve the performance of my system, I like to install applications I use infrequently in VMs. That's especially the case for services or other applications that automatically run at system startup. For example, because our main product, Stonefield Query, works with any database, we often have to install other database engines to test problems developers using those engines encounter. Most of those engines run as services, so they run at startup and continue running while the machine is on, slowing both the startup process and normal operation of the system. If we only have to test it once or occasionally, why bog down our main systems? We have VMs with Oracle, Pervasive, Firebird, and many other database engines you've likely never heard of.

Another issue is that some applications conflict with each other. For example, installing the ACT! contact management system changes the system so ACT! is the associated application for DBF files rather than VFP. Installing it on a VM eliminates that problem on your main system.

Beta testing

When the Windows 7 beta came out, I wanted to both play with it to learn its new features and test our applications on it to make sure there weren't any issues. In my opinion, it's crazy to install a beta operating system on your main working PC because there's just too much risk and potential loss of productivity. Instead, I created a new VPC and installed Windows 7 on it. You can do the same with the beta versions of applications as well, such as SQL Server.

Training

One of my companies, Stonefield Systems Group Inc., does a lot of training for customers on the Accpac accounting system. Cleaning up the training machines after a course was finished so they're ready for the next one was a tedious chore until we started using VMs. Now, we have VMs set up that contain the desired operating system and application modules. A student goes through the training program that adds records, deletes records, does monthly and annual posting, and so on. Once they're finished the training, we shut the machine down without saving changes so it's back to its original state, ready for the next person to train on.

Demos and presentations

Some of the demos and presentations I do require starting from a certain point, making changes throughout the presentation to illustrate various features, and then restoring to the starting point at the end so it's ready to go for the next time. I used to create a list of all of the things to “undo” but that can be tedious and error prone. Instead, I now do those types of presentations on a VM. When I’m finished, I shut the VM down without saving changes, so the state is automatically and painlessly reverted to its starting point.

Running legacy applications

When we changed accounting systems several years ago (from the DOS version of Accpac to the Windows version), not all records could be converted. As a result, we kept the old version around so we could look things up when needed. What happens if the old version no longer runs on a new OS (for example, DOS applications won’t run on the 64-bit version of Windows Vista)? A VM using an older OS can continue to run the application.

Tips and tricks

Here are some things you can do to improve your use of VPC:

- Use the best physical machine possible, especially with lots of RAM. Like anything else, the more memory you provide a VM, the faster it’ll run.
- Store your VMs on a separate drive. Not only will you get better performance, you won’t clutter up your main drive with large VHD files. I keep most of my VM files on an external USB hard drive, which also makes them portable to other physical computers.
- Run as few applications on your main system as possible while running a VM.
- Regularly defragment both your physical drive and the virtual drive inside a VM.
- VMs are just as susceptible to malware such as viruses as physical machines. Even worse, if a VM becomes infected, it could infect your main system and even your whole network. So make sure your VMs are kept up-to-date with OS patches, service packs, and anti-virus patches and you have firewalls turned on. In other words, from a security point-of-view, treat a VM as you would a physical computer.
- A fixed-size virtual drive has a significant performance improvement over dynamic ones, so consider using them if you’re sure you picked a reasonable size you’ll never need to change.
- Virtual Machine Additions causes time synchronization between the host and guest OS. However, you may want to disable that if you need to change the date or time on a VM, such as testing what happens with a licensed application when the user rolls back the system date to before the license expired. This blog entry, http://blogs.msdn.com/virtual_pc_guy/archive/2007/11/28/disabling-time-synchronization-under-virtual-pc-2007.aspx, provides a means to do that.
- If you forget the login password for the OS on a VM, Robert Moir has a utility (http://robertmoir.com/files/folders/virtual_machine_files/entry2099.aspx) that’s a bootable floppy image you can mount in a VM to reset the password.

- If you need to use DOS in a VM, see http://blogs.msdn.com/virtual_pc_guy/archive/2007/10/30/installing-dos-additions-under-vpc-2007.aspx.

Licensing issues

If each VM you create is like a separate physical box, how does it impact software licensing? In general, a VM has the same licensing requirements as a physical machine. That means you need to have enough licenses for both OS and applications to cover each VM you create. For example, if you have three VMs running Windows XP on a Windows Vista system and two of them have Microsoft Office installed, you need one license of Vista (which likely came with the machine), three licenses of XP, and three licenses of Office (assuming you also have Office installed on your main system). Some versions of Windows and some licensing models give you additional licenses you can use without purchasing them separately. For example, Windows Vista Enterprise allows you to install it on up to four VMs. The Microsoft Action Pack, an inexpensive subscription for Microsoft Office, Windows, and other software, provides 10 licenses of each. An MSDN or TechNet subscription allows you to install OS and applications on multiple systems that you (not others in your office) use.

Microsoft also has a limit on which versions of Windows you're allowed to run VPC on: specifically, it's not licensed to run on host systems using the Home versions of Windows XP or Vista.

Alternatives to Microsoft Virtual PC

Microsoft Virtual PC isn't the only virtualization solution available. There are several others you may wish to consider, including:

- Microsoft Virtual Server is similar to VPC. While VPC is intended for desktop operating systems, Virtual Server is intended for server operating systems.
- Windows Virtual PC (http://www.microsoft.com/windows/virtual-pc) ("Microsoft" is changed to "Windows") is intended for Windows 7. Windows VPC adds USB support, can run applications in windows on the host desktop rather than in the guest OS window ("Windows XP mode"), provides access to "known" Windows 7 folders (such as Documents) in the guest OS, and supports printer sharing.
- VMWare (http://www.vmware.com) has several virtualization solutions, such as VMWare Workstation. VMWare has better performance and more features, including a very cool snapshot feature that creates a VM from a running host or VM, but isn't free.
- VirtualBox (http://www.virtualbox.org) from Sun Microsystems is also a free solution. It also has better performance and more features than VPC, including snapshots and support for 64-bit guest OS.

Resources

Here are some resources I found handy when learning about VPC:

Background on virtual machine technology and specifics on Microsoft Virtual Server: http://www.microsoft.com/windowsserversystem/virtualserver/evaluation/virtualizationfaq.mspx

Windows Virtual PC home page: http://www.microsoft.com/windows/virtual-pc

Wikipedia article: http://en.wikipedia.org/wiki/Microsoft_Virtual_PC

Blog of one of the Microsoft virtualization team members: http://blogs.msdn.com/virtual_pc_guy

Tips and tricks, especially regarding differencing disks: http://www.andrewconnell.com/blog/articles/UseVirtualPCsDifferencingDisksToYourAdvantage.aspx

Performance tips and tricks: http://www.windowsnetworking.com/articles_tutorials/Tuning-Virtual-PC-Performance.html

Links to numerous resources on VPC, Virtual Server, and virtualization in general: http://blogs.technet.com/richard_macdonald/archive/2007/03/12/Virtually-Everything-About-Microsoft-Virtualisation-Technologies.aspx

Although I haven't found a need to do this, this article discusses how to "sysprep" a virtual machine to avoid conflicts with cloned VHDs: http://blogs.technet.com/megand/articles/357570.aspx

Rick Borup pointed me to this blog entry that describes a solution to a problem installing Microsoft Virtual PC 2007 SP1 on Windows Vista: http://ogasawalrus.com/blog/node/545

Summary

Whether you use Microsoft Virtual PC or one of its alternatives, virtualization solutions can make your development life much easier. Although installing an OS on a VM for the first time can be a little scary, hopefully you've seen in the document that it's actually a very simple (if time-consuming) task. Start using VPC today; I guarantee you won't go back to the old way of doing things.

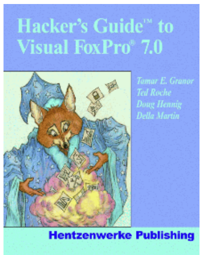
Biography

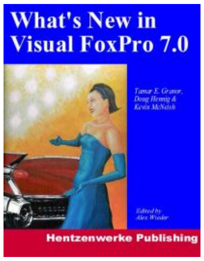
Doug Hennig is a partner with Stonefield Systems Group Inc. and Stonefield Software Inc. He is the author of the award-winning Stonefield Database Toolkit (SDT); the award-winning Stonefield Query; the MemberData Editor, Anchor Editor, and CursorAdapter and

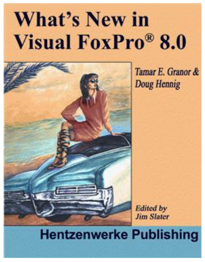
DataEnvironment builders that come with Microsoft Visual FoxPro; and the My namespace and updated Upsizing Wizard in Sedna.

Doug is co-author of “Making Sense of Sedna and SP2,” the “What’s New in Visual FoxPro” series (the latest being “What’s New in Nine”), “Visual FoxPro Best Practices For The Next Ten Years,” and “The Hacker’s Guide to Visual FoxPro 7.0.” He was the technical editor of “The Hacker’s Guide to Visual FoxPro 6.0” and “The Fundamentals.” All of these books are from Hentzenwerke Publishing (http://www.hentzenwerke.com). He wrote over 100 articles in 10 years for FoxTalk and has written numerous articles in FoxPro Advisor, Advisor Guide to Visual FoxPro, and CoDe. He currently writes for FoxRockX (http://www.foxrockx.com).

Doug spoke at every Microsoft FoxPro Developers Conference (DevCon) starting in 1997 and at user groups and developer conferences all over the world. He is one of the organizers of the annual Southwest Fox conference (http://www.swfox.net). He is one of the administrators for the VFPX VFP community extensions Web site (http://vfpx.codeplex.com). He has been a Microsoft Most Valuable Professional (MVP) since 1996. Doug was awarded the 2006 FoxPro Community Lifetime Achievement Award (http://fox.wikis.com/wc.dll?Wiki~FoxProCommunityLifetimeAchievementAward~VFP).






What's New in Visual FoxPro® 8.0
Tamar E. Granor & Doug Hennig
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