

VMware Tools

The VMware Tools is a whole set of drivers and software functions, which provide any virtual machine with extra value. Combined with current drivers for the virtual hardware it also offers additional functions, such as, for example, a time synchronization service or the ability to shut down smoothly or to restart the guest operating system. In this chapter you will learn everything you need to know about these tools.

VMware Server makes VMware Tools easy to install, but it's a different story with VMware Player. Chapter 14 offers more details about using VMware Player and how to install VMware Tools.

VMware Tools is a part of the VMware product range (with the exception of VMware Player) and is always updated along with the latest product versions. As a system owner it is a huge advantage not to have to worry about the current drivers or tools - VMware Tools is always there and can always be installed. You only have to remember that such updates require restarting your virtual machine.

Of course, it is always recommended that you maintain the same version of VMware Tools as the version of the VMware virtualization product. Therefore in production environments before updating the VMware product (and VMware Tools in the virtual machines), you should establish a plan to bring them up to the same level as fast as possible. This is to avoid unnecessary downtime.

Installation with VMware Server and VMware Playe

Updated with every version of VMware Server

Maintain the same version of VMware Tools and VMware Server

Many operating systems supported by VMware Tools

From the VMware Tools perspective, support for guest operating systems has recently increased enormously and now nearly any operating system is supported by the current VMware Server version. VMware is also constantly expanding support for operating systems or newer versions of operating systems, and delivering the appropriate VMware Tools.

Install VMware Tools whenever possible

If the guest operating system is supported by VMware Tools then I advise always installing it. So far I have never seen VMware Tools negatively impact the behavior of a virtual machine.

In the following sections I will go first into the installation and updating of VMware Tools on both of the most commonly used families of operating systems. Afterwards we will explore the functionality of VMware Tools and how best to use it.

12.1 Microsoft Windows

Full support for Microsoft Windows

VMware Tools offers full support. So far there are no Microsoft Windows operating systems (after Windows NT) which are not covered by VMware Tools.

12.1.1 Installation

To start the installation of VMware Tools, simply choose the option *VM, Install VMware Tools* in the VMware Server menu. Figure 12.1 shows the VMware Server Console from where you can install VMware Tools.



Figure 12.1 – Starting the VMware Tools installation

Next, a VMware Server dialog appears which explains the advantages of VMware Tools and informs that the guest operating system needs to be available and running, as can be seen in Figure 12.2.



Figure 12.2 – Do you want to install or do you want to cancel?

After choosing *Install* the VMware Tools CD ISO image is inserted in the virtual CD drive and the installation program starts via Autorun (if activated).

The installation wizard for VMware Tools is shown in Figure 12.3.

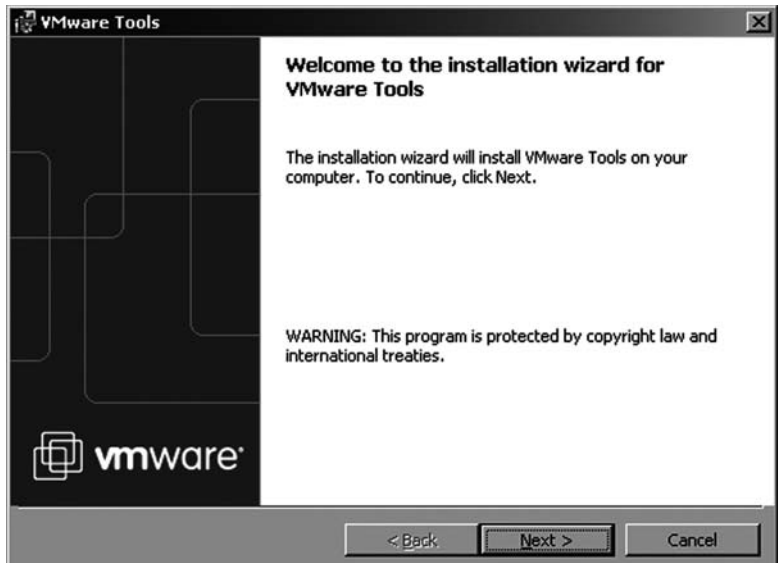


Figure 12.3 – The installation of VMware Tools

Choose the components to install

The second installation dialog (Figure 12.4) asks for the type of installation, where **Typical** installs only the components which are supported by the VMware product being used (in this case the components for VMware Server).

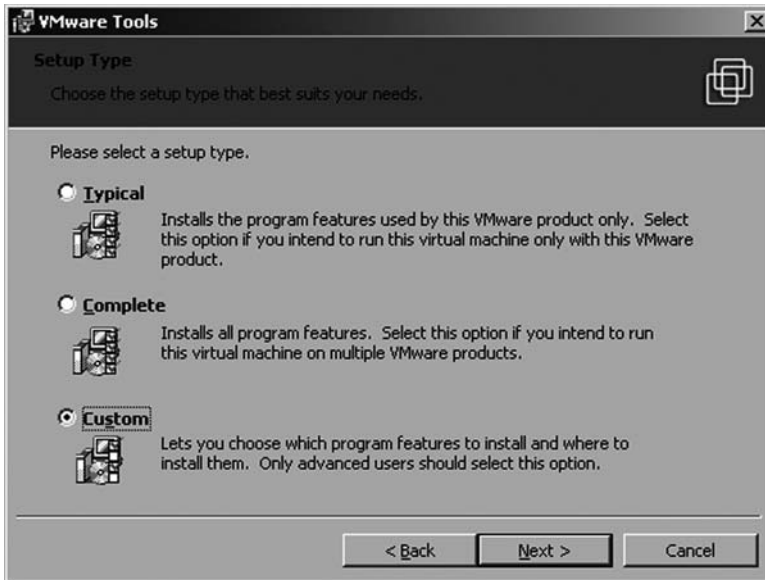


Figure 12.4 – Installation types

Complete installs everything, independently of the product being used. This is useful if the virtual machine is to be used with multiple VMware products such as Player, Workstation, Server, ACE and ESX.

Custom, on the other hand, allows an individual choice of components.

In choosing **Custom** the list of available components will be displayed (Figure 12.5). This is a colorful mix which offers many useful functions (such as time synchronization), the virtual device drivers and shared folder option. A shared folder is a directory for data exchange between the host and guest systems, but is not currently supported by either VMware Player or VMware Server.

Use custom installation and remove the shared folder

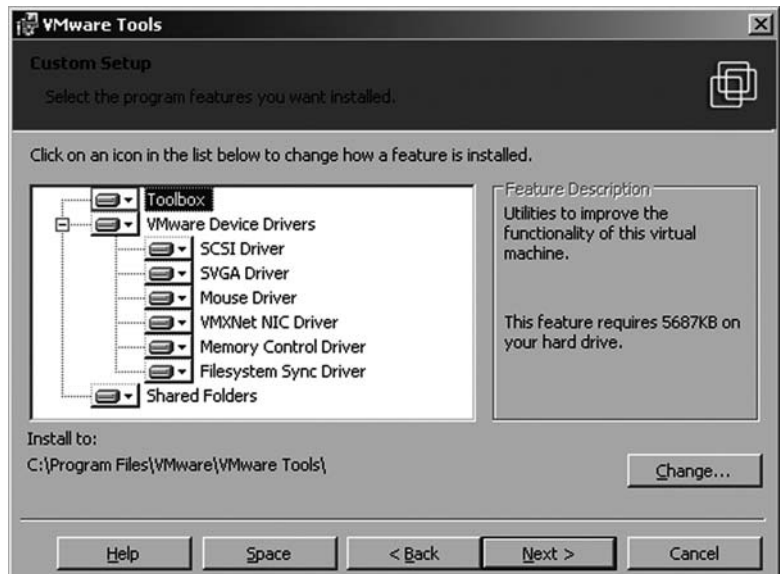


Figure 12.5 – The custom installation

Overview of components

The following list provides a short overview of the components:

- **Toolbox:** With functions such as time synchronization and clean shutdown of the guest system.
- **SCSI Driver:** Installs an improved BusLogic SCSI driver. If you use LSI Logic this driver is not required.
- **SVGA Driver:** Graphic card driver for the virtual graphics card; enables numerous screen resolutions and increases performance.
- **Mouse Driver:** Improved mouse driver which fixes glitches with the mouse.
- **VMXNet NIC Driver:** Network card driver for the VMXNet VMware network card. Improves network performance of the virtual machine, especially in gigabit environments. Furthermore the CPU usage is not as high as with AMD PCNet32. Using this driver requires a modification in the configuration file of the guest system.
- **Memory Control Driver:** Driver for improved memory management in the virtual machine. Is only required for the use of VMware ESX.
- **Filesystem Sync Driver:** Driver for the synchronization of the file system within the virtual machine. For example, for preparation of backups.

- **Shared Folders:** Directory for data exchange between the host system and the guest system. Currently only works when using VMware Workstation.

After installation of the device drivers and the additional selected tools is complete, the installation program then checks whether hardware acceleration has been enabled (Figure 12.6).

Hardware acceleration

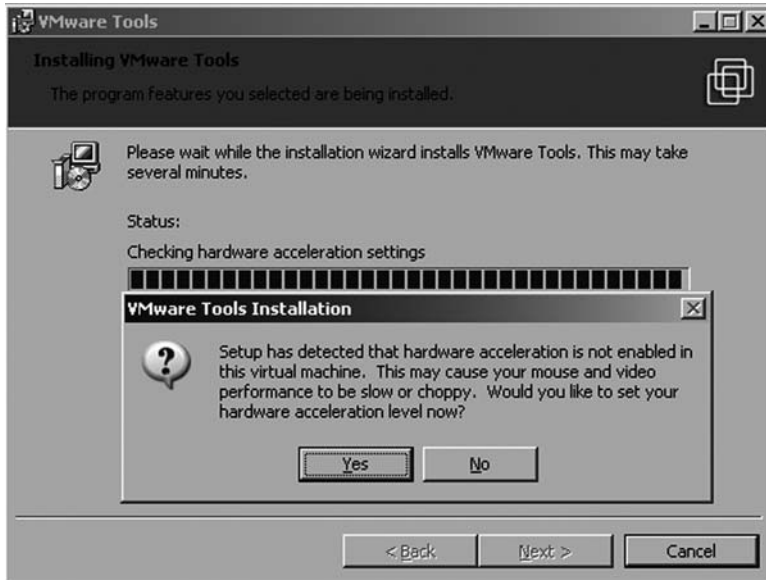


Figure 12.6 – Hardware acceleration settings

With most newly-installed virtual machines this is not the case and must therefore be done manually later.

To access the hardware acceleration configuration, you must go into the graphics settings shown in Figure 12.7 and choose **Advanced** configuration.

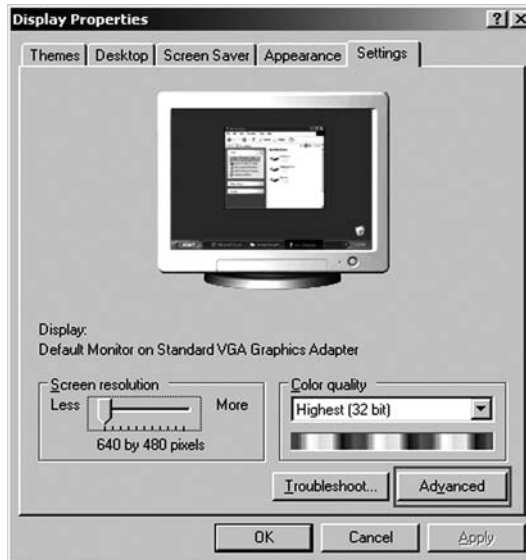


Figure 12.7 – Accessing hardware acceleration in the graphic settings

Manual steps after installation of the VMware SVGA graphic card

This happens automatically during the VMware Tools installation program. Otherwise right-click in the normal way on an empty area of the desktop, then choose **Properties** or go to *Start, Settings, Control Panel, Display*.

Within the **Advanced** settings go to the **Troubleshoot** tab and move the **Hardware Acceleration** bar to **Full** (Figure 12.8).

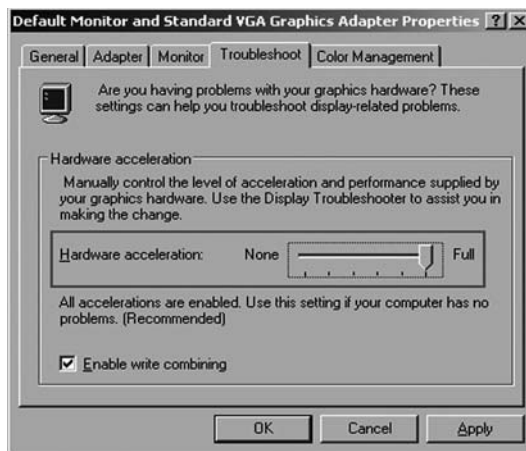


Figure 12.8 – Enabling hardware acceleration

Then accept the change with OK and the installation of VMware Tools and the configuration of the hardware acceleration is complete.

Increase hardware acceleration on Windows systems

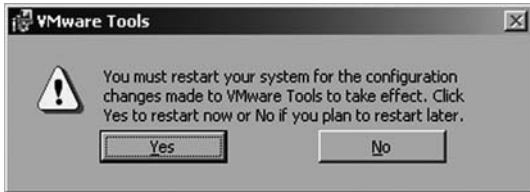


Figure 12.9 – Restart of the guest system after installation of VMware Tools

However after this a restart should be performed (Figure 12.9), so that all VMware Tools components are actually loaded.

12.1.2 Upgrade

In general upgrades of VMware Tools happen entirely automatically. The message in Figure 12.10 advises that a more recent version of the VMware Tools is available and asks whether you would like to proceed with the upgrade.

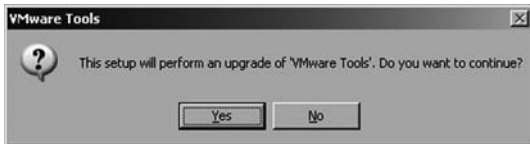


Figure 12.10 – Updating the version of VMware Tools

If the same version of VMware Tools is already present, a message appears allowing modification, repair or removal of VMware Tools.

Reboot required

12.1.3 Unattended Installation

Earlier versions of VMware Tools contained drivers which were not approved, and therefore not certified and signed, by Microsoft. This led to the problem with newer Windows versions (Windows 2000 and Windows 2003) that the installation of unsigned drivers could only proceed with

Issues with unsigned drivers in earlier versions

the user's explicit approval. Fortunately it was possible to modify this default setting through registry changes or a group policy to switch off the driver dialog.

All drivers now signed by Microsoft

VMware has now had all drivers in the virtual machine certified by Microsoft following the simple method of putting hard cash on the table. So now VMware Tools can be installed unattended with newer Microsoft Windows systems without the "unsigned driver" problems.

For automatic installation make the installation files accessible over the network

As the automatic installation of VMware Tools should preferably happen without a connected VMware Tools ISO file, you have to uncompress the ISO image (for example with WinZip, WinRar or WinISO) and make it available over a network share. In our example VMware Tools is located on a share called *vmtools* on the server *NAS* which is mapped in the script to drive *V:*.

msiexec used for installation

The automatic installation of VMware Tools makes use of the *msiexec* command, for example *msiexec -i "V:\VMware Tools.msi" ADDLOCAL=ALL /qn*. The parameter *ADDLOCAL=ALL* installs all components. The switch */q* runs the command in quiet mode and the switch */n* indicates that the GUI should not be shown. The combination of these two switches runs the unattended installation mode.

Setting hardware acceleration automatically

A further problem after installation is the configuration of hardware acceleration, which can be done using a registry entry. It is a pity that the registry hive, under which the registry key needs to be set, is named differently in every system.

FronD, a VMware community member, has created an unusual, but functional, mix of a *Reg* command and a **VB script** to solve the registry problem. Running the *Reg* command is done as follows:

```
reg query HKLM\HARDWARE\DEVICEMAP\VIDEO | find /i "video0"
| cscript enablehdwacc.vbs
```

This command queries the registry for the term "video0" and then executes the VB script *enablehdwacc.vbs*.

The content of the VB script *enablehdwacc.vbs* looks like this:

```
Set WshShell = WScript.CreateObject("WScript.Shell")
' Acceleration Levels go from 0 to 5. 0=full, 5=none
intAccelLevel = 0
strInputString = WScript.StdIn.ReadLine
intStartLocation = instr(1, strInputString,
"\System\CurrentControl Set\")
strPartKey = right(strInputString, len(strInputString)
- intStartLocation + 1)
strNewKey = "HKLM" & strPartKey & "\Acceleration.Level"
WshShell.RegWrite strNewKey, intAccelLevel, "REG_DWORD"
```

To summarize, the script file sets the acceleration level for graphical hardware to zero (0=full) in the registry by using the registry path found with the previous *reg* command, and then creates a new key called Acceleration Level with a *REG_DWORD* value of 0.

By copying the various scripts into the share mentioned above and creating a batch file to bring it all together, the following method for automated installation of VMware Tools can be used:

Fully automated
method for installation

ToolsAutoInstall.cmd

```
Rem Disconnect and connect drive V:
net use v: /d
net use v: //NAS/VMTools
Rem Run the automatic tools installation without restart
Msiexec -I "V:\VMwareTools.msi" ADDLOCAL=ALL /qn
REBOOT="ReallySuppress"
Rem Activation of hardware acceleration
reg query HKLM\HARDWARE\DEVICEMAP\VIDEO | find /i "video0"
| cscript v:\enablehdwacc.vbs
```

The batch file is properly documented with inline remarks, so you can follow what is happening.

After running this script VMware Tools is installed and the system can then be restarted.

Exclude components with `msiexec` switches

If you wish to leave out individual components during installation, you can add **Remove** to the `msiexec` command. The following command installs VMware Tools completely, except the shared folder:

```
msiexec -i "V:\VMware Tools.msi" ADDLOCAL=ALL REMOVE=Hgfs /qn
```

Table 12.1 lists the parameters for the different components, so that you can build your own `msiexec` commands with the Remove switch:

Table 12.1 – Remove Switches

Components	Parameter
Toolbox	Toolbox
VMware Device Drivers (all)	Drivers
SVGA Driver	SVGA
Mouse Driver	Mouse
SCSI Driver	Buslogic
VMXNet NIC Driver	VMXNet
Memory Control Driver	MemCtl
Shared Folder	Hgfs

12.1.4 Deinstallation

Removing VMware Tools

You can perform a deinstallation using either *Start, Settings, Control Panel, Add or Remove Programs*, or by running the VMware Tools setup program again and choosing **Remove** in the following dialog (Figure 12.11).

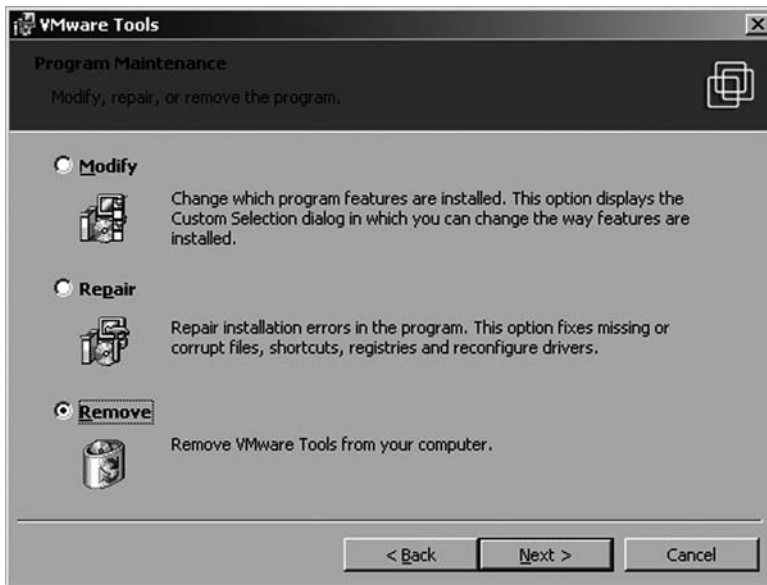


Figure 12.11 – Removing VMware Tools with the setup program

12.2 Linux

In earlier versions of VMware Tools, installation was only possible using the source installation package, as no RPM installation package existed. Meanwhile this has changed and in most cases the RPM installation is completely sufficient.

Source and RPM
installation supported

12.2.1 Installation

The first step for installation of VMware Tools is always the same. The VMware Tools ISO image is first associated with the virtual CD drive by choosing **Install VMware Tools** (Figure 12.1).

Most linux distributions do not connect CD/DVD media automatically

However, the CD rarely connects automatically on Linux. So you have to connect manually using the command `mount -t iso9660 /dev/cdrom "Mountpoint"`. Mountpoint needs to be already available as a directory. If an entry already exists in `etc/fstab` then the command `mount cdrom` would be sufficient and mounts the CD usually to `/media/cdrom`.

Use `/etc/fstab` for shortcuts and automounting

`fstab` is a configuration file that contains information of where and how your partitions and storage devices should be mounted. You probably have a misconfigured `/etc/fstab` file if you can't mount your CD; if you can't write to your floppy as a normal user; or if you have problems with your CD-RW. To fix these mounting problems edit your `fstab` file.

Two files on the VMware Tools CD

In the directory connected using the `mount` command you can now find two files: VMware Tools as an RPM file and VMware Tools as source (.tgz). In the following example I will go through the installation on **CentOS** with a GNOME Window Manager running.

CentOS connects to the CD drive automatically when recognizing a CD (automount). In this case it is an ISO, which will be inserted into the CD drive by the VMware Tools installation program.

On the CD you will find the two files mentioned before. Click on the file `VMwareTools-xxx.rpm` which will cause VMware Tools to be automatically installed. In contrast to a Microsoft Windows installation, no configuration program runs, so the remaining configuration must be carried out via the command line as described below.

Configuration of VMware Tools

1. Run `/usr/bin/vmware-config-tools.pl` which starts the configuration of VMware Tools. During the configuration various drivers and components are compiled to fit the system kernel. Among other things, the graphics card driver is first installed and then you are prompted for the resolution to be used in X11 (base for graphical user interfaces with linux). If the kernel hasn't been recognized you need to have the kernel sources at hand. Therefore always update the kernel sources when doing system updates.

Kernel sources needed!

Start `vmware-toolbox`

2. Start the VMware Tools software in Window Manager using `/usr/bin/vmware-toolbox`. If you wish to keep VMware Toolbox in the background it should be started using `/usr/bin/vmware-toolbox &`. You will learn more about this Toolbox later in the chapter in the section "Functions".

If you do not want to use the AMD PCNet32 network adapter, you can proceed as follows once VMware Tools have been installed:

Change from AMD PCNet to VMXnet

1. Change the virtual network card configuration on the virtual machine to VMXNet (by changing the configuration file).
2. Stop the network, load the driver files and start the network again with the following commands:

```
/etc/init.d/network stop
rmmod pcnet32
rmmod vmxnet
depmod -a
modprobe vmxnet
/etc/init.d/network start
```

12.2.2 Upgrade

An upgrade runs automatically by simply clicking on the RPM file, just like a new installation on CentOS and on many newer Linux distributions.

Upgrade is easy and quick

If it isn't happening, the update can be run using `rpm -Uhv VMwareTools-xxx.rpm`. The parameters `-Uhv` define the upgrade (U), run a progress report (h=hash) and enable verbose mode (v). After this the following command should be used again to run the configuration program:

```
/usr/bin/vmware-config-tools.pl.
```

12.2.3 Deinstallation

Deinstallation requires a handful of command line instructions in order to find the package name and to uninstall the package.

For deinstallation find the installed RPM packet

1. This command searches all installed packages for the string "VMware" `rpm -qa |grep VMware`. The result should be a line containing the string `VMwareTools Version Build`.
2. With the name found above (VMware Tools) the deinstallation can now be carried out using `rpm -e VMware-Tools-xxx`.

12.3 Functions

In addition to the already mentioned device drivers which are installed by VMware Tools (BusLogic, VMXNet, graphics card), there are also drivers which provide better performance within the virtual machine.

Seamless change between host and virtual machine

It is also possible, after installation of VMware Tools, to easily lose the focus of the virtual machine without using the hot keys *CTRL+ALT*. This means that the mouse and keyboard entries are only interpreted for the VM when you are actually in the VMware Server window. The loss of focus between VM and host system is therefore seamless.

Furthermore, on Windows the VMware Toolbox is automatically started whereas on Linux it must be manually started (*using vmware-toolbox*).

VMware Toolbox actually offers a variety of functions, of which just the most important ones are mentioned here. On Windows the VMware Toolbox dialog will appear by clicking on the icon shown in Figure 12.12. However Linux starts the dialog immediately.



Figure 12.12 – VMware Tools system tray icon on Windows

Time synchronization

On the **Options** tab (shown in Figure 12.13) the display of the system tray icon can be disabled. The same tab controls functions for synchronizing the time between the host and guest operating system.

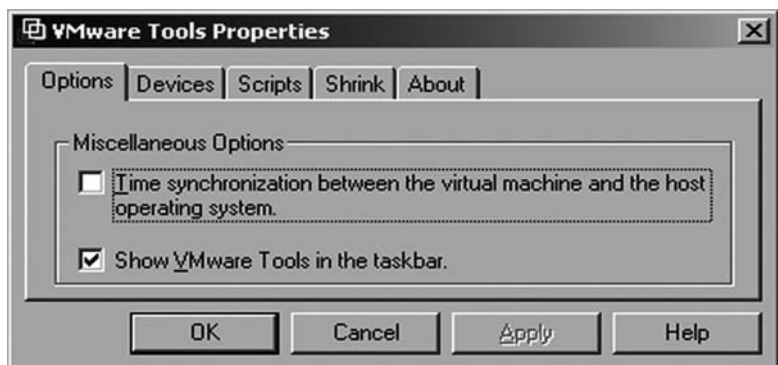


Figure 12.13 – VMware Tools options

The same effect can be obtained by modifying the configuration file and insert the line `tools.syncTime="true"`. Using this switch VMware Tools regularly synchronizes the guest system time with the host system time.

Change time synchronization by modifying the configuration file

The **Devices** tab allows one to connect or disconnect the removable media (diskette, CD/DVD).

Power-mode scripts are scripts which run before shutdown or startup of the virtual machine. If you wish to work with power-mode scripts you can find the necessary entries in the **Scripts** tab shown in Figure 12.14.

Use scripts for power modes

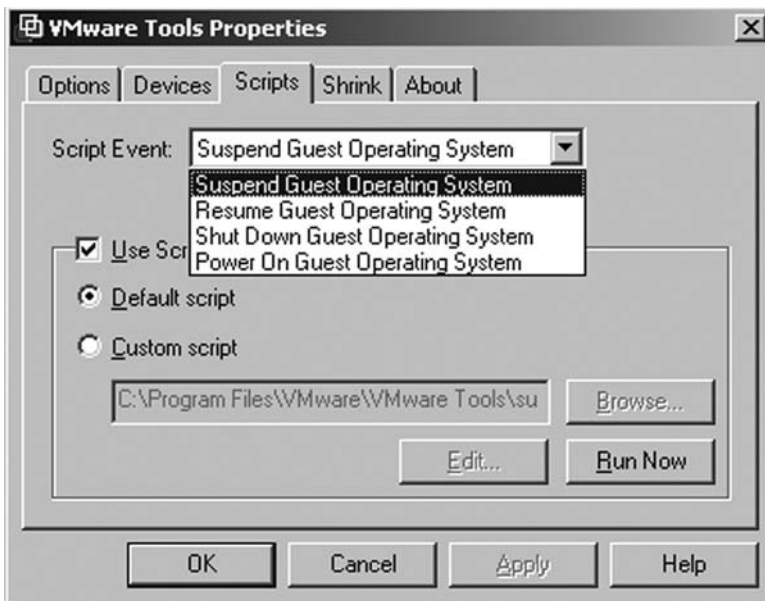


Figure 12.14 – Power-mode scripts

In the program directory of VMware Tools on Windows, or in `/etc/vmware-tools` on Linux, there are default script files that you can modify to your requirements. You will find all different kinds of actions such as sending a message or shutting down services.

Location of the scripts

Cleanly shutdown and restart VMs

As soon as VMware Tools is installed it is also possible to cleanly restart or shut down the virtual machine with the options **Restart Guest** and **Shutdown Guest**. However without VMware Tools VMs can only be completely reset or switched off, just like pulling the power plug on physical machines.

Dynamically growing hard disk files only ever grow. This sounds like some deep pearl of wisdom but it's actually really the way it works. VMware cannot shrink these hard disk files on its own because the program would first have to understand the content of the hard disk (of the guest file system). This would represent an enormous performance hit.

Shrink growing hard disks

Therefore after a certain period of use it makes sense to clean up the hard disk contents. The Shrink function was developed for this purpose, which you can access on the **Shrink** tab shown in Figure 12.15.

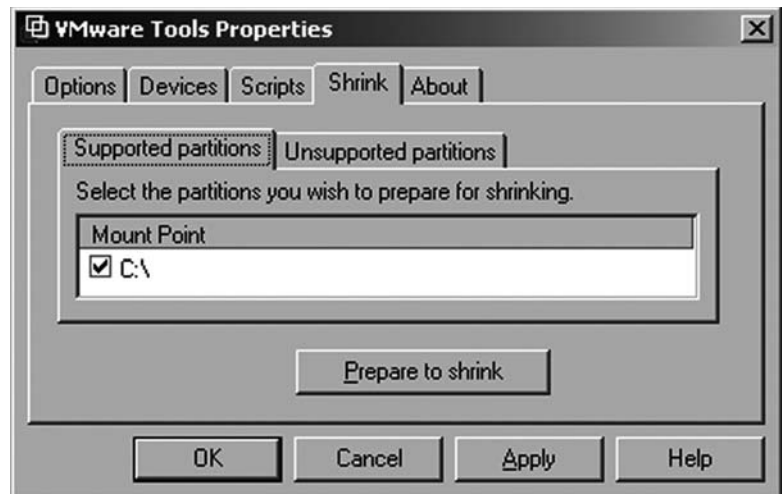


Figure 12.15 – Shrinking of partitions

The shrink process

The shrink process consists of two phases:

1. Identification of the unused hard disk areas through a process which can read the hard disk contents (the file system). The unused areas are overwritten with zeros.

2. The virtual machine is shut down and the hard disk file is duplicated using an imaging process and thereafter swapped. Therefore more disk space is required for duplication. For example, for 10 GB disks 10 GB of temporary space would also be required. If split hard disks are being used (maximum 2 GB parts), the individual pieces will be handled individually, so that the required temporary space would be just over 2 GB.

Because of the virtual machine's downtime during the shrink process you should choose a suitable time to do this. Duration of downtime is directly proportional to hard disk size.

And last but not least, in the **About** tab there is the current build number of VMware Tools which is an important piece of information.

Find the VMware Tools version in the About tab

Having learned how to install the VMware Tools package inside your virtual machines, Chapter 13 discusses how to work with predefined virtual machines and appliances, and indeed how to create your own.