User Guide
for Release 7.2

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1 About Oracle VirtualBox

Oracle VirtualBox is a cross-platform virtualization application. That means it extends the capabilities of your existing computer so that it can run multiple operating systems, inside multiple virtual machines (VMs), at the same time. As an example, you can run Windows and Linux on your Mac, run Windows Server on your Linux server, run Linux on your Windows PC, and so on, all alongside your existing applications.

You can install and run as many virtual machines as you like. The only practical limits are disk space and memory. You can also save, copy, export and transfer VMs between hosts, and Oracle Cloud Infrastructure.

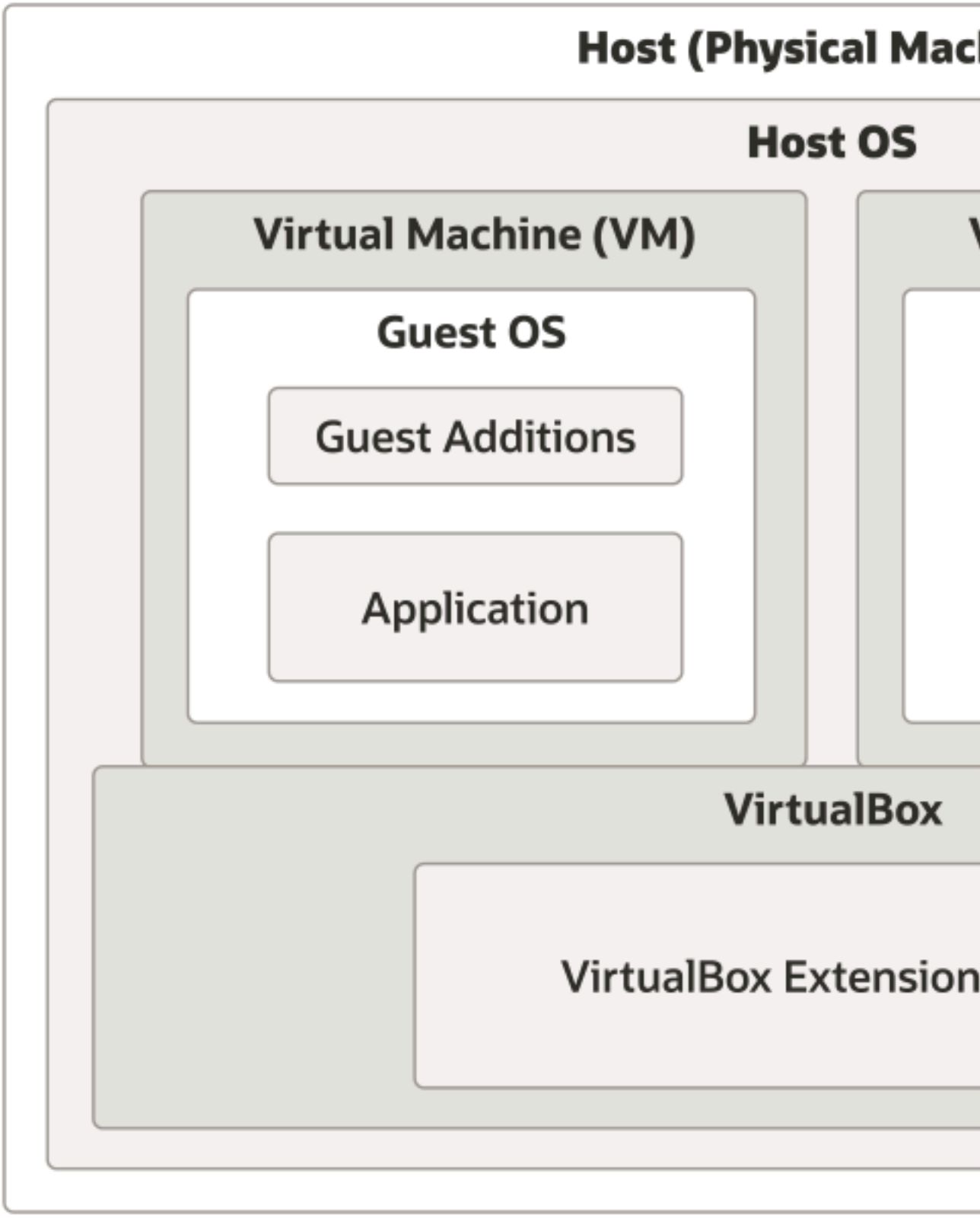
Oracle VirtualBox can run on multiple host operating systems, and on small embedded systems or desktop machines all the way up to data center servers and Cloud environments. You can install appliances (VMs pre-installed with applications and configured for a particular purpose, such as a mail server) to save time and improve consistency. You may even be able to install an old OS that your host computer no longer runs, because you can configure virtual hardware in a VM to suit your needs.

Virtualization can significantly reduce hardware and electricity costs. Most of the time, computers only use a fraction of their potential power and run with low average system loads. A lot of hardware resources are therefore wasted. So, instead of running many such physical computers that are only partially used, you can pack many VMs onto a few powerful hosts and balance the loads between them.

Oracle VirtualBox is a useful tool for development and testing. For example, you can investigate issues with software configuration or networking using VMs.

For more information on Oracle VirtualBox, including support and licensing, see *https://www.oracle.com/virtualization/virtualbox/#licensing*.

1.1 Oracle VirtualBox Components



Oracle VirtualBox is installed on the *host operating system*. The *host* is the physical computer, such as a laptop or server, where you run VirtualBox and the virtual machines you create or import. There are versions of Oracle VirtualBox for Windows, macOS, Linux, and Oracle Solaris hosts. See *2.1 Choosing an Installation Package on page 29* for more information. The *VirtualBox Platform Package* consists of all open source components and is licensed under the GNU General Public License V3.

The *Oracle VirtualBox Extension Pack* is an optional, separately licensed, installation package that includes these additional features:

- *VirtualBox Remote Desktop Protocol (VRDP) server*. See *Remote Display (VRDP Support)*. This allows remote clients to connect to a VM using RDP. For example in the case of a server running several applications in different VMs. There is no need for a GUI for any of these on the host machine, but you may wish to connect to them remotely for troubleshooting or maintenance.
- Host webcam passthrough. See *Webcam Passthrough*.
- Intel PXE boot ROM.
- Disk image encryption with AES algorithm. See *Encryption of Disk Images*.
- Cloud integration features. See *6 Integrating with Oracle Cloud Infrastructure on page 89*.

The *guest operating system (guest OS)* is the OS that is running inside a virtual machine. Theoretically, Oracle VirtualBox can run any x86 OS such as DOS, Windows, OS/2, FreeBSD, and OpenBSD on an x86_64 host. It can also run a selection of Arm guests on Arm hosts. See *1.3 Guest Operating Systems on page 24*.

The *virtual machine (VM)* is the special environment that Oracle VirtualBox creates for your guest OS while it is running. In other words, you run your guest OS *in* a VM. Normally, a VM is shown as a window on your computer's desktop. Depending on which of the various frontends of Oracle VirtualBox you use, the VM might be shown in full screen mode or remotely on another computer.

Internally, Oracle VirtualBox treats a VM as a set of parameters that specify its behavior. Some parameters describe hardware settings, such as the amount of memory and number of CPUs assigned. Other parameters describe the state information, such as whether the VM is running or saved.

You can view these VM settings in VirtualBox Manager, in the **Settings** window, and by running the VBoxManage command. See *15 VBoxManage on page 271*.

Guest Additions for OSs that qualify for Oracle Premier Support are included in the VirtualBox base package. These are installed *inside* a VM, once the OS is installed and running, to improve performance of the guest OS and to add extra features. See *7 Guest Additions on page 103*.

1.2 Oracle VirtualBox Features

Portability

Oracle VirtualBox is a so-called *hosted* hypervisor, sometimes referred to as a *type 2* hypervisor. Whereas a *bare-metal* or *type 1* hypervisor runs directly on the hardware, Oracle VirtualBox requires an existing OS to be installed. It can thus run alongside existing applications on that host. Oracle VirtualBox runs on a large number of 64-bit host operating systems. See *2.1 Choosing an Installation Package on page 29*.

CAUTION: Do not run other hypervisors together with Oracle VirtualBox.

While several hypervisors can normally be *installed* in parallel, do not attempt to *run* virtual machines from competing hypervisors at the same time. Oracle VirtualBox cannot track what another hypervisor is currently attempting to do on the same host, and especially if several products attempt to use hardware virtualization features such as VT-x, this can crash the entire host.

Oracle VirtualBox is available on multiple host platforms, and the same file and image formats are used on each. This enables you to run virtual machines created on one host on another host with a different host OS. For example, you can create a virtual machine (VM) on Windows and then run it on Linux.

In addition, VMs can easily be imported and exported using the Open Virtualization Format (OVF), an industry standard created for this purpose. You can even import OVFs that were created with a different virtualization software. See *5.3 Importing and Exporting Virtual Machines on page 60*.

OCI Integration

You can export and import VMs to and from Oracle Cloud Infrastructure. This simplifies development of applications and deployment to the production environment. See *6.8 Exporting an Appliance to Oracle Cloud Infrastructure on page 97*.

Guest Additions

The Oracle VirtualBox *Guest Additions* are software packages that can be installed on VMs to improve their performance and to provide additional integration and communication with the host system. VMs running Guest Additions support automatic adjustment of video resolutions, *seamless windows*, *accelerated 3D graphics*, *shared folders*, *clipboard sharing*, *drag and drop*, and more.

Virtual Hardware

Oracle VirtualBox implements virtual hardware devices and drivers, and implements resource sharing with the real hardware on the host.

- **Guest multiprocessing (SMP)**. Oracle VirtualBox can present up to 32 virtual CPUs to each virtual machine, irrespective of how many CPU cores are physically present on your host.
- **USB devices**. Oracle VirtualBox implements a virtual USB controller and enables you to connect arbitrary USB devices to your virtual machines without having to install device-specific drivers on the host. USB support is not limited to certain device categories. See *5.19.1 USB Settings on page 81*.
- **Hardware compatibility**. Oracle VirtualBox virtualizes a vast array of virtual devices, among them many devices that are typically provided by other virtualization platforms. That includes IDE, SCSI, and SATA hard disk controllers, several virtual network cards and sound cards, virtual serial ports and an Input/Output Advanced Programmable Interrupt Controller (I/O APIC), which is found in many computer systems. This enables easy cloning of disk images from real machines and importing of third-party virtual machines into Oracle VirtualBox.
- **ACPI**. The Advanced Configuration and Power Interface (ACPI) is available in Oracle VirtualBox. This enables easy cloning of disk images from real machines or third-party virtual machines into Oracle VirtualBox. With its unique *ACPI power status support*, Oracle

VirtualBox can even report to ACPI-aware guest OSs the power status of the host. For mobile systems running on battery, the guest can thus enable energy saving and notify the user of the remaining power, for example in full screen modes.

- **Multiscreen resolutions**. Oracle VirtualBox VMs support screen resolutions many times that of a physical screen, allowing them to be spread over a large number of screens attached to the host system.
- **Built-in iSCSI support**. This unique feature enables you to connect a virtual machine directly to an iSCSI storage server without going through the host system. The VM accesses the iSCSI target directly without the extra overhead that is required for virtualizing hard disks in container files. See *8.10 iSCSI Servers on page 138*.
- **PXE Network boot.** The integrated virtual network cards of Oracle VirtualBox fully support remote booting using the Preboot Execution Environment (PXE).

VM Management

- **Multigeneration branched snapshots.** Oracle VirtualBox can save arbitrary snapshots of the state of the VM. You can go back in time and revert the VM to any such snapshot and start an alternative VM configuration from there, effectively creating a whole snapshot tree. This can be useful for experimenting with a computing environment, testing, or troubleshooting without the need for frequent backups and restores. See *5.7 Snapshots on page 65*. You can create and delete snapshots while the VM is running.
- **VM groups.** Oracle VirtualBox provides a groups feature that enables the user to organize and control virtual machines collectively, as well as individually. In addition to basic groups, it is also possible for any VM to be in more than one group, and for groups to be nested in a hierarchy. This means you can have groups of groups. In general, the operations that can be performed on groups are the same as those that can be applied to individual VMs: Start, Pause, Reset, Close (Save state, Send Shutdown, Power off), Discard Saved State, Show in File System, Sort.

Remote Access

The VirtualBox Remote Desktop Extension (VRDE) is a host extension package that enables high-performance remote access to any running VM. This extension supports the Remote Desktop Protocol (RDP) originally built into Windows, with special additions for full client USB support.

The VRDE does not rely on the Windows RDP server and therefore works with guest OSs other than Windows, even in text mode, and does not require application support in the VM. The VRDE is described in detail in *Remote Display (VRDP Support)*.

- Oracle VirtualBox also provides
  - **Extensible RDP authentication.** Oracle VirtualBox already supports Winlogon on Windows and PAM on Linux and Oracle Solaris for RDP authentication. In addition, it includes an easy-to-use SDK which enables you to create arbitrary interfaces for other methods of authentication. See *RDP Authentication*.
  - **USB over RDP.** Using RDP virtual channel support, Oracle VirtualBox also enables you to connect arbitrary USB devices locally to a virtual machine which is running remotely on an Oracle VirtualBox RDP server. See *Remote USB*.

Modular Design and Interfaces

Oracle VirtualBox has an extremely modular design with well-defined internal programming interfaces and a clean separation of client and server code. This makes it easy to control it from

several interfaces at once. For example, you can start a VM simply by clicking on a button in the Oracle VirtualBox graphical user interface and then control that machine from the command line, or even remotely.

The front ends available are:

- VirtualBox Manager, a graphical user interface that uses the Qt toolkit. This interface is described throughout this user guide. While this is the simplest and easiest front end to use, some of the more advanced Oracle VirtualBox features are not included.
- *15 VBoxManage on page 271*, the command-line interface for automated and detailed control of every aspect of Oracle VirtualBox.
- *VBoxHeadless, the Remote Desktop Server*. An interface that produces no visible output on the host at all, but can act as a RDP server if the VirtualBox Remote Desktop Extension (VRDE) is installed and enabled for the VM. As opposed to the graphical interfaces, the headless front end requires no graphics support. This is useful, for example, if you want to host your virtual machines on a headless Linux server that has no X Window system installed.
- *Separate Mode*. A front end that is based on VBoxHeadless, but does not require VRDE or an RDP viewer.

Oracle VirtualBox also provides a comprehensive **software development kit (SDK),** that enables integration of Oracle VirtualBox with other software systems. See *Oracle VirtualBox Programming Interfaces*.

Experimental Features

Features listed as *16.1 Experimental Features on page 469* do not qualify for Oracle support. Feedback and suggestions about these features are welcome.

1.3 Guest Operating Systems

You can run most operating systems (OSs) successfully on a virtual machine (VM) in Oracle VirtualBox.

However, to achieve near-native performance of the guest code on your machine, some optimizations that are specific to certain OSs had to be made. So while your favorite OS *may* run as a guest, Oracle provides premier support only for selected OSs and guest additions.

Other guest OSs can be used with Oracle VirtualBox, but only qualify for limited support. Therefore, resolution of customer issues for such guest OSs cannot be assured.

The virtual hardware determines the choice of guest OSs available, as does the host machine. Ensure you take all aspects of VM configuration into consideration when creating a VM.

1.3.1 Host and Guest Combinations

Table 1: Host and Guest (VM) Platform Combinations Available in VirtualBox

Summary matrix of available host platforms and the Virtual machines they run.

Host Hardware Architecture	Host OS (all 64 bit)	Guest Virtual Hardware Architecture	Guest OS
x86_64 (for example Intel or AMD)	Windows Windows Server macOS (requires Intel hardware) Linux (various distributions) Oracle Solaris	x86 and x86_64	Windows Windows Server Oracle Solaris Linux (various distributions)
Arm64	Windows 11 (Experimental Feature) macOS (requires Apple silicon hardware)	Arm64	Linux (various distributions) Windows 11

1.3.2 Guest OSs That Run on x86_64 Hosts

The following table shows the Guest OSs that run on hosts with an x86_64 processor and the tier of Oracle support offered for each. See also *1.3.3 Guest OSs That Run on Arm64 Hosts on page 26*.

Table 2: Windows (x86_64), Linux (x86_64), macOS (x86_64), Solaris (x86_64) Hosts Will Run VMs with These OSs

Guest OSs that run on x86 hosts and their levels of support available from Oracle.

Guest Operating System (all x86)	Oracle Support Available
Windows 11 (64-bit). Released versions only.	Premier
Windows 10 (32-bit and 64-bit). Released versions only.	
Windows Server 2025 (64-bit)	
Windows Server 2022 (64-bit)	
Oracle Solaris 11 (32-bit and 64-bit)	
Oracle Linux 10 (64-bit), Red Hat Enterprise Linux 10 (64-bit)	
Oracle Linux 9 (64-bit), Red Hat Enterprise Linux 9 (64-bit)	
Oracle Linux 8 (64-bit), Red Hat Enterprise Linux 8 (64-bit)	
Windows 8.1 and 8 (32-bit and 64-bit)	Limited
Windows 7 (32-bit and 64-bit)	
Windows Vista SP2 and later (32-bit and 64-bit)	
Windows XP (32-bit)	
Windows Vista (32-bit)	
Windows Server 2019 (64-bit)	
Windows Server 2016 (64-bit)	
Windows Server 2012 and 2012 R2 (64-bit)	

Guest Operating System (all x86)	Oracle Support Available
Windows Server 2008 and 2008 R2 (32-bit and 64-bit)	
Windows Server 2003 (32-bit and 64-bit)	
Oracle Solaris 10 8/11 Update 10 and later (32-bit and 64-bit)	
Oracle Linux 7 (64-bit), Red Hat Enterprise Linux 7 (64-bit)	
Oracle Linux 6 (32-bit and 64-bit), Red Hat Enterprise Linux 6 (32-bit and 64-bit)	
Oracle Linux 5 (32-bit and 64-bit), Red Hat Enterprise Linux 5 (32-bit and 64-bit)	
Ubuntu 24.10 LTS (Oracular Oriole) (64-bit)	
Ubuntu 24.04 LTS (Noble Numbat) (64-bit)	
Ubuntu 22.04 LTS (Jammy Jellyfish) (64-bit)	
Ubuntu 20.04 LTS (Focal Fossa) (64-bit)	
Ubuntu 18.04 LTS (Bionic Beaver) (64-bit)	
Ubuntu 16.04 LTS (Xenial Xerus) (32-bit and 64-bit)	
Ubuntu 14.04.5 LTS (Trusty Tahr) (32-bit and 64-bit)	
SUSE Linux Enterprise Server 15 (64-bit)	
SUSE Linux Enterprise Server 12 (64-bit)	
OS/2 Warp 4.5	

1.3.3 Guest OSs That Run on Arm64 Hosts

The following table shows the Guest OSs that run on hosts with an aarch64 processor and the tier of Oracle support offered for each. See also *1.3.2 Guest OSs That Run on x86_64 Hosts on page 25*.

Table 3: Arm64 Hosts Will Run VMs with These OSs

Guest OSs that run on Arm64 hosts and their levels of support available from Oracle.

Guest Operating System (all 64-bit Arm)	Oracle Support Available
Windows 11 (64-bit). Released versions only.	Premier (macOS hosts only)
Oracle Linux 10, Red Hat Enterprise Linux 10	
Oracle Linux 9, Red Hat Enterprise Linux 9	
Oracle Linux 8, Red Hat Enterprise Linux 8	
Oracle Linux 7, Red Hat Enterprise Linux 7	Limited
Debian 12	
Debian 11	
Ubuntu 24.10 LTS (Oracular Oriole)	
Ubuntu 24.04 LTS (Noble Numbat)	
Ubuntu 22.04 LTS (Jammy Jellyfish)	

Guest Operating System (all 64-bit Arm)	Oracle Support Available
Ubuntu 20.04 LTS (Focal Fossa)	
Ubuntu 18.04 LTS (Bionic Beaver)	
SUSE Linux Enterprise Server 15	
SUSE Linux Enterprise Server 12	

1.3.4 64-bit Guests

Note:

Be sure to enable **I/O APIC** for virtual machines that you intend to use in 64-bit mode. This is especially true for 64-bit Windows VMs. See *5.13.1 Motherboard Tab on page 72*. For 64-bit Windows guests, ensure that the VM uses the **Intel networking device** because there is no 64-bit driver support for the AMD PCNet card. See *9.2 Virtual Networking Hardware on page 144*.

If you use the **Create VM** process in VirtualBox Manager, Oracle VirtualBox automatically uses the correct settings for each selected 64-bit OS type. See *4 Creating a New Virtual Machine on page 47*.

2 Installing VirtualBox

Installation of Oracle VirtualBox varies depending on your host operating system. Choose the instructions you require for Windows, macOS, Linux, or Oracle Solaris.

You may also require an extension package. For more information see *1.1 Oracle VirtualBox Components on page 20* and *3.1 Managing Oracle VirtualBox Extensions on page 43*.

2.1 Choosing an Installation Package

Download the appropriate Oracle VirtualBox platform installation package for the host processor and operating system (OS). These are the packages available, and the platforms you can install and run them on. See also *1.3.1 Host and Guest Combinations on page 24*.

- **Windows hosts**:
  - Windows 11 with Arm processors (Experimental Feature, see *16.1 Experimental Features on page 469*)
  - Windows 11 with x86_64 processors
  - Windows 10 with x86_64 processors
  - Windows Server 2025 with x86_64 processors
  - Windows Server 2022 with x86_64 processors
- **macOS / Intel hosts**:
  - 26 (Tahoe) with Intel x86_64 processors
  - 15 (Sequoia) with Intel x86_64 processors
  - 14 (Sonoma) with Intel x86_64 processors
  - 13 (Ventura) with Intel x86_64 processors
- **macOS / Apple Silicon hosts**:
  - 26 (Tahoe) with Apple Silicon Arm processors
  - 15 (Sequoia) with Apple Silicon Arm processors
  - 14 (Sonoma) with Apple Silicon Arm processors
  - 13 (Ventura) with Apple Silicon Arm processors
- **Linux Distributions**:
  - **Oracle Linux 10 / Red Hat Enterprise Linux 10** with x86_64 processors
  - **Oracle Linux 9 / Red Hat Enterprise Linux 9** with x86_64 processors
  - **Oracle Linux 8 / Red Hat Enterprise Linux 8** with x86_64 processors
  - **Ubuntu 24.10** with x86_64 processors
  - **Ubuntu 24.04** with x86_64 processors
  - **Ubuntu 22.04** with x86_64 processors
  - **Ubuntu 20.04** with x86_64 processors
  - **Debian 12** - Debian GNU/Linux 12 (Bookworm) with x86_64 processors
  - **Debian 11** - Debian GNU/Linux 11 (Bullseye) with x86_64 processors
  - **openSUSE 15.6** with x86_64 processors
  - **Fedora 40 / 41 / 42** with x86_64 processors

    - **All distributions** with x86_64 processors - Built on EL6 and therefore not requiring recent system libraries. Not covered by Oracle Premier Support.
- **Solaris hosts** and **Solaris 11 IPS hosts**
    - Oracle Solaris 11.4

2.1.1 Intel Host CPU Requirements

Intel host CPUs must have SSE2 (Streaming SIMD Extensions 2).

2.1.2 Arm Host Limitations

The following limitations apply when using an Arm platform host:

- Using Oracle VirtualBox on an Arm processor running Windows 11 is not covered by Oracle Premier Support. See *16.1.1 Windows on Arm Hosts on page 469*.
- Virtual machines must use an Arm-based guest operating system. Running an x86-based guest operating system on an Arm host platform is not supported.
- Only VMSVGA is supported as a graphics controller.
- Unattended installation isn't available.
- The following **System** page settings aren't available for Arm guests:
    - **Motherboard tab:** Chipset, TPM
    - **Processor tab:** Extended Features such as Enable PAE/NX, Enable Nested VT-x/AMD-V

2.2 Installing on Windows Hosts

2.2.1 Prerequisites

For the various versions of Windows that are supported as host operating systems, please refer to *2.1 Choosing an Installation Package on page 29*.

In addition, Windows Installer must be present on your system. This should be the case for all supported Windows platforms.

2.2.2 Windows Installation Directory Security Requirements

The installation directory on Windows hosts must meet certain security requirements, in order to be accepted by the Windows installer.

This also applies for upgrades of Oracle VirtualBox.

For example, when installing Oracle VirtualBox into a custom location at X:\Data\MyPrograms \Oracle VirtualBox, all parent directories of this path (namely X:\Data and X:\Data\MyPrograms) must meet the following Discretionary Access Control List (DACL).

```
Users                  S-1-5-32-545:(OI)(CI)(RX)
Users                  S-1-5-32-545:(DE,WD,AD,WEA,WA)
Authenticated Users    S-1-5-11:(OI)(CI)(RX)
Authenticated Users    S-1-5-11:(DE,WD,AD,WEA,WA)
```

Directory inheritance must also be disabled for all parent directories.

You can use the icacls Windows command line tool to modify a directory to meet the security requirements. For example:

```
icacls <Directory> /reset /t /c
icacls <Directory> /inheritance:d /t /c
icacls <Directory> /grant *S-1-5-32-545:(OI)(CI)(RX)
icacls <Directory> /deny  *S-1-5-32-545:(DE,WD,AD,WEA,WA)
icacls <Directory> /grant *S-1-5-11:(OI)(CI)(RX)
icacls <Directory> /deny  *S-1-5-11:(DE,WD,AD,WEA,WA)
```

Note that these commands must be repeated for all parent directories (X:\Data and X:\Data \MyPrograms in this example).

2.2.3 Performing the Installation

The Oracle VirtualBox installation can be started in either of the following ways:

- By double-clicking on the executable file.
- By entering the following command:

  ```
  VirtualBox-<version>-<revision>-Win.exe -extract
  ```

  This will extract the installer into a temporary directory, along with the .MSI file. Run the following command to perform the installation:

  ```
  msiexec /i VirtualBox-<version>-<revision>-Win.msi
  ```

Using either way displays the installation **Welcome** dialog and enables you to choose where to install Oracle VirtualBox, and which components to install. In addition to the Oracle VirtualBox application, the following components are available:

- **USB support.** This package contains special drivers for your Windows host that Oracle VirtualBox requires to fully support USB devices inside your virtual machines.
- **Networking.** This package contains extra networking drivers for your Windows host that Oracle VirtualBox needs to support Bridged Networking. This enables your VM's virtual network cards to be accessed from other machines on your physical network.
- **Python support.** This package contains Python scripting support for the Oracle VirtualBox API, see *Oracle VirtualBox Programming Interfaces*. For this to work, an already working Windows Python installation on the system is required.

  See, for example: http://www.python.org/download/windows/.

  > **Note:**
  >
  > Python version 3 is required. Python version 2.x is no longer supported.

Depending on your Windows configuration, you may see warnings about unsigned drivers, or similar. Click **Continue** for these warnings, as otherwise Oracle VirtualBox might not function correctly after installation.

The installer will create an Oracle VirtualBox group in the Windows **Start** menu, which enables you to launch the application and access its documentation.

With standard settings, Oracle VirtualBox will be installed for all users on the local system. If this is not wanted, you must invoke the installer by first extracting as follows:

```
VirtualBox.exe -extract
```

Then, run either of the following commands on the extracted .MSI file. This will install Oracle VirtualBox only for the current user.

```
VirtualBox.exe -msiparams ALLUSERS=2
msiexec /i VirtualBox-<version>-Win.msi ALLUSERS=2
```

If you do not want to install all features of Oracle VirtualBox, you can set the optional ADDLOCAL parameter to explicitly name the features to be installed. The following features are available:

VBoxApplication	Main binaries of Oracle VirtualBox. **Note:** This feature must not be absent, since it contains the minimum set of files to have working Oracle VirtualBox installation.
VBoxUSB	USB support.
VBoxNetwork	All networking support. This includes the VBoxNetworkFlt and VBoxNetworkAdp features.
VBoxNetworkFlt	Bridged networking support.
VBoxNetworkAdp	Host-only networking support
VBoxPython	Python support

For example, to only install USB support along with the main binaries, run either of the following commands:

```
VirtualBox.exe -msiparams ADDLOCAL=VBoxApplication,VBoxUSB
msiexec /i VirtualBox-<version>-Win.msi ADDLOCAL=VBoxApplication,VBoxUSB
```

2.2.4 Uninstallation

As Oracle VirtualBox uses the standard Microsoft Windows installer, Oracle VirtualBox can be safely uninstalled at any time. Click the program entry in the **Add/Remove Programs** list in the Windows Control Panel.

2.2.5 Unattended Installation

Unattended installations can be performed using the standard MSI support.

2.2.6 Public Properties

Public properties can be specified with the MSI API, to control additional behavior and features of the Windows host installer. Use either of the following commands:

```
VirtualBox.exe -msiparams NAME=VALUE [...]
msiexec /i VirtualBox-<version>-Win.msi NAME=VALUE [...]
```

The following public properties are available.

- VBOX_INSTALLDESKTOPSHORTCUT

  Specifies whether or not an Oracle VirtualBox icon on the desktop should be created.

  Set to 1 to enable, 0 to disable. Default is 1.
- VBOX_INSTALLQUICKLAUNCHSHORTCUT

  Specifies whether or not an Oracle VirtualBox icon in the Quick Launch Bar should be created.

  Set to 1 to enable, 0 to disable. Default is 1.
- VBOX_REGISTERFILEEXTENSIONS

  Specifies whether or not the file extensions .vbox, .vbox-extpack, .ovf, .ova, .vdi, .vmdk, .vhd and .vdd should be associated with Oracle VirtualBox. Files of these types then will be opened with Oracle VirtualBox.

  Set to 1 to enable, 0 to disable. Default is 1.
- VBOX_START

  Specifies whether to start Oracle VirtualBox right after successful installation.

  Set to 1 to enable, 0 to disable. Default is 1.

2.3 Installing on macOS Hosts

2.3.1 Performing the Installation

For macOS hosts, Oracle VirtualBox ships in a dmg disk image file. Perform the following steps to install on a macOS host:

1. Double-click the dmg file, to mount the contents.
2. A window opens, prompting you to double-click the VirtualBox.pkg installer file displayed in that window.
3. This starts the installer, which enables you to select where to install Oracle VirtualBox.
4. An Oracle VirtualBox icon is added to the Applications folder in the Finder.

2.3.2 Uninstallation

To uninstall Oracle VirtualBox, open the disk image dmg file and double-click the uninstall icon shown.

2.3.3 Unattended Installation

To perform a noninteractive installation of Oracle VirtualBox you can use the command line version of the installer application.

Mount the dmg disk image file, as described in the installation procedure, or use the following command line:

```
hdiutil attach /path/to/VirtualBox-xyz.dmg
```

Open a terminal session and run the following command:

```
sudo installer -pkg /Volumes/VirtualBox/VirtualBox.pkg -target /Volumes/Macintosh\ HD
```

2.4 Installing on Linux Hosts

2.4.1 Prerequisites

For the various versions of Linux that are supported as host operating systems, see *2.1 Choosing an Installation Package on page 29*.

You may need to install the following package on your Linux system before starting the installation. Some systems will do this for you automatically when you install Oracle VirtualBox.

- Qt 6.5.3 or later.

Note:

Qt is only required if you want to run the Oracle VirtualBox graphical user interfaces. In particular, VirtualBox, the graphical VirtualBox Manager, requires Qt. If you only want to run VBoxHeadless, Qt is not required.

2.4.2 The Oracle VirtualBox Kernel Modules

In order to run other operating systems in virtual machines alongside your main operating system, Oracle VirtualBox needs to integrate very tightly with your system. To do this it installs a driver module called vboxdrv into the system kernel. The kernel is the part of the operating system which controls your processor and physical hardware. Without this kernel module, you can still use VirtualBox Manager to configure virtual machines, but they will not start.

Network drivers called vboxnetflt and vboxnetadp are also installed. They enable virtual machines to make more use of your computer's network capabilities and are needed for any virtual machine networking beyond the basic NAT mode.

Since distributing driver modules separately from the kernel is not something which Linux supports well, the Oracle VirtualBox install process creates the modules on the system where they will be used. This means that you may need to install some software packages from the distribution which are needed for the build process. Required packages may include the following:

- GNU compiler (GCC)
- GNU Make (make)
- Kernel header files

Also ensure that all system updates have been installed and that your system is running the most up-to-date kernel for the distribution.

Note:

The running kernel and the kernel header files must be updated to matching versions.

The following list includes some details of the required files for some common distributions. Start by finding the version name of your kernel, using the command uname -r in a terminal. The list assumes that you have not changed too much from the original installation, in particular that you have not installed a different kernel type.

- With Debian and Ubuntu-based distributions, you must install the correct version of the linux-headers, usually whichever of linux-headers-generic, linux-headers-amd64, linux-headers-i686 or linux-headers-i686-pae best matches the kernel version name. Also, the linux-kbuild package if it exists. Basic Ubuntu releases should have the correct packages installed by default.
- On Fedora, Red Hat, Oracle Linux and many other RPM-based systems, the kernel version sometimes has a code of letters or a word close to the end of the version name. For example "uek" for the Oracle Unbreakable Enterprise Kernel or "default" or "desktop" for the standard kernels. In this case, the package name is kernel-uek-devel or equivalent. If there is no such code, it is usually kernel-devel.
- On some SUSE and openSUSE Linux versions, you may need to install the kernel-source and kernel-syms packages.

If you suspect that something has gone wrong with module installation, check that your system is set up as described above and try running the following command, as root:

```
rcvboxdrv setup
```

2.4.2.1 Kernel Modules and UEFI Secure Boot

If you are running on a system using UEFI (Unified Extensible Firmware Interface) Secure Boot, you may need to sign the following kernel modules before you can load them:

- vboxdrv
- vboxnetadp
- vboxnetflt
- vboxpci

See your system documentation for details of the kernel module signing process.

2.4.3 Performing the Installation

Oracle VirtualBox is available in a number of package formats native to various common Linux distributions. See *2.1 Choosing an Installation Package on page 29*. In addition, there is an alternative generic installer (.run) which you can use on supported Linux distributions.

2.4.3.1 Installing Oracle VirtualBox from a Debian or Ubuntu Package

Download the appropriate package for your distribution. The following example assumes that you are installing to a 64-bit Ubuntu Xenial system. Use dpkg to install the Debian package,as follows:

```
sudo dpkg -i virtualbox-version-number_Ubuntu_xenial_amd64.deb
```

The installer will also try to build kernel modules suitable for the current running kernel. If the build process is not successful you will be shown a warning and the package will be left unconfigured. Look at /var/log/vbox-install.log to find out why the compilation failed. You may have to install the appropriate Linux kernel headers, see *2.4.2 The Oracle VirtualBox Kernel Modules on page 34*. After correcting any problems, run the following command:

```
sudo rcvboxdrv setup
```

This will start a second attempt to build the module.

If a suitable kernel module was found in the package or the module was successfully built, the installation script will attempt to load that module. If this fails, please see *Linux Kernel Module Refuses to Load* for further information.

Once Oracle VirtualBox has been successfully installed and configured, you can start it by clicking **VirtualBox** in your **Start** menu or from the command line. See *2.4.5 Starting Oracle VirtualBox on Linux on page 39*.

2.4.3.2 Using the Alternative Generic Installer (VirtualBox.run)

The alternative generic installer performs the following steps:

- Unpacks the application files to the target directory /opt/VirtualBox/, which cannot be changed.
- Builds and installs the Oracle VirtualBox kernel modules: vboxdrv, vboxnetflt, and vboxnetadp.
- Creates /sbin/rcvboxdrv, an init script to start the Oracle VirtualBox kernel module.
- Creates a new system group called vboxusers.
- Creates symbolic links in /usr/bin to a shell script /opt/VirtualBox/VBox which does some sanity checks and dispatches to the actual executables: VirtualBox, VBoxVRDP, VBoxHeadless and VBoxManage.
- Creates /etc/udev/rules.d/60-vboxdrv.rules, a description file for udev, if that is present, which makes the USB devices accessible to all users in the vboxusers group.
- Writes the installation directory to /etc/vbox/vbox.cfg.

The installer must be executed as root with either install or uninstall as the first parameter. For example:

```
sudo ./VirtualBox.run install
```

Or if you do not have the sudo command available, run the following as root instead:

```
./VirtualBox.run install
```

Add every user who needs to access USB devices from a VirtualBox guests to the group vboxusers. Either use the OS user management tools or run the following command as root:

```
sudo usermod -a -G vboxusers username
```

> **Note:**
>
> The usermod command of some older Linux distributions does not support the -a option, which adds the user to the given group without affecting membership of other groups. In this case, find out the current group memberships with the groups command and add all these groups in a comma-separated list to the command line after the -G option. For example: usermod -G *group1*,*group2*,vboxusers *username*.

2.4.3.3 Performing a Manual Installation

If you cannot use the shell script installer described in *2.4.3.2 Using the Alternative Generic Installer (VirtualBox.run) on page 36*, you can perform a manual installation. Run the installer as follows:

```
./VirtualBox.run --keep --noexec
```

This will unpack all the files needed for installation in the directory install under the current directory. The Oracle VirtualBox application files are contained in VirtualBox.tar.bz2 which you can unpack to any directory on your system. For example:

```
sudo mkdir /opt/VirtualBox
sudo tar jxf ./install/VirtualBox.tar.bz2 -C /opt/VirtualBox
```

To run the same example as root, use the following commands:

```
mkdir /opt/VirtualBox
tar jxf ./install/VirtualBox.tar.bz2 -C /opt/VirtualBox
```

The sources for Oracle VirtualBox's kernel module are provided in the src directory. To build the module, change to the directory and use the following command:

```
make
```

If everything builds correctly, run the following command to install the module to the appropriate module directory:

```
sudo make install
```

In case you do not have sudo, switch the user account to root and run the following command:

```
make install
```

The Oracle VirtualBox kernel module needs a device node to operate. The above make command will tell you how to create the device node, depending on your Linux system. The procedure is slightly different for a classical Linux setup with a /dev directory, a system with the now deprecated devfs and a modern Linux system with udev.

On certain Linux distributions, you might experience difficulties building the module. You will have to analyze the error messages from the build system to diagnose the cause of the problems. In general, make sure that the correct Linux kernel sources are used for the build process.

Note that the /dev/vboxdrv kernel module device node must be owned by root:root and must be read/writable only for the user.

Next, you install the system initialization script for the kernel module and activate the initialization script using the right method for your distribution, as follows:

```
cp /opt/VirtualBox/vboxdrv.sh /sbin/rcvboxdrv
```

This example assumes you installed Oracle VirtualBox to the /opt/VirtualBox directory.

Create a configuration file for Oracle VirtualBox, as follows:

```
mkdir /etc/vbox
echo INSTALL_DIR=/opt/VirtualBox > /etc/vbox/vbox.cfg
```

Create the following symbolic links:

```
ln -sf /opt/VirtualBox/VBox.sh /usr/bin/VirtualBox
ln -sf /opt/VirtualBox/VBox.sh /usr/bin/VBoxManage
ln -sf /opt/VirtualBox/VBox.sh /usr/bin/VBoxHeadless
```

2.4.3.4 Updating and Uninstalling Oracle VirtualBox

Before updating or uninstalling Oracle VirtualBox, you must terminate any virtual machines which are currently running and exit the Oracle VirtualBox or VBoxSVC applications. To update Oracle VirtualBox, simply run the installer of the updated version. To uninstall Oracle VirtualBox, run the installer as follows:

```
sudo ./VirtualBox.run uninstall
```

As root, you can use the following command:

```
./VirtualBox.run uninstall
```

You can uninstall the .run package as follows:

```
/opt/VirtualBox/uninstall.sh
```

To manually uninstall Oracle VirtualBox, perform the manual installation steps in reverse order.

2.4.3.5 Automatic Installation of Debian Packages

The Debian packages will request some user feedback when installed for the first time. The debconf system is used to perform this task. To prevent any user interaction during installation, default values can be defined. A file vboxconf can contain the following debconf settings:

```
virtualbox virtualbox/module-compilation-allowed boolean true
virtualbox virtualbox/delete-old-modules boolean true
```

The first line enables compilation of the vboxdrv kernel module if no module was found for the current kernel. The second line enables the package to delete any old vboxdrv kernel modules compiled by previous installations.

These default settings can be applied prior to the installation of the Oracle VirtualBox Debian package, as follows:

```
debconf-set-selections vboxconf
```

In addition there are some common configuration options that can be set prior to the installation. See *2.4.3.7 Automatic Installation Options on page 38*.

2.4.3.6 Automatic Installation of RPM Packages

The RPM format does not provide a configuration system comparable to the debconf system. See *2.4.3.7 Automatic Installation Options on page 38* for how to set some common installation options provided by Oracle VirtualBox.

2.4.3.7 Automatic Installation Options

To configure the installation process for .deb and .rpm packages, you can create a response file named /etc/default/virtualbox. The automatic generation of the udev rule can be prevented with the following setting:

```
INSTALL_NO_UDEV=1
```

The creation of the group vboxusers can be prevented as follows:

```
INSTALL_NO_GROUP=1
```

If the following line is specified, the package installer will not try to build the vboxdrv kernel module if no module fitting the current kernel was found.

```
INSTALL_NO_VBOXDRV=1
```

2.4.4 The vboxusers Group

The Linux installers create the system user group vboxusers during installation. Any system user who is going to use USB devices from Oracle VirtualBox guests must be a member of that group. A user can be made a member of the group vboxusers either by using the desktop user and group tools, or with the following command:

```
sudo usermod -a -G vboxusers username
```

2.4.5 Starting Oracle VirtualBox on Linux

The easiest way to start an Oracle VirtualBox program is by running the program of your choice (VirtualBox, VBoxManage, or VBoxHeadless) from a terminal. These are symbolic links to VBox.sh that start the required program for you.

The following detailed instructions should only be of interest if you want to execute Oracle VirtualBox without installing it first. You should start by compiling the vboxdrv kernel module and inserting it into the Linux kernel. Oracle VirtualBox consists of a service daemon, VBoxSVC, and several application programs. The daemon is automatically started if necessary. All Oracle VirtualBox applications will communicate with the daemon through UNIX local domain sockets. There can be multiple daemon instances under different user accounts and applications can only communicate with the daemon running under the user account as the application. The local domain socket resides in a subdirectory of your system's directory for temporary files called .vbox-<username>-ipc. In case of communication problems or server startup problems, you may try to remove this directory.

All Oracle VirtualBox applications (VirtualBox, VBoxManage, and VBoxHeadless) require the Oracle VirtualBox directory to be in the library path, as follows:

```
LD_LIBRARY_PATH=. ./VBoxManage showvminfo "Windows XP"
```

2.5 Installing on Oracle Solaris Hosts

For the specific versions of Oracle Solaris that are supported as host operating systems, see *2.1 Choosing an Installation Package on page 29*.

If you have a previously installed instance of Oracle VirtualBox on your Oracle Solaris host, please uninstall it first before installing a new instance. See *2.5.4 Uninstallation on page 40* for uninstall instructions.

2.5.1 Performing the Installation

Oracle VirtualBox is available as a standard Oracle Solaris package. Download the Oracle VirtualBox SunOS package, which includes the 64-bit version of Oracle VirtualBox. *The installation must be performed as root and from the global zone*. This is because the Oracle VirtualBox installer loads kernel drivers, which cannot be done from non-global zones. To verify which zone you are currently in, execute the zonename command.

To start installation, run the following commands:

```
gunzip -cd VirtualBox-version-number-SunOS.tar.gz | tar xvf -
```

The Oracle VirtualBox kernel package is integrated into the main package. Install the Oracle VirtualBox package as follows:

```
pkgadd -d VirtualBox-version-number-SunOS.pkg
```

The installer will then prompt you to enter the package you want to install. Choose **1** or **all** and proceed. Next the installer will ask you if you want to allow the postinstall script to be executed. Choose **y** and proceed, as it is essential to execute this script which installs the Oracle VirtualBox kernel module. Following this confirmation the installer will install Oracle VirtualBox and execute the postinstall setup script.

Once the postinstall script has been executed your installation is now complete. You may now safely delete the uncompressed package and autoresponse files from your system. Oracle VirtualBox is installed in /opt/VirtualBox.

Note:

If you need to use Oracle VirtualBox from non-global zones, see *2.5.6 Configuring a Non-Global Zone for Running Oracle VirtualBox on page 41*.

2.5.2 The vboxuser Group

The installer creates the system user group vboxuser during installation for Oracle Solaris hosts that support the USB features required by Oracle VirtualBox. Any system user who is going to use USB devices from Oracle VirtualBox guests must be a member of this group. A user can be made a member of this group either by using the desktop user and group tools or by running the following command as root:

```
usermod -G vboxuser username
```

Note that adding an active user to the vboxuser group will require the user to log out and then log in again. This should be done manually after successful installation of the package.

2.5.3 Starting Oracle VirtualBox on Oracle Solaris

The easiest way to start an Oracle VirtualBox program is by running the program of your choice (VirtualBox, VBoxManage, or VBoxHeadless) from a terminal. These are symbolic links to VBox.sh that start the required program for you.

Alternatively, you can directly invoke the required programs from /opt/VirtualBox. Using the links provided is easier as you do not have to enter the full path.

You can configure some elements of the VirtualBox Qt GUI, such as fonts and colours, by running VBoxQtconfig from the terminal.

2.5.4 Uninstallation

Uninstallation of Oracle VirtualBox on Oracle Solaris requires root permissions. To perform the uninstallation, start a root terminal session and run the following command:

```
pkgrm SUNWvbox
```

After confirmation, this will remove Oracle VirtualBox from your system.

2.5.5 Unattended Installation

To perform a noninteractive installation of Oracle VirtualBox there is a response file named autoresponse. The installer uses this for responses to inputs, rather than prompting the user.

Extract the tar.gz package as described in *2.5.1 Performing the Installation on page 39*. Then open a root terminal session and run the following command:

```
pkgadd -d VirtualBox-version-number-SunOS-x86 -n -a autoresponse SUNWvbox
```

To perform a noninteractive uninstallation, open a root terminal session and run the following command:

```
pkgrm -n -a /opt/VirtualBox/autoresponse SUNWvbox
```

2.5.6 Configuring a Non-Global Zone for Running Oracle VirtualBox

After installing Oracle VirtualBox in the global zone (see *2.5 Installing on Oracle Solaris Hosts on page 39* for the installation instructions) the first step required to run Oracle VirtualBox in a non-global zone is to modify the zone's configuration to be able to access the Oracle VirtualBox device nodes located in the global zone. This is done by performing the following steps as a zone administrator in the global zone.

```
global$ zonecfg -z vboxzone
```

Replace *vboxzone* with the name of the non-gloabl zone where you plan to run Oracle VirtualBox.

Use zonecfg(8) to add the device resource and the match property for each Oracle VirtualBox device node in the global zone to the non-global zone as follows:

```
zonecfg:vboxzone> add device
zonecfg:vboxzone:device> set match=/dev/vboxdrv
zonecfg:vboxzone:device> end
zonecfg:vboxzone> add device
zonecfg:vboxzone:device> set match=/dev/vboxdrvu
zonecfg:vboxzone:device> end
zonecfg:vboxzone> exit
```

On Oracle Solaris 11 if you plan to use VMs configured to use a USB device, e.g. a USB pointing device or a USB pass-through device, you should also pass through the /dev/vboxusbmon device using the steps above.

Oracle Solaris 11 does not support sparse root zones so you will need to loopback mount /opt/VirtualBox from the global zone into the non-global zone at the same path. This is done using zonecfg(8) to set the dir attribute and the special attribute for this directory. For example:

```
zonecfg:vboxzone> add fs
zonecfg:vboxzone:fs> set dir=/opt/VirtualBox
zonecfg:vboxzone:fs> set special=/opt/VirtualBox
zonecfg:vboxzone:fs> set type=lofs
zonecfg:vboxzone:fs> add options [readonly]
zonecfg:vboxzone:fs> end
zonecfg:vboxzone> exit
```

After making the above changes using zonecfg(8), reboot the zone using zoneadm(8) as follows:

```
global$ zoneadm -z vboxzone reboot
```

for the changes to take effect. You will then be able to run Oracle VirtualBox from /opt/VirtualBox within the configured non-global zone.

2.6 Starting Oracle VirtualBox

After installation, you can start Oracle VirtualBox as follows:

- **Windows hosts.** In the **Programs** menu, click the item in the **VirtualBox** group. On some Windows platforms, you can also enter VirtualBox in the search box of the **Start** menu.
- **macOS hosts.** In the Finder, double-click the **VirtualBox** item in the Applications folder. You may want to drag this item onto your Dock.

- **Linux or Oracle Solaris hosts**. Depending on your desktop environment, an Oracle VirtualBox item may have been placed in either the System or System Tools group of your **Applications** menu. Alternatively, you can enter VirtualBox in a terminal window.

When you start Oracle VirtualBox, the VirtualBox Manager interface is shown. See *3 Configuring Oracle VirtualBox on page 43*.

3 Configuring Oracle VirtualBox

Before creating, adding or importing any Virtual Machines, configure Oracle VirtualBox for your host.

- Install any extension packs you require, see *3.1.1 Install the Oracle VirtualBox Extension Pack on page 43*.

  Extension packs provide extra functionality to the Oracle VirtualBox base package. The Oracle VirtualBox Extension Pack includes VirtualBox Remote DesktopProtocol (VRDP) support, disk image encryption using AES, and cloud integration features. For more information, see *1.1 Oracle VirtualBox Components on page 20*.
- *3.2 Set Oracle VirtualBox Preferences on page 44*. These are settings that apply to Oracle VirtualBox rather than individual VMs.
- If the default NAT network is not sufficient for your needs, set up virtual networks. See *9.1 Configure Networking on page 143*.

3.1 Managing Oracle VirtualBox Extensions

Oracle VirtualBox extension packs (file extension .vbox-extpack) extend the features of Oracle VirtualBox on the host machine. For more information on the Oracle VirtualBox Extension Pack, see *1.1 Oracle VirtualBox Components on page 20*

Extension packs can be installed and managed using the **Extensions** tool in VirtualBox Manager.

Alternatively, you can use the VBoxManage command line to install and manage extension packs. See *15.22 VBoxManage extpack on page 358*.

3.1.1 Install the Oracle VirtualBox Extension Pack

1. Download the latest Oracle VirtualBox Extension Pack from *Download VirtualBox* and save it on the host machine.
2. In VirtualBox Manager, Click **Extensions**.
3. Click **Install** and select the extension package file. Follow the on-screen instructions.

   The extension pack is installed on the host and displayed in the extensions list.

Alternatively, in VBoxManage, use *15.22.2.1 extpack install on page 358* to install the extension pack.

3.1.2 Remove the Oracle VirtualBox Extension Pack

1. In VirtualBox Manager, Click **Extensions**.
2. Click Oracle VirtualBox Extension Pack, and then click **Uninstall**.

   The extension pack is uninstalled from the host.

Alternatively, in VBoxManage, use *15.22.2.2 extpack uninstall on page 358* to remove the extension pack.

3.2 Set Oracle VirtualBox Preferences

Use the **Preferences** to change settings that apply to all virtual machines.

> **Note:**
>
> Settings will differ, depending on your host OS.

1. From the **File** menu, choose **Preferences**.
2. Choose your preferred experience level. To display all preferences, set the experience level to **Expert**.

   See also *3.3 Experience Levels for VirtualBox Manager on page 44*.
3. On the **General** tab, specify the default folder or directory for VM files, and the VRDP Authentication Library.
4. On the **Input** tab, set keyboard shortcuts, both in VirtualBox Manager and in individual VMs. For example you might want to specify a different **Host key**. This is the key that toggles whether the cursor is in the focus of the VM or the Host OS windows, see *5.1.3 Capturing and Releasing Keyboard and Mouse on page 54*. The Host key is also used to trigger certain VM actions, see *5.1.4 Typing Special Characters on page 55*.
5. On the **Update** tab, select the type of software updates you want to install, and how frequently to check for updates.
6. On the **Language** tab, choose the language used for menus, labels, and text in VirtualBox Manager.
7. On the **Display** tab, specify the display properties for all VM displays.
8. On the **Proxy** tab, configure an HTTP proxy server if you need one.
9. On the **Interface** tab, select the color theme to be used by VirtualBox Manager. This can only be changed on Windows 10 or Windows 11. Other OSs use system settings.

3.3 Experience Levels for VirtualBox Manager

When you use VirtualBox Manager to configure preferences, and settings for virtual machines, you can select an *experience level* for the user interface. The following experience levels are available:

- **Basic**. Only a limited number of settings and tools are shown. Workflows are used to display settings and configuration options. This is the default setting for new installations.

  This level is suitable for a first time user of Oracle VirtualBox.
- **Expert**. All available settings and tools are shown.

  Single pages show all settings and configuration options. This is the default setting for upgrades when a user already has at least one saved VM.

  This level is suitable for an experienced user who needs more control of virtual machine settings.

Experience levels apply, and can be set, in the following places in VirtualBox Manager:

- **Home** (new installations only)
- **Preferences**

- **Settings** for a virtual machine

Wherever you set it, the preference applies throughout VirtualBox Manager.

Selecting the Experience Level

1. In the File menu, choose **Preferences**.
2. Click **Basic** or **Expert** to select the required experience level.

The number of available settings and tools changes depending on the selected experience level.

4 Creating a New Virtual Machine

To create a Virtual Machine (VM) using the GUI, follow the steps below. To use VBoxManage, see *4.4 Creating a New Virtual Machine Using VBoxManage on page 49*.

- In VirtualBox Manager window, click **Home**, then click **New** and follow the workflow.

  If you don't see the **New Virtual Machine** workflow, change the experience level to **Basic**. See *3.3 Experience Levels for VirtualBox Manager on page 44*. In **Expert** mode you see all the options on one page.

  The exact settings available depend on the architecture of the host platform.

Once created, the virtual machine is displayed in the **Machines** list in VirtualBox Manager, with the name that you specify. You can make changes later, in the **Settings** for the VM.

You must supply an operating system image, in ISO format, for the operating system you intend to install on the VM. Oracle VirtualBox does not supply the OS or any license required to use it.

4.1 Specify Name and Operating System

1. Give the virtual machine (VM) a name. The name you enter is shown in the **Machines** tool in VirtualBox Manager and is also used for the VM's files on disk. Be sure to assign each VM an informative name that describes the OS and software running on the VM. For example, Windows 10 with Visio. The name is also used to help Oracle VirtualBox suggest the appropriate OS and related field contents automatically, unless you have selected the OS Type.
2. Select the location where VMs are stored on your computer, called the **VM Folder**. Ensure that the folder location has enough free space, especially if you intend to use the snapshots feature. See also *13.1.1 The VM Folder on page 237*.
3. Select the ISO image file for the operating system you intend to install on the new VM. The image file can be used directly to install an OS on the new VM as part of an unattended installation, or it can be attached to a DVD drive on the new VM. If the image contains more than one edition or variant, select the one you want to use.
4. Oracle VirtualBox completes the **OS** and related fields if it can detect the operating system in the ISO. If it cannot detect the OS, then set these according to your OS. For example, if the **OS** is Linux, the **OS Distribution** might be Oracle Linux and the **OS Version** might be Oracle Linux 8.x (64-bit). The options available for the guest OS are also limited by the host architecture. See *1.3 Guest Operating Systems on page 24* for more information.

   The supported OSs are grouped into types. If you want to install something very unusual that is not listed, select **Other** as the **OS**.

   Depending on your selection, Oracle VirtualBox will enable or disable certain VM settings that your guest OS may require. This is particularly important for 64-bit guests (see *1.3.4 64-bit Guests on page 27*).
5. By default, Oracle VirtualBox will install the chosen OS using the ISO image provided, if the image supports unattended installation. See also *4.2 Configure Unattended Installation of Guest OS on page 48*.

   If you prefer to install the OS manually, deselect **Install OS Using Unattended Installation**. The selected ISO image is attached to the new VM and you must install the OS from there.

4.2 Configure Unattended Installation of Guest OS

If you chose Unattended Installation, Oracle VirtualBox you must supply certain configuration options to be used in the installation.

See also *4.4 Creating a New Virtual Machine Using VBoxManage on page 49* for details of how to configure unattended installation from the command line.

1. Enter the **User Name** and **Password** for a default user on the guest OS. On Windows, this will be an administrator. On Linux, the **root** user will also be created with the same password.
2. For Windows guests, enter the **Product Key** supplied with Windows.
3. Enter the **Host Name** for the VM. By default, this is the same as the VM name.
4. Enter the **Domain Name** for the VM.
5. Select **Install in Background** if you want to create the VM without a GUI.
6. Unattended Guest Additions installation is available for some guests. Select **Install Guest Additions** if you would like Oracle VirtualBox to install the Guest Additions after the OS. Specify the ISO to use, usually the default file that is part of the VirtualBox installation on the host machine.

4.3 Specify Virtual Hardware

1. Based on the OS you have chosen, Oracle VirtualBox suggests a suitable default size for **Base Memory**. This is the amount of RAM that Oracle VirtualBox should allocate to the virtual machine (VM) every time it is started. The guest OS will report this size as the VM's installed RAM.

   CAUTION:

   Choose this setting carefully. The memory you give to the VM will not be available to your host OS while the VM is running.

   Do not specify more than you can spare, whilst ensuring you allocate enough for your guest OS and applications to run properly. For example, if your host machine has 4 GB of RAM and you enter 2048 MB as the base memory for a VM, you will have 2 GB left for all the other software on your host while that VM is running.

   A guest OS may require at least 1 or 2 GB of memory to install and boot up. If you intend to run more than one VM at a time, plan accordingly. A VM will not start if it does not have enough RAM to boot.

   Always ensure that the host OS has enough RAM remaining. If insufficient RAM remains, the system might excessively swap memory to the hard disk, which will effectively bring the host system to a standstill.
2. For **Processors**, select the number of virtual processors to assign to the VM. Do not assign more than half of the total processor threads from the host machine.
3. Choose the **Disk Size** for a new, dynamically allocated, virtual hard disk image to be created in the VM folder.

   For other options when allocating virtual storage, see *8 Virtual Storage on page 125*.
4. Select **Use EFI** to boot the guest OS using Extended Firmware Interface (EFI).

4.4 Creating a New Virtual Machine Using VBoxManage

You can create a VM on the command line using VBoxManage. See also *15.15 VBoxManage createvm on page 330*.

The following example uses various VBoxManage commands to specify the VM and configure an unattended guest installation for an Oracle Linux VM on a Linux host.

It then shows the use of the VBoxManage unattended install command to install and configure the guest OS.

1. Set a variable for the name of the OS.

   ```
   # VM="ol8-autoinstall"
   ```

2. List the available guest OS types and note the exact name of the one you need. This is required in VBoxManage commands.

   ```
   # VBoxManage list ostypes
   ```

3. Create the virtual machine.

   ```
   # VBoxManage createvm --name $VM --ostype "Oracle_64" --register
   ```

   The VM has a unique UUID.

   An XML settings file is generated.

4. Create a 32768 MB virtual hard disk for the VM.

   ```
   # VBoxManage createhd --filename /VirtualBox/$VM/$VM.vdi --size 32768
   ```

5. Create storage devices for the VM.

   - Create a SATA storage controller and attach the virtual hard disk.

     ```
     # VBoxManage storagectl $VM --name "SATA Controller" --add sata --controller IntelAHCI
     # VBoxManage storageattach $VM --storagectl "SATA Controller" --port 0 --device 0 \
     --type hdd --medium /VirtualBox/$VM/$VM.vdi
     ```

   - Create an IDE storage controller for a virtual DVD drive and attach an Oracle Linux installation ISO.

     ```
     # VBoxManage storagectl $VM --name "IDE Controller" --add ide
     # VBoxManage storageattach $VM --storagectl "IDE Controller" --port 0 --device 0 \
     --type dvddrive --medium /u01/Software/OL/OracleLinux-R7-U6-Server-x86_64-dvd.iso
     ```

6. (Optional) Configure some settings for the VM.

   - Enable I/O APIC for the motherboard of the VM.

     ```
     # VBoxManage modifyvm $VM --ioapic on
     ```

   - Configure the boot device order for the VM.

     ```
     # VBoxManage modifyvm $VM --boot1 dvd --boot2 disk --boot3 none --boot4 none
     ```

   - Allocate 8192 MB of RAM and 128 MB of video RAM to the VM.

     ```
     # VBoxManage modifyvm $VM --memory 8192 --vram 128
     ```

7. Specify the Unattended Installation parameters, and then install the OS.

   - Specify an Oracle Linux ISO as the installation ISO.

     ```
     # VBoxManage unattended install $VM \
     --iso=/u01/Software/OL/OracleLinux-R7-U6-Server-x86_64-dvd.iso \
     ```

   - Specifiy a user name, full name, and password for a default user on the guest OS.

     --user=*login* --full-user-name=*name* --user-password *password* \

     Note that the specified password is also used for the root user account on the guest.

   - Specify that you want to install the VirtualBox Guest Additions on the VM.

```
--install-additions \
```

- Sets the time zone for the guest OS to Central European Time (CET).

```
--time-zone=CET
```

8. Start the virtual machine.

```
# VBoxManage startvm $VM --type headless
```

The VM starts in headless mode, which means that it does not have a GUI.

5 Working with Virtual Machines

This chapter provides detailed steps for configuring an Oracle VirtualBox virtual machine (VM). For an introduction to Oracle VirtualBox and steps to get your first virtual machine running, see *1 About Oracle VirtualBox on page 19*.

You have considerable latitude when deciding what virtual hardware to provide to the guest. Use virtual hardware to communicate with the host system or with other guests. For example, you can use virtual hardware in the following ways:

- Have Oracle VirtualBox present an ISO CD-ROM image to a guest system as if it were a physical CD-ROM.
- Provide a guest system access to the physical network through its virtual network card.
- Provide the host system, other guests, and computers on the Internet access to the guest system.

5.1 Running a Virtual Machine

To start a virtual machine (VM), you have the following options:

- Open the **Machines** list in VirtualBox Manager, and then double-click the VM's name.
- Select the VM's name in the **Machines** tool in VirtualBox Manager, and then click **Start**.
- Go to the VirtualBox VMs folder in your system user's home directory. Find the subdirectory of the machine you want to start and double-click the machine settings file. This file has a .vbox file extension.

The VM you started appears in a new window and you will see it start to boot up, or prompt you to install an operating system as required. Everything that would normally be seen on the virtual system's monitor is shown in the window.

In general, you can use the virtual machine as you would use a real computer. The following topics describe a few points to note when running a VM.

5.1.1 Starting a New VM for the First Time

When you start a VM for the first time the Unattended Installation process is started automatically, using the ISO image file specified. See *4 Creating a New Virtual Machine on page 47*.

Follow the onscreen instructions to install your OS.

The installation operation changes the boot device order to boot the virtual hard disk first and then the virtual DVD drive. If the virtual hard disk is empty prior to the automatic installation, the VM boots from the virtual DVD drive and begins the installation.

If the virtual hard disk contains a bootable OS, the installation operation exits. In this case, change the boot device order manually by pressing F12 during the BIOS splash screen.

5.1.2 Virtual Machine Status Bar

A status bar is displayed at the bottom of the virtual machine window. The status bar contains icons that enable you to view and change settings for the virtual machine, as follows:

- Highlight an icon to show details of the current settings.
- Right-click an icon to change a setting.

  Some settings, such as audio, can be changed directly by right-clicking the status bar icon. For other settings, you select from the displayed menu options.

Table 4: Virtual Machine Status Bar Icons on page 52 describes the icons on the status bar.

Table 4: Virtual Machine Status Bar Icons

Describes icons on the status bar located at the bottom of the virtual machine window

Icon	Description
	Storage (SATA) Settings for attached SATA storage devices, such as hard disk drives. See also *5.15 Storage Settings on page 76*.
	Storage (IDE) Settings for attached IDE storage devices, such as optical CD-ROM drives. See also *5.15 Storage Settings on page 76*. Right-click to show options for adding and removing IDE devices. See also *8.3 The Virtual Media Manager on page 128*.
	Audio Settings for audio output and audio input. Right-click to change a setting. The status bar icon is updated automatically to show which settings are enabled. See also *5.16 Audio Settings on page 78*.
	Network Settings for attached network adapters. Right-click to connect or disconnect a network adapter. See also *5.17 Network Settings on page 78*.
	USB Settings for attached USB devices. Right-click to select from the available USB devices on the host and to specify a USB filter. See also *5.19.1 USB Settings on page 81*.

Icon	Description
	Shared Folders Settings for shared folders. Right-click to change shared folder settings or to add a new shared folder. See also *5.20 Shared Folders on page 83*.
	Display Settings for the virtual machine display. Right-click to show options for resizing and scaling the display. See also *5.1.7 Resizing the VM's Window on page 58*.
	Recording Settings for video and audio recording. Right-click to show options to enable and disable recording, or to change recording settings. To enable recording, right-click the status bar icon and select the **Recording** option. The icon changes to a pulsing red dot to indicate that recording is in progress. To disable recording, right-click the status bar icon and deselect the **Recording** option. The icon changes back to the default image. See also *5.14.3 Recording Tab on page 76*.
	Processor Settings for the CPU used by the virtual machine. The colored bar in the icon indicates current processor activity. Red indicates high CPU usage, Green indicates low CPU usage. A green turtle icon indicates that a native hypervisor, such as Hyper-V, is running on the host. See also *5.13.2 Processor Tab on page 74*.
	Mouse Integration Settings for capturing the host mouse pointer. The icon indicates whether mouse integration is on (green arrow) or off (yellow arrow) and whether the pointer is captured (mouse icon colored) or not (mouse icon gray). Right-click to enable or disable mouse integration. See also *5.1.3 Capturing and Releasing Keyboard and Mouse on page 54*.

Icon	Description
	Host Key Settings for capturing the host keyboard. The arrow on the icon is green if the keyboard is captured, and black if not. The background is blue if the host key is not pressed, and white when it is pressed. A check icon appears when the VM is waiting for a host key combination to be typed. The current host key is displayed to the right of the icon. Right-click to show options for configuring the host key combination and other keyboard shortcuts. Right-click to insert a special key combination, such as Ctrl-Alt-Del. See also *5.1.4 Typing Special Characters on page 55*.

Configuring the Status Bar

You can configure the status bar as follows:

- To **hide** the status bar, right-click in the status bar area and deselect **Show Status Bar**.
- To **show** the status bar, select **View**, **Status Bar**, **Show Status Bar** from the virtual machine's menu bar.
- To **modify** the status bar contents, right-click in the status bar area and select **Status Bar Settings**. You can then do the following:
  - Select icons that you want to include in the status bar.
  - Deselect icons that you want to remove from the status bar.
  - Drag and drop icons to change their order in the status bar.

  Click the check mark button to save your changes to the status bar.

  See also *5.21 User Interface on page 83* for other options to change the status bar.

5.1.3 Capturing and Releasing Keyboard and Mouse

Oracle VirtualBox provides a virtual USB tablet device to new virtual machines through which mouse events are communicated to the guest OS. If you are running a modern guest OS that can handle such devices, mouse support may work out of the box without the mouse being *captured* as described below. See *5.13.1 Motherboard Tab on page 72*.

Otherwise, if the virtual machine detects only standard PS/2 mouse and keyboard devices, since the OS in the virtual machine does not know that it is not running on a real computer, it expects to have exclusive control over your keyboard and mouse. But unless you are running the VM in full screen mode, your VM needs to share keyboard and mouse with other applications and possibly other VMs on your host.

After installing a guest OS and before you install the Guest Additions, described in *7 Guest Additions on page 103*, either your VM or the rest of your computer can *own* the keyboard and the mouse. Both cannot own the keyboard and mouse at the same time. You will see a *second*

mouse pointer which is always confined to the limits of the VM window. You activate the VM by clicking inside it.

To return ownership of keyboard and mouse to your host OS, Oracle VirtualBox reserves a special key on your keyboard: the *Host key*. By default, this is the *right Ctrl key* on your keyboard. On a Mac host, the default Host key is the left Command key. You can change this default using the Preferences window. See *3.2 Set Oracle VirtualBox Preferences on page 44*. The current setting for the Host key is always displayed at the bottom right of your VM window.

Figure 1: Host Key Setting on the Virtual Machine Status Bar

This means the following:

- Your **keyboard** is owned by the VM if the VM window on your host desktop has the keyboard focus. If you have many windows open in your guest OS, the window that has the focus in your VM is used. This means that if you want to enter text within your VM, click the title bar of your VM window first.

  To release keyboard ownership, press the Host key. As explained above, this is typically the right Ctrl key.

  Note that while the VM owns the keyboard, some key sequences, such as Alt+Tab, will no longer be seen by the host, but will go to the guest instead. After you press the Host key to reenable the host keyboard, all key presses will go through the host again, so that sequences such as Alt+Tab will no longer reach the guest. For technical reasons it may not be possible for the VM to get all keyboard input even when it does own the keyboard. Examples of this are the Ctrl+Alt+Del sequence on Windows hosts or single keys grabbed by other applications on X11 hosts such as the GNOME desktop Locate Pointer feature.
- Your **mouse** is owned by the VM only after you have clicked in the VM window. The host mouse pointer will disappear, and your mouse will drive the guest's pointer instead of your normal mouse pointer.

  Note that mouse ownership is independent of that of the keyboard. Even after you have clicked on a titlebar to be able to enter text into the VM window, your mouse is not necessarily owned by the VM yet.

  To release ownership of your mouse by the VM, press the Host key.

As this behavior is inconvenient, Oracle VirtualBox provides a set of tools and device drivers for guest systems called the Oracle VirtualBox Guest Additions. These tools make VM keyboard and mouse operations much more seamless. Most importantly, the Guest Additions suppress the second "guest" mouse pointer and make your host mouse pointer work directly in the guest. See *7 Guest Additions on page 103*.

5.1.4 Typing Special Characters

Some OSes expect certain key combinations to initiate certain procedures. The key combinations that you type into a VM might target the host OS, the Oracle VirtualBox software, or the guest OS. The recipient of these keypresses depends on a number of factors, including the key combination itself.

- Host OSes reserve certain key combinations for themselves. For example, you cannot use the **Ctrl+Alt+Delete** combination to reboot the guest OS in your VM, because this key combination is reserved by the host OS. Even though both Windows and Linux OSes can intercept this key combination, the host OS is rebooted automatically.

  On Linux and Oracle Solaris hosts, which use the X Window System, the key combination **Ctrl+Alt+Backspace** normally resets the X server and restarts the entire graphical user interface. As the X server intercepts this combination, pressing it will usually restart your *host* graphical user interface and kill all running programs, including Oracle VirtualBox, in the process.

  On Linux hosts supporting virtual terminals, the key combination **Ctrl+Alt+Fx**, where Fx is one of the function keys from F1 to F12, normally enables you to switch between virtual terminals. As with **Ctrl+Alt+Delete**, these combinations are intercepted by the host OS and therefore always switch terminals on the *host*.

  If, instead, you want to send these key combinations to the *guest* OS in the virtual machine, you will need to use one of the following methods:

  - Use the items in the **Input**, **Keyboard** menu of the virtual machine window. This menu includes the settings **Insert Ctrl+Alt+Delete** and **Insert Ctrl+Alt+Backspace**. However, the latter setting affects only Linux guests or Oracle Solaris guests.

    This menu also includes an option for inserting the Host key combination.
  - Use special key combinations with the Host key, which is normally the right Control key. Oracle VirtualBox then translates the following key combinations for the VM:

    - **Host key + Del** sends **Ctrl+Alt+Del** to reboot the guest OS.
    - **Host key + Backspace** sends **Ctrl+Alt+Backspace** to restart the graphical user interface of a Linux or Oracle Solaris guest.
    - **Host key + Function key**. For example, use this key combination to simulate **Ctrl+Alt +Fx** to switch between virtual terminals in a Linux guest.
- For some other keyboard combinations such as **Alt+Tab** to switch between open windows, Oracle VirtualBox enables you to configure whether these combinations will affect the host or the guest, if a virtual machine currently has the focus. This is a global setting for all virtual machines and can be found under **File**, **Preferences**, **Input**.
- A soft keyboard can be used to input key combinations in the guest. See *5.1.5.1 Using the Soft Keyboard on page 57*.

5.1.5 Soft Keyboard

Oracle VirtualBox provides a *soft keyboard* that enables you to input keyboard characters on the guest. A soft keyboard is an on-screen keyboard that can be used as an alternative to a physical keyboard. See *5.1.5.1 Using the Soft Keyboard on page 57* for details of how to use the soft keyboard.

CAUTION:

For best results, ensure that the keyboard layout configured on the guest OS matches the keyboard layout used by the soft keyboard. Oracle VirtualBox does not do this automatically.

The soft keyboard can be used in the following scenarios:

- When the physical keyboard on the host is not the same as the keyboard layout configured on the guest. For example, if the guest is configured to use an international keyboard, but the host keyboard is US English.
- To send special key combinations to the guest. Note that some common key combinations are also available in the **Input**, **Keyboard** menu of the guest VM window. See *5.1.4 Typing Special Characters on page 55*.
- For guests in kiosk mode, where a physical keyboard is not present.
- When using nested virtualization, the soft keyboard provides a method of sending key presses to a guest.

By default, the soft keyboard includes some common international keyboard layouts. You can copy and modify these to meet your own requirements. See *5.1.5.2 Creating a Custom Keyboard Layout on page 57*.

5.1.5.1 Using the Soft Keyboard

1. Display the soft keyboard.

   In the guest VM window, select **Input**, **Keyboard**, **Soft Keyboard**.
2. Select the required keyboard layout.

   The name of the current keyboard layout is displayed in the toolbar of the soft keyboard window. This is the previous keyboard layout that was used.

   Click the **Layout List** icon in the toolbar of the soft keyboard window. The **Layout List** window is displayed.

   Select the required keyboard layout from the entries in the **Layout List** window.

   The keyboard display graphic is updated to show the available input keys.
3. Use the soft keyboard to enter keyboard characters on the guest.

   - Modifier keys such as Shift, Ctrl, and Alt are available on the soft keyboard. Click once to select the modifier key, click twice to lock the modifier key.

     The **Reset the Keyboard and Release All Keys** icon can be used to release all pressed modifier keys, both on the host and the guest.
   - To change the look of the soft keyboard, click the **Settings** icon in the toolbar. You can change colors used in the keyboard graphic, and can hide or show sections of the keyboard, such as the NumPad or multimedia keys.

5.1.5.2 Creating a Custom Keyboard Layout

You can use one of the supplied default keyboard layouts as the starting point to create a custom keyboard layout.

Note:

To permanently save a custom keyboard layout, you must save it to a file. Otherwise, any changes you make are discarded when you close down the **Soft Keyboard** window.

Custom keyboard layouts that you save are stored as an XML file on the host, in the `keyboardLayouts` folder in the global configuration data directory. For example, in `$HOME/.config/VirtualBox/keyboardLayouts` on a Linux host.

1. Display the **Layout List**.

   Click the **Layout List** icon in the toolbar of the soft keyboard window.
2. Make a copy of an existing keyboard layout.

   Highlight the required layout and click the **Copy the Selected Layout** icon.

   A new layout entry with a name suffix of -Copy is created.
3. Edit the new keyboard layout.

   Highlight the new layout in the **Layout List** and click the **Edit the Selected Layout** icon.

   Enter a new name for the layout.

   Edit keys in the new layout. Click the key that you want to edit and enter new key captions in the **Captions** fields.

   The keyboard graphic is updated with the new captions.
4. (Optional) Save the layout to a file. This means that your custom keyboard layout will be available for future use.

   Highlight the new layout in the **Layout List** and click the **Save the Selected Layout into File** icon.

   Any custom layouts that you create can later be removed from the Layout List, by highlighting and clicking the **Delete the Selected Layout** icon.

5.1.6 Changing Removable Media

While a virtual machine is running, you can change removable media in the **Devices** menu of the VM's window. Here you can select in detail what Oracle VirtualBox presents to your VM as a CD, DVD, or floppy drive.

The settings are the same as those available for the VM in the **Settings** window of VirtualBox Manager. But as the **Settings** window is disabled while the VM is in the Running or Saved state, the **Devices** menu saves you from having to shut down and restart the VM every time you want to change media.

Using the **Devices** menu, you can attach the host drive to the guest or select a floppy or DVD image, as described in *5.15 Storage Settings on page 76*.

The **Devices** menu also includes an option for creating a virtual ISO (VISO) from selected files on the host.

5.1.7 Resizing the VM's Window

You can resize the VM's window while that VM is running. When you do, the window is scaled as follows:

- If you have **scaled mode** enabled, then the virtual machine's screen will be scaled to the size of the window. This can be useful if you have many machines running and want to have a look at one of them while it is running in the background. Alternatively, it might be useful to enlarge a window if the VM's output screen is very small, for example because you are running an old OS in it.

  To enable scaled mode, press **Host key + C**, or select **Scaled Mode** from the **View** menu in the VM window. To leave scaled mode, press **Host key + C** again.

The aspect ratio of the guest screen is preserved when resizing the window. To ignore the aspect ratio, press **Shift** during the resize operation.

- If you have the Guest Additions installed and they support automatic **resizing**, the Guest Additions will automatically adjust the screen resolution of the guest OS. For example, if you are running a Windows guest with a resolution of 1024x768 pixels and you then resize the VM window to make it 100 pixels wider, the Guest Additions will change the Windows display resolution to 1124x768.

  See *7 Guest Additions on page 103*.
- Otherwise, if the window is bigger than the VM's screen, the screen will be centered. If it is smaller, then scroll bars will be added to the machine window.

5.1.8 Pausing a VM

Pausing a VM suspends all the processes running on the VM.

To pause a VM:

1. Open the **Machines** tool in VirtualBox Manager, and select the running VM you want to pause.
2. Right-click the VM name, or open the **Machine** menu, and choose **Pause**.

To start a paused VM running again:

1. Open the **Machines** tool in VirtualBox Manager, and select the paused VM.
2. Right-click the VM name, or open the **Machine** menu, and choose **Pause**.

   The VM starts running again.

5.1.9 Resetting a VM

Resetting a VM is the equivalent of choosing the reset or restart option in the OS. It does not reset to factory settings or other known state, it restarts the guest OS.

To reset a VM

1. Open the **Machines** tool in VirtualBox Manager, and select the running VM you want to reset.
2. Right-click the VM name, or open the **Machine** menu, and choose **Reset**.
3. Click **Reset** to confirm. Note that you will lose unsaved data.

5.1.10 Closing or Saving a VM

When you click the **Close** button of your virtual machine window, at the top right of the window, just like you would close any other window on your system, Oracle VirtualBox asks you whether you want to save or power off the VM. As a shortcut, you can also press **Host key + Q**.

The difference between the three options is important. They mean the following:

- **Save State** With this option, Oracle VirtualBox *freezes* the virtual machine by completely saving its state to your local disk.

  When you start the VM again later, you will find that the VM continues exactly where it was left off. All your programs will still be open, and your computer resumes operation. Saving the state of a virtual machine is thus in some ways similar to suspending a laptop by closing its lid.

- **Shut Down** This will send an ACPI shutdown signal to the virtual machine, which has the same effect as if you had pressed the power button on a real computer. This should trigger a proper shutdown mechanism from within the VM. State is not saved. Save any open applications before choosing this option.
- **Power Off** With this option, Oracle VirtualBox also stops running the virtual machine, but *immediately* without shutdown procedures or saving its state.

  CAUTION:

  This is equivalent to pulling the power plug on a real computer without shutting it down properly. If you start the machine again after powering it off, your OS will have to reboot completely and may begin a lengthy check of its virtual system disks. As a result, this should not normally be done, since it can potentially cause data loss or an inconsistent state of the guest system on disk.

  As an exception, if your virtual machine has any snapshots, see *5.7 Snapshots on page 65*, you can use this option to quickly **restore the current snapshot** of the virtual machine. In that case, powering off the machine will discard the current state and any changes made since the previous snapshot was taken will be lost.

The **Discard** button discards a virtual machine's saved state. This has the same effect as powering it off, and the same warnings apply.

5.2 Adding Virtual Machines

- If you want to create a completely new VM, click **New** and follow the steps in *4 Creating a New Virtual Machine on page 47*.
- If you already have a VM saved on your machine, you can add it to the machine list by clicking **Open**.
- If you have a VM on a different machine, you can import it by clicking **Import**. See *5.3.2 Importing an Appliance in OVF Format on page 61*.
- If you want to view an OCI instance from within VirtualBox Manager, see *6.7.3 Adding a Cloud VM on page 94*.

5.3 Importing and Exporting Virtual Machines

Oracle VirtualBox can import and export virtual machines in the following formats:

- **Open Virtualization Format (OVF).** This is the industry-standard format. See *5.3.1 About the OVF Format on page 60*.
- **Cloud service formats.** Export to and import from cloud services such as Oracle Cloud Infrastructure is supported. See *6 Integrating with Oracle Cloud Infrastructure on page 89*.

5.3.1 About the OVF Format

OVF is a cross-platform standard supported by many virtualization products which enables the creation of ready-made virtual machines that can then be imported into a hypervisor such as Oracle VirtualBox. Oracle VirtualBox makes OVF import and export easy to do, using VirtualBox Manager or the command-line interface.

Using OVF enables packaging of *virtual appliances*. These are disk images, together with configuration settings that can be distributed easily. This way one can offer complete ready-to-use software packages, including OSes with applications, that need no configuration or installation except for importing into Oracle VirtualBox.

Note:

The OVF standard is complex, and support in Oracle VirtualBox is an ongoing process. No guarantee is made that Oracle VirtualBox supports all appliances created by other virtualization software. In particular, the following limitations exist:

- OVF localization, with multiple languages in a single OVF file, is not yet supported.
- Some OVF sections like StartupSection, DeploymentOptionSection, and InstallSection are ignored.
- OVF environment documents, including their property sections are not yet supported.
- Remote files using HTTP or other mechanisms are not yet supported.

Appliances in OVF format can appear in the following variants:

- They can come in several files, as one or several disk images, typically in the widely-used VMDK format. See *8.2 Disk Image Files (VDI, VMDK, VHD, HDD) on page 128*. They also include a textual description file in an XML dialect with an .ovf extension. These files must then reside in the same directory for Oracle VirtualBox to be able to import them.
- Alternatively, the above files can be packed together into a single archive file, typically with an .ova extension. Such archive files use a variant of the TAR archive format and can therefore be unpacked outside of Oracle VirtualBox with any utility that can unpack standard TAR files.

Note:

OVF cannot describe snapshots that were taken for a virtual machine. As a result, when you export a virtual machine that has snapshots, only the current state of the machine will be exported. The disk images in the export will have a *flattened* state identical to the current state of the virtual machine.

5.3.2 Importing an Appliance in OVF Format

The following steps show how to import one or more VMs from OVF format.

1. In VirtualBox Manager, click **Home**, and then click **Import**. Choose the file you want to import.

   Alternatively, double-click the OVF or OVA file in your file manager. Oracle VirtualBox creates file type associations automatically for any OVF and OVA files on your host OS.
2. In **Appliance Settings**, check the VMs described in the OVF or OVA file and change any of the VM settings you need to.
3. By default, membership of VM groups is preserved on import for VMs that were initially exported from Oracle VirtualBox. You can change this behavior by using the **Primary Group** setting for the VM.

   The following global settings apply to all of the VMs that you import:

   - **Base Folder:** Specifies the directory on the host in which to store the imported VMs.

If an appliance has multiple VMs, you can specify a different directory for each VM by editing the **Base Folder** setting for the VM.

- **MAC Address Policy:** Reinitializes the MAC addresses of network cards in your VMs prior to import, by default. You can override the default behavior and preserve the MAC addresses on import.
- **Import Hard Drives as VDI:** Imports hard drives in the VDI format rather than in the default VMDK format.

4. Click **Finish** to import the appliance.

   Oracle VirtualBox copies the disk images and creates local VMs with the settings described on the **Appliance Settings** page. The imported VMs are shown in the list of VMs in VirtualBox Manager.

   Because disk images are large, the VMDK images that are included with virtual appliances are shipped in a compressed format that cannot be used directly by VMs. So, the images are first unpacked and copied, which might take several minutes.

You can use the VBoxManage import command to import an appliance. See *15.28 VBoxManage import on page 380*.

5.3.3 Exporting an Appliance in OVF Format

The following steps show how to export one or more VMs to OVF format.

1. Select **File**, **Export Appliance**.

   On the initial **Virtual machines** page, you can combine several VMs into an OVF appliance.

   Select one or more VMs to export, and click **Next**.
2. The **Format Settings** page enables you to configure the following settings:

   - **Format:** Selects the **Open Virtualization Format** value for the output files.

     The **Oracle Cloud Infrastructure** value exports the appliance to Oracle Cloud Infrastructure. See *6.8 Exporting an Appliance to Oracle Cloud Infrastructure on page 97*.
   - **File:** Selects the location in which to store the exported files.
   - **MAC Address Policy:** Specifies whether to retain or reassign network card MAC addresses on export.
   - **Write Manifest File:** Enables you to include a manifest file in the exported archive file.
   - **Include ISO Image Files:** Enables you to include ISO image files in the exported archive file.
3. Click **Next** to show the **Appliance Settings** page.

   You can edit settings for the virtual appliance. For example, you can change the name of the virtual appliance or add product information, such as vendor details or license text.

   Double-click the appropriate field to change its value.
4. Click **Finish** to begin the export process. Note that this operation might take several minutes.

You can use the VBoxManage export command to export an appliance. See *15.21 VBoxManage export on page 354*.

5.4 Removing and Moving Virtual Machines

You can remove a VM from Oracle VirtualBox or move the VM and its associated files, such as disk images, to another location on the host.

- **Removing a VM.** To remove a VM, click **Machines** in VirtualBox Manager. Right-click the VM in the machine list and choose **Remove**.

  The confirmation dialog enables you to specify whether to only remove the VM from the list of machines or to remove the files associated with the VM.

  Note that the **Remove** menu item is disabled while a VM is running.
- **Moving a VM.** To move a VM to a new location on the host, click **Machines** in VirtualBox Manager. Right-click the VM in the machine list and choose **Move**.

  Specify a new location for the VM.

  When you move a VM, Oracle VirtualBox configuration files are updated automatically to use the new location on the host.

  Note that the **Move** menu item is disabled while a VM is running.

  You can also use the VBoxManage movevm command to move a VM. See *15.36 VBoxManage movevm on page 426*.

For information about removing or moving a disk image file from Oracle VirtualBox, see *8.3 The Virtual Media Manager on page 128*.

5.5 Cloning a Virtual Machine

You can create a full copy or a linked copy of an existing VM. This copy is called a *clone*. You might use a cloned VM to experiment with a VM configuration, to test different guest OS levels, or to back up a VM.

To clone a VM:

1. In VirtualBox Manager, click **Machines**. Ensure the VM you want to clone is not running.
2. Right-click the VM name in the **Machines** list, and choose **Clone...**.
3. Enter the following details for the clone.
   - **Name:** A name for the cloned machine.
   - **Path:** Choose a location for the cloned virtual machine, otherwise Oracle VirtualBox uses the default machines folder.
   - **MAC Address Policy:** Specifies whether to retain network card MAC addresses when cloning the VM.

     The **Generate New MAC Addresses For All Network Adapters** value assigns a new MAC address to each network card during cloning. This is the default setting. This is the best option when both the source VM and the cloned VM must operate on the same network. Other values enable you to retain the existing MAC addresses in the cloned VM.
   - **Keep Disk Names:** Retains the disk image names when cloning the VM.
   - **Keep Hardware UUIDs:** Retains the hardware universally unique identifiers (UUIDs) when cloning the VM.
4. Click **Next**. The **Clone Type** page is displayed.

5. The **Clone Type** option specifies whether to create a clone that is linked to the source VM or to create a fully independent clone:
   - **Full Clone:** Copies all dependent disk images to the new VM folder. A full clone can operate fully without the source VM.
   - **Linked Clone:** Creates new differencing disk images based on the source VM disk images. If you select the current state of the source VM as the clone point, Oracle VirtualBox creates a new snapshot.
6. Click **Next**. If your VM has snapshots and you chose Full Clone, use the **Snapshots** page to select the parts of the snapshot tree to clone with the VM.
   - **Current Machine State:** Clones the current state of the VM. Snapshots are not included.
   - **Everything:** Clones the current machine state and all its snapshots.
7. Click **Finish** to start the clone operation.

The duration of the clone operation depends on the size and number of attached disk images. In addition, the clone operation saves all the differencing disk images of a snapshot.

You can also use the VBoxManage clonevm command to clone a VM. See *15.8 VBoxManage clonevm on page 294*.

5.6 Managing VMs

As you add, import or create VMs they will appear in the **Machines** list.

To change the hardware configuration of a VM. See *5.6.1 Configure the Settings for a VM on page 64*

To use VM Groups, see *5.6.2 Using VM Groups on page 65*.

Check the **Notification Center** for tasks in progress and error messages. Click **Open notification center** to see the list of notifications. Errors are indicated by a warning triangle.

5.6.1 Configure the Settings for a VM

You may need to change the configuration of a Virtual Machine (VM) after it has been created. For example, you may want to add more memory.

Be careful when changing VM settings. It is possible to change all VM settings after installing a guest OS, but certain changes might prevent a guest OS from functioning correctly if done after installation.

To change the settings for a VM:

1. Select the VM in the **Machines** list.
2. Ensure the VM is Powered off, not Running or Saved. You can't change fundamental characteristics of the VM if it is running.
3. Click **Settings** to see the current configuration for the VM, and change the parameters as required.

The parameters are described in detail in *5.11 Virtual Machine Settings on page 70*.

Even more parameters are available when using the VBoxManage command line interface. See *15 VBoxManage on page 271*.

5.6.2 Using VM Groups

Create VM groups if you want to manage several VMs together, and perform functions on them collectively, as well as individually.

- Create a group using VirtualBox Manager. Do one of the following:
  - Drag a VM on top of another VM.
  - Select multiple VMs and choose **Move to Group**, **New Group** from the right-click menu.
- A default name is assigned to new groups, following the format **New Group <Number>**. To rename the new group, right-click on the group's name and choose **Rename Group**. Type the new name, and then press Enter.
- To remove a VM from a group, right-click the VM and choose **Move to Group**, **No Group**.
- Create and manage a group using the command line. Do one of the following:
  - Create a group and assign a VM. For example:

    ```
    VBoxManage modifyvm "vm01" --groups "/TestGroup"
    ```

    This command creates a group TestGroup and attaches the VM vm01 to that group.
  - Detach a VM from the group, and delete the group if empty. For example:

    ```
    VBoxManage modifyvm "vm01" --groups ""
    ```

    This command detaches all groups from the VM vm01 and deletes the empty group.
- Create multiple groups. For example:

  ```
  VBoxManage modifyvm "vm01" --groups "/TestGroup,/TestGroup2"
  ```

  This command creates the groups TestGroup and TestGroup2, if they do not exist, and attaches the VM vm01 to both of them.
- Create nested groups, having a group hierarchy. For example:

  ```
  VBoxManage modifyvm "vm01" --groups "/TestGroup/TestGroup2"
  ```

  This command attaches the VM vm01 to the subgroup TestGroup2 of the TestGroup group.
- Use VirtualBox Manager menu options to control and manage all the VMs in a group. For example: **Start**, **Pause**, **Reset**, **Close** (save state, send shutdown signal, poweroff), **Discard Saved State**, **Show in Explorer**, **Sort**.

5.7 Snapshots

With snapshots, you can save a particular state of a virtual machine for later use. At any later time, you can revert to that state, even though you may have changed the VM considerably since then. A snapshot of a virtual machine is thus similar to a machine in Saved state, but there can be many of them, and these saved states are preserved.

To see the snapshots of a virtual machine, click the VM name in the **Machines** list in VirtualBox Manager, and then click **Snapshots**.

If you select multiple VMs in the machine list, all snapshots are listed for each VM.

Until you take a snapshot of the virtual machine, the list of snapshots will be empty, except for the **Current State** item. This item represents the current point in the lifetime of the virtual machine.

The **Snapshots** toolbar includes the following snapshot operations:

- **Take.** Takes a snapshot of the selected VM. See *5.7.1 Taking, Restoring, and Deleting Snapshots on page 66*.
- **Delete.** Removes a snapshot from the list of snapshots. See *5.7.1 Taking, Restoring, and Deleting Snapshots on page 66*.
- **Restore.** Restores the VM state to be the same as the selected snapshot. See *5.7.1 Taking, Restoring, and Deleting Snapshots on page 66*.
- **Properties.** Displays the properties for the selected snapshot. The **Attributes** tab is used to specify a Name and Description for the snapshot. The **Information** tab shows VM settings for the snapshot.
- **Clone.** Displays the **Clone Virtual Machine** workflow. This enables you to create a clone of the VM, based on the selected snapshot.
- **Settings.** Available for the Current State snapshot only. Displays the **Settings** window for the VM, enabling you to make configuration changes.
- **Discard.** For a running VM, discards the saved state for the VM and closes it down.
- **Start.** Start the VM. This operation is available for the **Current State** item.

5.7.1 Taking, Restoring, and Deleting Snapshots

There are three operations related to snapshots, as follows:

1. **Take a snapshot.** This makes a copy of the machine's current state, to which you can go back at any given time later.

   - If your VM is running:

     In the VM window, select **Take Snapshot** from the **Machine** menu.

     The VM is paused while the snapshot is being created. After snapshot creation, the VM continues to run as normal.
   - In VirtualBox Manager, if your VM is in either the Saved or the Powered Off state, as displayed next to the VM name in the **Machines** list:

     Click **Snapshots** and do one of the following:

     - Click **Take** in the Snapshots toolbar.
     - Right-click the **Current State** item in the snapshots list and select **Take**.

   A dialog is displayed, prompting you for a snapshot name. This name is purely for reference purposes, to help you remember the state of the snapshot. For example, a useful name would be *Fresh installation from scratch, no Guest Additions*, or *Service Pack 3 just installed*. You can also add a longer text description in the **Snapshot Description** field.

   Your new snapshot will then appear in the snapshots list. Underneath your new snapshot, you will see an item called **Current State**, signifying that the current state of your VM is a variation based on the snapshot you took earlier. If you later take another snapshot, you will see that they are displayed in sequence, and that each subsequent snapshot is derived from an earlier one.

   Oracle VirtualBox imposes no limits on the number of snapshots you can take. The only practical limitation is disk space on your host. Each snapshot stores the state of the virtual machine and thus occupies some disk space. See *5.7.2 Snapshot Contents on page 67* for details on what is stored in a snapshot.
2. **Restore a snapshot.** In the Snapshots tab, select the snapshot you have taken and click **Restore** in the toolbar. By restoring a snapshot, you go back or forward in time. The current

state of the machine is lost, and the machine is restored to the exact state it was in when the snapshot was taken.

> **Note:**
>
> Restoring a snapshot will affect the virtual hard drives that are connected to your VM, as the entire state of the virtual hard drive will be reverted as well. This means also that all files that have been created since the snapshot and all other file changes *will be lost*. In order to prevent such data loss while still making use of the snapshot feature, it is possible to add a second hard drive in *write-through* mode using the VBoxManage interface and use it to store your data. As write-through hard drives are *not* included in snapshots, they remain unaltered when a machine is reverted. See *8.4 Special Image Write Modes on page 132*.

To avoid losing the current state when restoring a snapshot, you can create a new snapshot before the restore operation.

By restoring an earlier snapshot and taking more snapshots from there, it is even possible to create a kind of alternate reality and to switch between these different histories of the virtual machine. This can result in a whole tree of virtual machine snapshots.

3. **Delete a snapshot.** This does not affect the state of the virtual machine, but only releases the files on disk that Oracle VirtualBox used to store the snapshot data, thus freeing disk space. To delete a snapshot, select the snapshot name in the **Snapshots** tab and click **Delete** in the toolbar. Snapshots can be deleted even while a machine is running.

   > **Note:**
   >
   > Whereas taking and restoring snapshots are fairly quick operations, deleting a snapshot can take a considerable amount of time since large amounts of data may need to be copied between several disk image files. Temporary disk files may also need large amounts of disk space while the operation is in progress.

   There are some situations that cannot be handled while a VM is running, and you will get an appropriate message that you need to perform this snapshot deletion when the VM is shut down.

5.7.2 Snapshot Contents

Think of a snapshot as a point in time that you have preserved. More formally, a snapshot consists of the following:

- The snapshot contains a complete copy of the VM settings, including the hardware configuration, so that when you restore a snapshot, the VM settings are restored as well. For example, if you changed the hard disk configuration or the VM's system settings, that change is undone when you restore the snapshot.

  The copy of the settings is stored in the machine configuration, an XML text file, and thus occupies very little space.
- The complete state of all the virtual disks attached to the machine is preserved. Going back to a snapshot means that all changes that had been made to the machine's disks, file by file and bit by bit, will be undone. Files that were since created will disappear, files that were deleted will be restored, changes to files will be reverted.

Strictly speaking, this is only true for virtual hard disks in "normal" mode. You can configure disks to behave differently with snapshots, see *8.4 Special Image Write Modes on page 132*. In technical terms, it is not the virtual disk itself that is restored when a snapshot is restored. Instead, when a snapshot is taken, Oracle VirtualBox creates differencing images which contain only the changes since the snapshot were taken. When the snapshot is restored, Oracle VirtualBox throws away that differencing image, thus going back to the previous state. This is both faster and uses less disk space. For the details, which can be complex, see *8.5 Differencing Images on page 134*.

Creating the differencing image as such does not occupy much space on the host disk initially, since the differencing image will initially be empty and grow dynamically later with each write operation to the disk. The longer you use the machine after having created the snapshot, however, the more the differencing image will grow in size.

- If you took a snapshot while the machine was running, the memory state of the machine is also saved in the snapshot. This is in the same way that memory can be saved when you close a VM window. When you restore such a snapshot, execution resumes at exactly the point when the snapshot was taken.

  The memory state file can be as large as the memory size of the VM and will therefore occupy considerable disk space.

5.8 Emulated Hardware

Oracle VirtualBox virtualizes nearly all of the host's hardware. Depending on a VM's configuration, the guest will see the following virtual hardware:

- **Input devices.** Oracle VirtualBox can emulate a standard PS/2 keyboard and mouse. These devices are supported by most guest OSes.

  In addition, Oracle VirtualBox can provide virtual USB input devices to avoid having to capture mouse and keyboard, as described in *5.1.3 Capturing and Releasing Keyboard and Mouse on page 54*.
- **Graphics.** The default Oracle VirtualBox graphics device for Windows guests is an SVGA device. For Linux guests, the default graphics device emulates a VMware SVGA graphics device. See *5.14.1 Screen Tab on page 75*.

  For legacy guest OSes, a VGA-compatible graphics device is available.
- **Storage.** Oracle VirtualBox emulates the most common types of hard disk controllers. See *8.1 Hard Disk Controllers on page 125*. Whereas supporting only one of these controllers would be enough for Oracle VirtualBox by itself, this multitude of storage adapters is required for compatibility with other hypervisors. Windows is very selective about its boot devices, and migrating VMs between hypervisors is very difficult or impossible if the storage controllers are different.
- **Networking.** See *9.2 Virtual Networking Hardware on page 144*.
- **USB.** Oracle VirtualBox emulates the most common USB host controllers. See *5.19 USB Support on page 81*.

  The emulated USB controllers do not communicate directly with devices on the host. Instead they communicate with a virtual USB layer that abstracts the USB protocol and enables the use of remote USB devices.
- **Audio.** See *5.16 Audio Settings on page 78*.

5.9 Paravirtualization Providers

Oracle VirtualBox enables the exposure of a paravirtualization interface, to facilitate accurate and efficient execution of software within a virtual machine. These interfaces require the guest operating system to recognize their presence and make use of them in order to leverage the benefits of communicating with the Oracle VirtualBox hypervisor.

Most modern, mainstream guest operating systems, including Windows and Linux, ship with support for one or more paravirtualization interfaces. Hence, there is typically no need to install additional software in the guest to take advantage of this feature.

Exposing a paravirtualization provider to the guest operating system does not rely on the choice of host platforms. For example, the *Hyper-V* paravirtualization provider can be used for VMs to run on any host platform supported by Oracle VirtualBox and not just Windows.

Oracle VirtualBox provides the following interfaces:

- **Minimal**: Announces the presence of a virtualized environment. Additionally, reports the TSC and APIC frequency to the guest operating system. This provider is mandatory for running any Mac OS X guests.
- **KVM**: Presents a Linux KVM hypervisor interface which is recognized by Linux kernels version 2.6.25 or later. Oracle VirtualBox's implementation currently supports paravirtualized clocks and SMP spinlocks. This provider is recommended for Linux guests.
- **Hyper-V**: Presents a Microsoft Hyper-V hypervisor interface which is recognized by Windows 7 and newer operating systems. Oracle VirtualBox's implementation currently supports paravirtualized clocks, APIC frequency reporting, guest debugging, guest crash reporting and relaxed timer checks. This provider is recommended for Windows guests.

5.10 Nested Paging and VPIDs

In addition to normal hardware virtualization, your processor may also support the following additional sophisticated techniques:

- Nested paging implements some memory management in hardware, which can greatly accelerate hardware virtualization since these tasks no longer need to be performed by the virtualization software.

  With nested paging, the hardware provides another level of indirection when translating linear to physical addresses. Page tables function as before, but linear addresses are now translated to "guest physical" addresses first and not physical addresses directly. A new set of paging registers now exists under the traditional paging mechanism and translates from guest physical addresses to host physical addresses, which are used to access memory.

  Nested paging eliminates the overhead caused by VM exits and page table accesses. In essence, with nested page tables the guest can handle paging without intervention from the hypervisor. Nested paging thus significantly improves virtualization performance.

  On AMD processors, nested paging has been available starting with the Barcelona (K10) architecture. They now call it rapid virtualization indexing (RVI). Intel added support for nested paging, which they call extended page tables (EPT), with their Core i7 (Nehalem) processors.

If nested paging is enabled, the Oracle VirtualBox hypervisor can also use *large pages* to reduce TLB usage and overhead. This can yield a performance improvement of up to 5%. To enable this feature for a VM, you use the VBoxManage modifyvm --large-pages command. See *15.35 VBoxManage modifyvm on page 402*.

If you have an Intel CPU with EPT, please consult *14.4.1 CVE-2018-3646 on page 267* for security concerns regarding EPT.

- On Intel CPUs, a hardware feature called Virtual Processor Identifiers (VPIDs) can greatly accelerate context switching by reducing the need for expensive flushing of the processor's Translation Lookaside Buffers (TLBs).

  To enable these features for a VM, you use the VBoxManage modifyvm --vtx-vpid and VBoxManage modifyvm --large-pages commands. See *15.35 VBoxManage modifyvm on page 402*.

5.11 Virtual Machine Settings

Settings for a virtual machine are configured using the **Settings** window.

To display the **Settings** window, do either of the following:

- In the **Machines** list, right-click the virtual machine name, and click **Settings...**.
- In the **Machines** list, click the virtual machine name, and then click **Settings** on the toolbar.

> **Note:**
>
> The available settings depend on the selected experience level. To display all available settings, ensure the experience level is set to **Expert**.
>
> See *3.3 Experience Levels for VirtualBox Manager on page 44*.

5.12 General Settings

In the **Settings** window, under **General**, you can configure the most fundamental aspects of the virtual machine such as memory and essential hardware. The following tabs are available.

5.12.1 Identity Tab

On the **Identity** tab of the **General** settings category, you can find these settings:

- **VM Name**: The name of the the VM, as shown in the list of VMs in the main VirtualBox Manager window. Using this name, Oracle VirtualBox also saves the VM's configuration files. If you change the name, Oracle VirtualBox renames these files as well. As a result, you can only use characters which are allowed for file names on your host OS.

  Note that internally, Oracle VirtualBox uses unique identifiers (UUIDs) to identify virtual machines. You can display these using the VBoxManage commands.
- **OS**: The type of guest OS for the VM. Additionally, set the **OS Distribution** or **OS Edition**, and **OS Version**. For example, if the **OS** is Linux, the **OS Distribution** might be Oracle Linux and the **OS Version** might be Oracle Linux 8.x (64-bit).

These are the same settings that are specified in the **New Virtual Machine** workflow. See *4 Creating a New Virtual Machine on page 47*.

Whereas the default settings of a newly created VM depend on the selected OS, changing the OS later has no effect on VM settings.

5.12.2 Features Tab

The following settings are available in the **Features** tab:

- **Snapshot Folder**: By default, Oracle VirtualBox saves snapshot data together with your other Oracle VirtualBox configuration data. See *Where Oracle VirtualBox Stores its Files*. With this setting, you can specify any other folder for each VM.
- **Shared Clipboard**: You can select here whether the clipboard of the guest OS should be shared with that of your host. If you select **Bidirectional**, then Oracle VirtualBox will always make sure that both clipboards contain the same data. If you select **Host to Guest** or **Guest to Host**, then Oracle VirtualBox will only ever copy clipboard data in one direction.

  Clipboard sharing requires the Oracle VirtualBox *7 Guest Additions on page 103*.

  For security reasons, the shared clipboard is disabled by default. This setting can be changed at any time using the **Shared Clipboard** menu item in the **Devices** menu of the virtual machine.
- **Drag and Drop**: You can select multiple drag and drop modes for a VM to enable or restrict access in either direction.

  For drag and drop to work, the Guest Additions need to be installed on the guest.

  Note:

  Drag and drop is disabled by default. This setting can be changed at any time using the **Drag and Drop** menu item in the **Devices** menu of the virtual machine.

  See *7.5 Drag and Drop on page 115*.

5.12.3 Description Tab

On the **Description** tab you can enter a description for your virtual machine. This has no effect on the functionality of the machine, but you may find this space useful to note down things such as the configuration of a virtual machine and the software that has been installed into it.

To insert a line break into the **Description** text field, press Shift+Enter.

5.12.4 Disk Encryption Tab

The **Disk Encryption** tab enables you to encrypt disks that are attached to the virtual machine.

To enable disk encryption, select the **Encrypt Disks** check box.

Settings are available to configure the cipher used for encryption and the encryption password.

Note:

All files related to the virtual machine except disk images are stored unencrypted. To encrypt these files, use the VBoxManage encryptvm command as described in *Encryption of VMs*.

5.13 System Settings

The **System** category groups various settings that are related to the basic hardware that is presented to the virtual machine.

Note:

As the activation mechanism of Windows is sensitive to hardware changes, if you are changing hardware settings for a Windows guest, some of these changes may trigger a request for another activation with Microsoft.

The following tabs are available.

5.13.1 Motherboard Tab

On the **Motherboard** tab, you can configure virtual hardware that would normally be on the motherboard of a real computer.

- **Base Memory**: Sets the amount of RAM that is allocated and given to the VM when it is running. The specified amount of memory will be requested from the host OS, so it must be available or made available as free memory on the host when attempting to start the VM and will not be available to the host while the VM is running. This is the same setting that was specified when *4 Creating a New Virtual Machine on page 47*.

  Generally, it is possible to change the memory size after installing the guest OS. But you must not reduce the memory to an amount where the OS would no longer boot.
- **Boot Device Order (BIOS only)**: Determines the order in which the guest OS will attempt to boot from the various virtual boot devices. Analogous to a real PC's BIOS setting, Oracle VirtualBox can tell a guest OS to start from the virtual floppy, the virtual CD/DVD drive, the virtual hard drive (each of these as defined by the other VM settings), the network, or none of these.

  If you select **Network**, the VM will attempt to boot from a network using the PXE mechanism. This needs to be configured in detail on the command line. See *15.35 VBoxManage modifyvm on page 402*.
- **Chipset**: You can select which chipset will be presented to the virtual machine. This can't be changed on VMs with an Arm architecture. PIIX3 is the default chipset for most guests. For some guest OSs, the PIIX3 chipset is not well supported. As a result, Oracle VirtualBox provides an emulation of the ICH9 chipset, which supports PCI express, three PCI buses, PCI-to-PCI bridges and Message Signaled Interrupts (MSI). This enables modern OSs to address more PCI devices and no longer requires IRQ sharing. Using the ICH9 chipset it is also possible to configure up to 36 network cards, compared to a maximum of eight network adapters with PIIX3.

- **TPM Version**: Enables support for a Trusted Platform Module (TPM) security processor. Choose from the available TPM versions. This can't be changed on VMs with an Arm architecture.
- **Pointing Device**: The default virtual pointing device for some guest OSs is the traditional PS/2 mouse. If set to **USB Tablet**, Oracle VirtualBox reports to the virtual machine that a USB tablet device is present and communicates mouse events to the virtual machine through this device. Another setting is **USB Multi-Touch Tablet**, which is suitable for guests running Windows 8 or later.

  Using the virtual USB tablet has the advantage that movements are reported in absolute coordinates, instead of as relative position changes. This enables Oracle VirtualBox to translate mouse events over the VM window into tablet events without having to capture the mouse in the guest as described in *5.1.3 Capturing and Releasing Keyboard and Mouse on page 54*. This makes using the VM less tedious even if Guest Additions are not installed.
- **I/O APIC**: Advanced Programmable Interrupt Controllers (APICs) are an x86 hardware feature that have replaced Programmable Interrupt Controllers (PICs). With an I/O APIC, OSs can use more than 16 interrupt requests (IRQs) and therefore avoid IRQ sharing for improved reliability. Can't be changed on VMs with an Arm architecture.

  Note:

  Enabling the I/O APIC is *required* for 64-bit Windows guest OSs. It is also required if you want to use more than one virtual CPU in a virtual machine.

  However, software support for I/O APICs has been unreliable with some OSs other than Windows. Also, the use of an I/O APIC slightly increases the overhead of virtualization and therefore slows down the guest OS a little.

  Note:

  All Windows OSs install different kernels, depending on whether an I/O APIC is available. As with ACPI, the I/O APIC therefore *must not be turned off after installation* of a Windows guest OS. Turning it on after installation will have no effect however.
- **Hardware Clock in UTC**: If selected, Oracle VirtualBox will report the system time in UTC format to the guest instead of the local (host) time. This affects how the virtual real-time clock (RTC) operates and may be useful for UNIX-like guest OSs, which typically expect the hardware clock to be set to UTC.
- **UEFI** Enables Extensible Firmware Interface (EFI), which replaces the legacy BIOS and may be useful for certain advanced use cases. See *5.22 Alternative Firmware (UEFI) on page 83*. Can't be changed on VMs with an Arm architecture.
- **Secure Boot**: Enables Secure Boot, to provide a secure environment for starting the guest OS.

In addition, you can turn off the **Advanced Configuration and Power Interface (ACPI)** which Oracle VirtualBox presents to the guest OS by default.

ACPI is the current industry standard to allow OSs to recognize hardware, configure motherboards and other devices and manage power. As most computers contain this feature and Windows and Linux support ACPI, it is also enabled by default in Oracle VirtualBox. However, no ACPI information, such as battery status or power source, is reported to Oracle Solaris guests.

ACPI can only be turned off using the command line. See *15.35 VBoxManage modifyvm on page 402*.

Note:

All Windows OSs install different kernels, depending on whether ACPI is available. This means that ACPI *must not be turned off* after installation of a Windows guest OS. However, turning it on after installation will have no effect.

5.13.2 Processor Tab

On the **Processor** tab, you can configure settings for the CPU used by the virtual machine.

- **Number of CPUs**: Sets the number of virtual CPU cores the guest OSes can see. Oracle VirtualBox supports symmetrical multiprocessing (SMP) and can present up to 32 virtual CPU cores to each virtual machine.

  You should not configure virtual machines to use more CPU cores than are available physically. This includes real cores, with no hyperthreads.
- **Processing Cap**: Configures the CPU processing cap. This limits the amount of time a host CPU spends to emulate a virtual CPU. The default setting is 100%, meaning that there is no limitation. A setting of 50% implies a single virtual CPU can use up to 50% of a single host CPU. Note that limiting the execution time of the virtual CPUs may cause guest timing problems.

  A warning is displayed at the bottom of the Processor tab if a Processing Cap setting is made that may affect system performance.
- **PAE/NX**: Determines whether the PAE (Physical Address Extension) and NX capabilities of the host CPU will be exposed to the virtual machine. Can't be changed on VMs with an Arm architecture.

  Normally, if enabled and supported by the OS, then even a 32-bit x86 CPU can access more than 4 GB of RAM. This is made possible by adding another 4 bits to memory addresses, so that with 36 bits, up to 64 GB can be addressed. Some OSs, such as Ubuntu Server, require PAE support from the CPU and cannot be run in a virtual machine without it.
- **Nested VT-x/AMD-V**: Enables nested virtualization, with passthrough of hardware virtualization functions to the guest VM. Can't be changed on VMs with an Arm architecture.

With virtual machines running modern server OSs, Oracle VirtualBox also supports CPU hot-plugging. For details, see *CPU Hot-Plugging*.

5.13.3 Acceleration Tab

On this tab, you can configure Oracle VirtualBox to use hardware virtualization extensions that your host CPU supports.

- **Paravirtualization Interface**: Oracle VirtualBox provides paravirtualization interfaces to improve time-keeping accuracy and performance of guest OSs. The options available are documented under the --paravirt-provider option in *15 VBoxManage on page 271* **modifyvm**. For further details on the paravirtualization providers, see *Paravirtualization Providers*.
- **Hardware Virtualization**:
  - **Nested Paging**: If the host CPU supports the nested paging (AMD-V) or EPT (Intel VT-x) features, then you can expect a significant performance increase by enabling nested paging in addition to hardware virtualization. For technical details, see *Nested Paging and VPIDs*. For Intel EPT security recommendations, see *CVE-2018-3646*.

5.14 Display Settings

The following tabs are available for configuring the display for a virtual machine.

5.14.1 Screen Tab

- **Video Memory**: Sets the size of the memory provided by the virtual graphics card available to the guest, in megabytes. As with the main memory, the specified amount will be allocated from the host's resident memory. Based on the amount of video memory, higher resolutions and color depths may be available.

  VirtualBox Manager will show a warning if the amount of video memory is too small to be able to switch the VM into full screen mode. The minimum value depends on the number of virtual monitors, the screen resolution and the color depth of the host display as well as on the use of *3D acceleration*. A rough estimate is (*color depth* / 8) x *vertical pixels* x *horizontal pixels* x *number of screens* = *number of bytes*. Extra memory may be required if display acceleration is used.
- **Number of Virtual Monitors**: With this setting, Oracle VirtualBox can provide more than one virtual monitor to a virtual machine. If a guest OS supports multiple attached monitors, Oracle VirtualBox can pretend that multiple virtual monitors are present. Up to eight such virtual monitors are supported.

  The output of the multiple monitors are displayed on the host in multiple VM windows which are running side by side. However, in full screen and seamless mode, they use the available physical monitors attached to the host. As a result, for full screen and seamless modes to work with multiple monitors, you will need at least as many physical monitors as you have virtual monitors configured, or Oracle VirtualBox will report an error.

  You can configure the relationship between guest and host monitors using the **View** menu by pressing Host key + Home when you are in full screen or seamless mode.

  See also *13.7 Known Issues on page 251*.
- **Scale Factor**: Enables scaling of the display size. For multiple monitor displays, you can set the scale factor for individual monitors, or globally for all of the monitors. Use the slider to select a scaling factor up to 200%.

  You can set a default scale factor for all VMs. Use the **Display** tab in the Preferences window.
- **Graphics Controller**: Specifies the graphics adapter type used by the guest VM. Note that you must install the Guest Additions on the guest VM to specify the VBoxSVGA or VMSVGA graphics controller. The following options are available:

  - **VBoxSVGA:** The default graphics controller for new VMs that use Windows 7 or later.

    This graphics controller improves performance and 3D support when compared to the legacy VBoxVGA option.
  - **VBoxVGA:** Use this graphics controller for legacy guest OSes. This is the default graphics controller for Windows versions before Windows 7 and for Oracle Solaris.

    3D acceleration is not supported for this graphics controller.
  - **VMSVGA:** Use this graphics controller to emulate a VMware SVGA graphics device. This is the default graphics controller for Linux guests.
  - **None:** Does not emulate a graphics adapter type.

- **3D Acceleration**: If a virtual machine has Guest Additions installed, you can enable accelerated 3D graphics on the VM. With 3D acceleration enabled, the VM also uses video decoding acceleration if the host also supports video decoding acceleration. See *7.6 Hardware-Accelerated Graphics on page 116*.

5.14.2 Remote Display Tab

On the **Remote Display** tab, if the VirtualBox Remote Display Extension (VRDE) is installed, you can enable the VRDP server that is built into Oracle VirtualBox. This enables you to connect to the console of the virtual machine remotely with any standard RDP viewer, such as mstsc.exe that comes with Microsoft Windows. On Linux and Oracle Solaris systems you can use the standard open source rdesktop program. These features are described in *Remote Display (VRDP Support)*.

- **Enable Server**: Select this check box and configure settings for the remote display connection.

5.14.3 Recording Tab

On the **Recording** tab you can enable video and audio recording for a virtual machine and change related settings. Note that these features can be enabled and disabled while a VM is running. Settings apply to all selected screens.

- **Enable Recording**: Select this check box and select a **Recording Mode** option.
- **Recording Mode**: You can choose to record video, audio, or both video and audio.

  Some settings on the **Recording** tab may be grayed out, depending on the **Recording Mode** setting.
- **File Path**: The file where the recording is saved.
- **Frame Size**: The video resolution of the recorded video, in pixels. The drop-down list enables you to select from common frame sizes.
- **Frame Rate**: Use the slider to set the maximum number of video frames per second (FPS) to record. Frames that have a higher frequency are skipped. Increasing this value reduces the number of skipped frames and increases the file size.
- **Video Quality**: Use the slider to set the bit rate of the video in kilobits per second. Increasing this value improves the appearance of the video at the cost of an increased file size.
- **Audio Quality**: Use the slider to set the quality of the audio recording. Increasing this value improves the audio quality at the cost of an increased file size.
- **Screens**: For a multiple monitor display, you can select which screens to record video from.

As you adjust the video and audio recording settings, the approximate output file size for a five minute video is shown.

5.15 Storage Settings

The **Storage** category in the VM settings enables you to connect virtual hard disk and CD/DVD images and drives to your virtual machine.

In a real computer, so-called *storage controllers* connect physical disk drives to the rest of the computer. Similarly, Oracle VirtualBox presents virtual storage controllers to a virtual machine. Under each controller, the virtual devices, such as hard disks and CD/DVD drives, attached to the controller are shown.

Note:

This section gives a quick introduction to the Oracle VirtualBox storage settings. See *8 Virtual Storage on page 125* for a full description of the available storage settings in Oracle VirtualBox.

Depending on the guest OS type that you selected when you created the VM, a new VM includes the following storage devices:

- **IDE controller.** A virtual CD/DVD drive is attached to device 0 on the secondary channel of the IDE controller.
- **SATA controller.** This is a modern type of storage controller for higher hard disk data throughput, to which the virtual hard disks are attached. Initially you will normally have one such virtual disk, but as shown in the previous screenshot, you can have more than one. Each is represented by a disk image file, such as a VDI file in this example.

VMs with an Arm architecture have VirtIO SCSI only.

If you created your VM with an older version of Oracle VirtualBox, the default storage layout may differ. You might then only have an IDE controller to which both the CD/DVD drive and the hard disks have been attached. This might also apply if you selected an older OS type when you created the VM. Since older OSes do not support SATA without additional drivers, Oracle VirtualBox will make sure that no such devices are present initially. See *8.1 Hard Disk Controllers on page 125*.

Oracle VirtualBox also provides a *floppy controller*. You cannot add devices other than floppy drives to this controller. Virtual floppy drives, like virtual CD/DVD drives, can be connected to either a host floppy drive, if you have one, or a disk image, which in this case must be in RAW format.

You can modify these media attachments freely. For example, if you want to copy some files from another virtual disk that you created, you can connect that disk as a second hard disk, as in the above screenshot. You could also add a second virtual CD/DVD drive, or change where these items are attached. The following options are available:

- To **add another virtual hard disk, or a CD/DVD or floppy drive**, select the storage controller to which it should be added (such as IDE, SATA, SCSI, SAS, floppy controller) and then click the **Add Disk** button below the tree. You can then either select **Optical Drive** or **Hard Disk**. If you clicked on a floppy controller, you can add a floppy drive instead. Alternatively, right-click the storage controller and select a menu item there.

  A dialog is displayed, enabling you to select an existing disk image file or to create a new disk image file. Depending on the type of disk image, the dialog is called **Hard Disk Selector**, **Optical Disk Selector**, or **Floppy Disk Selector**.

  See *8.2 Disk Image Files (VDI, VMDK, VHD, HDD) on page 128* for information on the image file types that are supported by Oracle VirtualBox.

  For virtual CD/DVD drives, the image files will typically be in the standard ISO format instead. Most commonly, you will select this option when installing an OS from an ISO file that you have obtained from the Internet. For example, most Linux distributions are available in this way.

  Depending on the type of disk image, you can set the following **Attributes** for the disk image in the right part of the Storage settings page:

    - The **device slot** of the controller that the virtual disk is connected to. IDE controllers have four slots: primary device 0, primary device 1, secondary device 0, and secondary device 1. By contrast, SATA and SCSI controllers offer you up to 30 slots for attaching virtual devices.
    - **Solid-state Drive** presents a virtual disk to the guest as a solid-state device.
    - **Hot-pluggable** presents a virtual disk to the guest as a hot-pluggable device.
    - For virtual CD/DVD drives, you can select **Live CD/DVD**. This means that the virtual optical disk is not removed from when the guest system ejects it.
- To **remove an attachment**, either select it and click the **Remove** icon at the bottom, or right-click the attachment and select the menu item.

Removable media, such as CD/DVDs and floppies, can be changed while the guest is running. Since the **Settings** window is not available at that time, you can also access these settings from the **Devices** menu of your virtual machine window.

5.16 Audio Settings

The **Audio** section in a virtual machine's **Settings** window determines whether the VM will detect a connected sound card, and if the audio output should be played on the host system.

To enable audio for a guest, select the **Enable Audio** check box. The following settings are available:

- **Host Audio Driver:** The audio driver that Oracle VirtualBox uses on the host.

  The **Default** option is enabled by default for all new VMs. This option selects the best audio driver for the host platform automatically. This enables you to move VMs between different platforms without having to change the audio driver.

  On a Linux host, depending on your host configuration, you can select between the OSS, ALSA, or the PulseAudio subsystem. On newer Linux distributions, the PulseAudio subsystem is preferred.

  Only OSS is supported on Oracle Solaris hosts. The Oracle Solaris Audio audio backend is no longer supported on Oracle Solaris hosts.
- **Audio Controller**: You can choose between the emulation of an Intel AC'97 controller, an Intel HD Audio controller, or a SoundBlaster 16 card.
- **Audio Output**: Enables audio output only for the VM.
- **Audio Input**: Enables audio input only for the VM.

5.17 Network Settings

The **Network** section in a virtual machine's **Settings** window enables you to configure how Oracle VirtualBox presents virtual network cards to your VM, and how they operate.

When you first create a virtual machine, Oracle VirtualBox by default enables one virtual network card and selects the Network Address Translation (NAT) mode for it. This way the guest can connect to the outside world using the host's networking and the outside world can connect to services on the guest which you choose to make visible outside of the virtual machine.

This default setup is good for the majority of Oracle VirtualBox users. However, Oracle VirtualBox is extremely flexible in how it can virtualize networking. It supports many virtual network cards per virtual machine. The first four virtual network cards can be configured in detail in VirtualBox Manager. Additional network cards can be configured using the VBoxManage command.

Many networking options are available. See *9 Virtual Networking on page 143* for more information.

5.18 Serial Ports

Oracle VirtualBox supports the use of virtual serial ports in a virtual machine with an x86 architecture. Serial ports are not available on Arm VMs.

Ever since the original IBM PC, personal computers have been equipped with one or two serial ports, also called COM ports by DOS and Windows. Serial ports were commonly used with modems, and some computer mice used to be connected to serial ports before USB became commonplace.

While serial ports are no longer as common as they used to be, there are still some important uses left for them. For example, serial ports can be used to set up a primitive network over a null-modem cable, in case Ethernet is not available. Also, serial ports are indispensable for system programmers needing to do kernel debugging, since kernel debugging software usually interacts with developers over a serial port. With virtual serial ports, system programmers can do kernel debugging on a virtual machine instead of needing a real computer to connect to.

If a virtual serial port is enabled, the guest OS sees a standard 16550A compatible UART device. Other UART types can be configured using the VBoxManage modifyvm command. Both receiving and transmitting data is supported. How this virtual serial port is then connected to the host is configurable, and the details depend on your host OS.

You can use either the Settings tabs or the VBoxManage command to set up virtual serial ports. For the latter, see *15.35 VBoxManage modifyvm on page 402* for information on the --uart, --uart-mode and --uart-type options.

You can configure up to four virtual serial ports per virtual machine. For each device, you must set the following:

1. **Port Number:** This determines the serial port that the virtual machine should see. For best results, use the traditional values as follows:

   - COM1: I/O base 0x3F8, IRQ 4
   - COM2: I/O base 0x2F8, IRQ 3
   - COM3: I/O base 0x3E8, IRQ 4
   - COM4: I/O base 0x2E8, IRQ 3

   You can also configure a user-defined serial port. Enter an I/O base address and interrupt (IRQ).
2. **Port Mode:** What the virtual port is connected to. For each virtual serial port, you have the following options:

   - **Disconnected:** The guest will see the device, but it will behave as if no cable had been connected to it.

- **Host Device:** Connects the virtual serial port to a physical serial port on your host. On a Windows host, this will be a name like COM1. On Linux or Oracle Solaris hosts, it will be a device node like /dev/ttyS0. Oracle VirtualBox will then simply redirect all data received from and sent to the virtual serial port to the physical device.
- **Host Pipe:** Configure Oracle VirtualBox to connect the virtual serial port to a software pipe on the host. This depends on your host OS, as follows:

  - On a Windows host, data will be sent and received through a named pipe. The pipe name must be in the format \\.\pipe*name* where *name* should identify the virtual machine but may be freely chosen.
  - On a Mac OS, Linux, or Oracle Solaris host, a local domain socket is used instead. The socket filename must be chosen such that the user running Oracle VirtualBox has sufficient privileges to create and write to it. The /tmp directory is often a good candidate.

    On Linux there are various tools which can connect to a local domain socket or create one in server mode. The most flexible tool is socat and is available as part of many distributions.

  In this case, you can configure whether Oracle VirtualBox should create the named pipe, or the local domain socket on non-Windows hosts, itself or whether Oracle VirtualBox should assume that the pipe or socket exists already. With the VBoxManage command-line options, this is referred to as server mode or client mode, respectively.

  For a direct connection between two virtual machines, corresponding to a null-modem cable, simply configure one VM to create a pipe or socket and another to attach to it.
- **Raw File:** Send the virtual serial port output to a file. This option is very useful for capturing diagnostic output from a guest. Any file may be used for this purpose, as long as the user running Oracle VirtualBox has sufficient privileges to create and write to the file.
- **TCP:** Useful for forwarding serial traffic over TCP/IP, acting as a server, or it can act as a TCP client connecting to other servers. This option enables a remote machine to directly connect to the guest's serial port using TCP.

  - **TCP Server:** Deselect the **Connect to Existing Pipe/Socket** check box and specify the port number in the **Path/Address** field. This is typically 23 or 2023. Note that on UNIX-like systems you will have to use a port a number greater than 1024 for regular users.

    The client can use software such as PuTTY or the telnet command line tool to access the TCP Server.
  - **TCP Client:** To create a virtual null-modem cable over the Internet or LAN, the other side can connect using TCP by specifying *hostname*:*port* in the **Path/Address** field. The TCP socket will act in client mode if you select the **Connect to Existing Pipe/Socket** check box.

Up to four serial ports can be configured per virtual machine, but you can pick any port numbers out of the above. However, serial ports cannot reliably share interrupts. If both ports are to be used at the same time, they must use different interrupt levels, for example COM1 and COM2, but not COM1 and COM3.

5.19 USB Support

5.19.1 USB Settings

The **USB** section in a virtual machine's **Settings** window enables you to configure Oracle VirtualBox's sophisticated USB support.

Oracle VirtualBox can enable virtual machines to access the USB devices on your host directly. To achieve this, Oracle VirtualBox presents the guest OS with a virtual USB controller.

CAUTION:

As soon as the guest system starts using a USB device, it will be disconnected from the host without a proper shutdown. This may cause data loss.

Note:

USB support on Oracle Solaris hosts requires Oracle Solaris 11 FCS or later. Webcams and other isochronous devices are known to have poor performance.

Oracle VirtualBox also enables your guests to connect to remote USB devices by use of the VirtualBox Remote Desktop Extension (VRDE). See *Remote USB*.

Enable USB for a VM

1. Ensure the VM is not running.
2. Select the VM in the machine list, and then click **Settings**.
3. On the USB tab, select **Enable USB Controller** and choose the USB Controller you need for your guest OS. In most cases this will be xHCI. Only use OHCI or EHCI if your guest OS does not support xHCI. For some legacy Windows guests you'll need to install third party drivers for xHCI support.
   - OHCI supports USB 1.1
   - EHCI supports USB 2.0. This also enables OHCI.
   - xHCI supports all USB speeds up to USB 3.0
4. Specify which devices can be attached to the guest by adding **USB Device Filters**. USB devices with a matching filter will be automatically passed to the guest once they are attached to the host. USB devices without a matching filter can be passed manually to the guest, for example by using the **Devices**, **USB** menu.
   - Click the **USB filter** button to create a new filter with blank fields, and then complete the fields.
   - Or, click the **Add USB filter** button to create a filter with the fields completed for the selected USB device.

   Give the filter a name, for later reference, and specify the filter criteria. The more criteria you specify, the more precisely devices will be selected. For instance, if you specify only a vendor ID of 046d, all devices produced by Logitech will be available to the guest. If you fill in all fields, on the other hand, the filter will only apply to a particular device model from a

particular vendor, and not even to other devices of the same type with a different revision and serial number.

The following criteria are available:

- **Vendor and Product ID.** With USB, each vendor of USB products carries an identification number that is unique world-wide, called the *vendor ID*. Similarly, each line of products is assigned a *product ID* number. Both numbers are commonly written in hexadecimal, and a colon separates the vendor from the product ID. For example, 046d:c016 stands for Logitech as a vendor, and the M-UV69a Optical Wheel Mouse product.

  Alternatively, you can also specify **Manufacturer** and **Product** by name.

  To list all the USB devices that are connected to your host machine with their respective vendor IDs and product IDs, use the following command:

  ```
  VBoxManage list usbhost
  ```

  On Windows, you can also see all USB devices that are attached to your system in the Device Manager. On Linux, you can use the lsusb command.
- **Serial Number.** While vendor ID and product ID are quite specific to identify USB devices, if you have two identical devices of the same brand and product line, you will also need their serial numbers to filter them out correctly.
- **Remote.** This setting specifies whether the device will be local only, remote only, such as over VRDP, or either.

As an example, you could create a new USB filter and specify a vendor ID of 046d for Logitech, Inc, a manufacturer index of 1, and *not remote*. Then any USB devices on the host system produced by Logitech, Inc with a manufacturer index of 1 will be visible to the guest system.

Several filters can select a single device. For example, a filter which selects all Logitech devices, and one which selects a particular webcam.

5. On a Windows host, you will need to unplug and reconnect a USB device to use it after creating a filter for it.
6. Ensure the filters you need immediately are selected in the list. Selected filters will be attached automatically when the VM starts.

5.19.2 Implementation Notes for Windows and Linux Hosts

On Windows hosts, a kernel mode device driver provides USB proxy support. It implements both a USB monitor, which enables Oracle VirtualBox to capture devices when they are plugged in, and a USB device driver to claim USB devices for a particular virtual machine. System reboots are not necessary after installing the driver. Also, you do not need to replug devices for Oracle VirtualBox to claim them.

On supported Linux hosts, Oracle VirtualBox accesses USB devices through special files in the file system. When Oracle VirtualBox is installed, these are made available to all users in the vboxusers system group. In order to be able to access USB from guest systems, make sure that you are a member of this group.

5.20 Shared Folders

Shared folders enable you to easily exchange data between a virtual machine and your host, or between VMs. This feature requires that the Oracle VirtualBox Guest Additions be installed in a virtual machine and is described in detail in *7.3 Shared Folders on page 111*.

5.21 User Interface

The **User Interface** section enables you to change certain aspects of the user interface of the selected VM.

- **Menu Bar:** This widget enables you to disable a complete menu, by clicking on the menu name to deselect it. Menu entries can be disabled, by deselecting the check box next to the entry. On Windows and Linux hosts, the complete menu bar can be disabled by deselecting the check box on the right, after the menus.
- **Mini ToolBar:** In full screen or seamless mode, Oracle VirtualBox can display a small toolbar that contains some of the items that are normally available from the virtual machine's menu bar. This toolbar reduces itself to a small gray line unless you move the mouse over it. With the toolbar, you can return from full screen or seamless mode, control machine execution, or enable certain devices. If you do not want to see the toolbar, disable the **Show in Full Screen/ Seamless** setting.

  The **Show at Top of Screen** setting enables you to show the toolbar at the top of the screen, instead of showing it at the bottom.

  The Mini Toolbar is not available on macOS hosts.
- **Status Bar:** This widget enables you to disable and reorder icons on the status bar. Deselect the check box of an icon to disable it, or rearrange icons by dragging and dropping the icon. To disable the complete status bar deselect the check box on the left, before the icons.

5.22 Alternative Firmware (UEFI)

Oracle VirtualBox includes support for the Unified Extensible Firmware Interface (UEFI), which is an industry standard intended to replace the legacy BIOS as the primary interface for bootstrapping computers and certain system services later.

By default, Oracle VirtualBox uses the BIOS firmware for virtual machines. To use UEFI for a given virtual machine, you can enable EFI in the machine's **Settings**. See *5.13.1 Motherboard Tab on page 72*. Alternatively, use the VBoxManage command line interface as follows:

```
VBoxManage modifyvm "VM name" --firmware efi
```

To switch back to using the BIOS:

```
VBoxManage modifyvm "VM name" --firmware bios
```

Most modern macOS and Windows releases require UEFI. All Arm VMs require UEFI.

Another possible use of UEFI in Oracle VirtualBox is development and testing of UEFI applications, without booting any OS.

5.22.1 Video Modes in EFI

EFI provides two distinct video interfaces: GOP (Graphics Output Protocol) and UGA (Universal Graphics Adapter). Modern OSes, such as Mac OS X, generally use GOP, while some older ones still use UGA. Oracle VirtualBox provides a configuration option to control the graphics resolution for both interfaces, making the difference mostly irrelevant for users.

The default resolution is 1024x768. To select a graphics resolution for EFI, use the following VBoxManage command:

```
VBoxManage setextradata "VM name" VBoxInternal2/EfiGraphicsResolution HxV
```

Find the horizontal resolution H and the vertical resolution V from the following list of default resolutions:

Table 5: Default Resolutions for Display Types

Common display types and their default resolution values.

Display Type	Default Horizontal Resolution (px)	Default Vertical Resolution (px)	Color Depth (BPP)	Display Aspect Ratio
VGA	640	480	32	4:3
SVGA	800	600	32	4:3
XGA	1024	768	32	4:3
XGA+	1152	864	32	4:3
HD	1280	720	32	16:9
WXGA	1280	800	32	16:10
SXGA	1280	1024	32	5:4
SXGA+	1400	1050	32	4:3
WXGA+	1440	900	32	16:10
HD+	1600	900	32	16:9
UXGA	1600	1200	32	4:3
WSXGA+	1680	1050	32	16:10
Full HD	1920	1080	32	16:9
WUXGA	1920	1200	32	16:10
DCI 2K	2048	1080	32	19:10
Full HD+	2160	1440	32	3:2
Unnamed	2304	1440	32	16:10
QHD	2560	1440	32	16:9
WQXGA	2560	1600	32	16:10
QWXGA+	2880	1800	32	16:10
QHD+	3200	1800	32	16:9
WQSXGA	3200	2048	32	16:10
4K UHD	3840	2160	32	16:9
WQUXGA	3840	2400	32	16:10

Display Type	Default Horizontal Resolution (px)	Default Vertical Resolution (px)	Color Depth (BPP)	Display Aspect Ratio
DCI 4K	4096	2160	32	19:10
HXGA	4096	3072	32	4:3
UHD+	5120	2880	32	16:9
WHXGA	5120	3200	32	16:10
WHSXGA	6400	4096	32	16:10
HUXGA	6400	4800	32	4:3
8K UHD2	7680	4320	32	16:9

If this list of default resolutions does not cover your needs, see *Custom VESA Resolutions*. Note that the color depth value specified in a custom video mode must be specified. Color depths of 8, 16, 24, and 32 are accepted. EFI assumes a color depth of 32 by default.

The EFI default video resolution settings can only be changed when the VM is powered off.

5.22.2 Specifying Boot Arguments

It is currently not possible to manipulate EFI variables from within a running guest. For example, setting the boot-args variable by running the nvram tool in a Mac OS X guest will not work. As an alternative method, VBoxInternal2/EfiBootArgs extradata can be passed to a VM in order to set the boot-args variable. To change the boot-args EFI variable, use the following command:

```
VBoxManage setextradata "VM name" VBoxInternal2/EfiBootArgs <value>
```

5.23 Monitoring of Virtual Machines

VirtualBox Manager includes the following tools for viewing runtime information, configuration details, and performance metrics of virtual machines and cloud VM instances.

> **Note:**
>
> To monitor a cloud VM, the Compute Instance Monitoring plugin must be enabled and running on the Oracle Cloud Infrastructure instance. See the Oracle Cloud Infrastructure documentation for more details.

- **Resources**. Displays an overview of performance metrics for all running virtual machines and cloud VM instances.

  See *5.23.1 Resources on page 86*.
- **Session Information Dialog**. Displays configuration and runtime information for the selected VM.

  See *5.23.2 Session Information Dialog on page 86*.

5.23.1 Resources

The **Resources** tool displays several performance metrics for all running virtual machines and cloud VM instances, and for the host system. This provides an overview of system resources used by individual virtual machines and the host system.

To display the **Resources**, in VirtualBox Manager click **Resources**.

- To show metrics for *all* virtual machines, including those that are not running, right-click the list of virtual machines and select **List All Virtual Machines**.
- To show metrics for cloud VMs, right-click the list of virtual machines and select **Show Cloud Virtual Machines**.
- To configure the set of metrics to be shown, click **Columns** in the toolbar. You can then sort the list of virtual machines by a particular metric.
- To see more performance information for a virtual machine, select the VM name and click **Resource Use** in the toolbar. The **Resource Use** tab of the **Session Information** dialog is shown, see *5.23.2 Session Information Dialog on page 86*.

5.23.2 Session Information Dialog

The Session Information dialog includes multiple tabs that show important configuration and runtime information for the guest system. The tabs are as follows:

- **Configuration Details**. Displays the system configuration of the virtual machine in a tabular format. The displayed information includes details such as storage configuration and audio settings.
- **Runtime Information**. Displays runtime information for the guest session in a tabular format similar to the Configuration Details tab.
- **Resource Use**. Includes several time series charts which monitor guest resource usage including CPU, RAM, Disk I/O, and Network. Note that the RAM chart requires the Guest Additions to be running on the guest system. The **Resource Use** tab can also be accessed directly from the **Resources**. See *5.23.1 Resources on page 86*.
- **Guest Control**. Details of processes used by the Guest Control File Manager. See *7.9 Guest Control File Manager on page 120*.

> **Note:**
>
> For cloud VMs, only the **Resource Use** tab is shown.

To display session information for a guest VM or a cloud VM, select the VM name in the **Machines** list and click the **Resource Use** tab.

5.23.3 The Log Viewer

Every time you start up a VM, Oracle VirtualBox creates a log file that records system configuration and events. The **Log Viewer** is a VirtualBox Manager tool that enables you to view and analyze system logs.

To display the Log Viewer, do either of the following:

- Click the VM name in the machine list and select **Logs** from the machine tools menu.
- In the VM, select **Machine**, **Show Log**.

Log messages for the VM are displayed in tabs in the Log Viewer window. See *Collecting Debugging Information* for details of the various log files generated by Oracle VirtualBox.

If you select multiple VMs in the machine list, logs are listed for each VM.

The toolbar of the Log Viewer includes the following options:

- **Save:** Exports the contents of the selected log file to a text file. Specify the destination filename and location in the displayed dialog.
- **Find:** Searches for a text string in the log file.
- **Filter:** Uses filter terms to display specific types of log messages. Common log message terms used by Oracle VirtualBox, such as Audio and NAT, are included by default. Select one or more terms from the drop-down list. To add your own filter term, enter the text string in the text box field.
- **Bookmark:** Saves the location of a log message, enabling you to find it quickly. To create a bookmark, either click the line number, or select some text and then click **Bookmark**.
- **Preferences:** Configures the text display used in the log message window.
- **Refresh:** Refreshes the log file you are currently viewing. Only log messages in the current tab are updated.
- **Reload:** Refreshes all log files. Log messages in every tab are updated.
- **Settings:** Displays the **Settings** window for the VM, enabling you to make configuration changes.
- **Discard:** For a running VM, discards the saved state for the VM and closes it down.
- **Show/Start:** For a running VM, **Show** displays the VM window. For a stopped VM, **Start** displays options for powering up the VM.

6 Integrating with Oracle Cloud Infrastructure

Oracle VirtualBox can integrate with Oracle Cloud Infrastructure. For example you can create cloud VMs, or import Compute instances to Oracle VirtualBox.

6.6 Using Oracle VirtualBox With Oracle Cloud Infrastructure on page 92 describes how you can use Oracle VirtualBox with Oracle Cloud Infrastructure.

Before using Oracle VirtualBox with Oracle Cloud Infrastructure there are some initial configuration steps you may need to do. See *6.1 Preparing for Oracle Cloud Infrastructure Integration on page 89*.

6.1 Preparing for Oracle Cloud Infrastructure Integration

Perform the following configuration steps before using Oracle VirtualBox to integrate with your Oracle Cloud Infrastructure account.

1. **Install the Extension Pack.** Cloud integration features are only available when you install the Oracle VirtualBox Extension Pack. See *3.1.1 Install the Oracle VirtualBox Extension Pack on page 43*.
2. **Create a key pair.** Generate an API signing key pair that is used for API requests to Oracle Cloud Infrastructure. See *6.2 Creating an API Signing Key Pair on page 89*.

   Upload the public key of the key pair from your client device to the cloud service. See *6.3 Uploading the Public Key to Oracle Cloud Infrastructure on page 90*.
3. **Create a cloud profile.** The cloud profile contains resource identifiers for your cloud account, such as your user OCID, and details of your key pair. See *6.4 Creating a Cloud Profile on page 90*.

6.2 Creating an API Signing Key Pair

To use the cloud integration features of Oracle VirtualBox, you must generate an API signing key pair that is used for API requests to Oracle Cloud Infrastructure.

Your API requests are signed with your private key, and Oracle Cloud Infrastructure uses the public key to verify the authenticity of the request. You must upload the public key to the Oracle Cloud Infrastructure Console.

> **Note:**
>
> This key pair is not the same SSH key that you use to access compute instances on Oracle Cloud Infrastructure.

1. (Optional) Create a .oci directory to store the key pair.

   ```
   $ mkdir ~/.oci
   ```

   The key pair is usually installed in the .oci folder in your home directory. For example, ~/.oci on a Linux system.
2. Generate the private key.

Use the openssl command.

- To generate a private key with a passphrase (prompt for passphrase):

  ```
  $ openssl genrsa -out ~/.oci/oci_api_key.pem -aes256 2048
  ```
- To generate a private key with a passphrase entered on the command line as an argument:

  ```
  $ openssl genrsa -aes256 -passout pass:user_passphrase -out ~/.oci/oci_api_key.pem 2048
  ```
- To generate a private key without a passphrase:

  ```
  $ openssl genrsa -out ~/.oci/oci_api_key.pem 2048
  ```

3. Change permissions for the private key.

   ```
   $ chmod 600 ~/.oci/oci_api_key.pem
   ```

   Generate the public key.

   ```
   $ openssl rsa -pubout -in ~/.oci/oci_api_key.pem -out ~/.oci/oci_api_key_public.pem
   ```

   Enter the passphrase when prompted, if you set one.

6.3 Uploading the Public Key to Oracle Cloud Infrastructure

Use the following steps to upload your public key to Oracle Cloud Infrastructure.

1. Log in to the Oracle Cloud Console.
2. Click **Profile**, **User settings**.
3. Display your current API signing keys.

   Click **Resources**, **API Keys**.
4. Upload the public key.

   Click **Add Public Key**.

   The **Add Public Key** dialog is displayed.
5. Select one of the following options:

   - **Choose Public Key File.** This option enables you to browse to the public key file on your local hard disk.
   - **Paste Public Keys.** This option enables you to paste the contents of the public key file into the window in the dialog box.
6. Click **Add** to upload the public key.

6.4 Creating a Cloud Profile

Oracle VirtualBox uses a *cloud profile* to connect to Oracle Cloud Infrastructure. A cloud profile is a text file that contains details of your key files and Oracle Cloud Identifier (OCID) resource identifiers for your cloud account, such as the following:

- **Fingerprint of the public key.** To obtain the fingerprint, you can use the openssl command:

  ```
  $ openssl rsa -pubout -outform DER -in ~/.oci/oci_api_key.pem | openssl md5 -c
  ```
- **Location of the private key on the client device.** Specify the full path to the private key.
- **(Optional) Passphrase for the private key.** This is only required if the key is encrypted.
- **Region**. Shown on the Oracle Cloud Infrastructure Console. Click **Administration**, **Tenancy Details**.

- **Tenancy OCID.** Shown on the Oracle Cloud Infrastructure Console. Click **Administration**, **Tenancy Details**.

  A link enables you to copy the Tenancy OCID.
- **Compartment OCID.** Shown on the Oracle Cloud Infrastructure Console. Click **Identity**, **Compartments**.

  A link enables you to copy the Compartment OCID.
- **User OCID.** Shown on the Oracle Cloud Infrastructure Console. Click **Profile**, **User Settings**.

  A link enables you to copy the User OCID.

You can create a cloud profile in the following ways:

- Automatically, by using the **Cloud Profile Manager**. See *6.5 Using the Cloud Profile Manager on page 91*.

  The Cloud Profile Manager is a VirtualBox Manager tool that enables you to create, edit, and manage cloud profiles for your cloud service accounts.
- Automatically, by using the VBoxManage cloudprofile command. See *15.11 VBoxManage cloudprofile on page 307*.
- Manually, by creating an oci_config file in your Oracle VirtualBox global configuration directory. For example, this is $HOME/.config/VirtualBox/oci_config on a Linux host.
- Manually, by creating a config file in your Oracle Cloud Infrastructure configuration directory. For example, this is $HOME/.oci/config on a Linux host.

  This is the same file that is used by the Oracle Cloud Infrastructure command line interface.

  Oracle VirtualBox automatically uses the config file if no cloud profile file is present in your global configuration directory. Alternatively, you can import this file manually into the Cloud Profile Manager.

6.5 Using the Cloud Profile Manager

To open the Cloud Profile Manager click **Cloud** in VirtualBox Manager.

You can use the Cloud Profile Manager in the following ways:

- To create a new cloud profile automatically.
- To create a cloud profile by importing settings from your Oracle Cloud Infrastructure configuration file.

6.5.1 Creating a New Cloud Profile

1. Click **Add** and specify a **Name** for the profile.
2. Select the new profile, and then click **Properties**. Specify the following property values for the profile:
   - Compartment OCID
   - Fingerprint of the public key
   - Location of the private key on the client device
   - Region OCID
   - Tenancy OCID
   - User OCID

Some of these are settings for your Oracle Cloud Infrastructure account, which you can view from the Oracle Cloud Console.

3. (Optional) If you are using the cloud profile to connect to cloud virtual machines, select the **Show VMs** check box.

   This creates a new subgroup of the **OCI** group in VirtualBox Manager. See *6.7.1 About the OCI VM Group on page 93*.

4. Click **Apply** to save your changes.

   The cloud profile settings are saved to the oci_config file in your Oracle VirtualBox global settings directory.

You can also use VBoxManage cloudprofile to create a cloud profile. See *6.11 Using VBoxManage Commands With Oracle Cloud Infrastructure on page 100*.

6.5.2 Importing a Cloud Profile

Follow these steps to import an existing Oracle Cloud Infrastructure configuration file into the Cloud Profile Manager:

1. Ensure that a config file is present in your Oracle Cloud Infrastructure configuration directory. For example, this is $HOME/.oci/config on a Linux host.
2. Click the **Import** icon to open a dialog that prompts you to import cloud profiles from external files.

   Note:

   This action overwrites any cloud profiles that are in your Oracle VirtualBox global settings directory.

3. Click **Import**.

   Your cloud profile settings are saved to the oci_config file in your Oracle VirtualBox global settings directory.

4. Click **Properties** to show the cloud profile settings.

   Double-click the appropriate field to change the value.

5. Click **Apply** to save your changes.

6.6 Using Oracle VirtualBox With Oracle Cloud Infrastructure

This section describes how you can use Oracle VirtualBox with Oracle Cloud Infrastructure to do the following tasks:

- Create, add, and manage Oracle Cloud Infrastructure cloud instances using VirtualBox Manager. See *6.7 Using Cloud Virtual Machines on page 93*.
- Export an Oracle VirtualBox VM to Oracle Cloud Infrastructure. See *6.8 Exporting an Appliance to Oracle Cloud Infrastructure on page 97*.
- Import a cloud instance into Oracle VirtualBox. See *6.9 Importing an Instance from Oracle Cloud Infrastructure on page 99*.
- Connect from a local VM to an Oracle Cloud Infrastructure cloud subnet. See *6.10 Using a Cloud Network on page 100*.

- Use the VBoxManage commands to integrate with Oracle Cloud Infrastructure and perform cloud operations. See *6.11 Using VBoxManage Commands With Oracle Cloud Infrastructure on page 100*.

6.7 Using Cloud Virtual Machines

A cloud virtual machine (*cloud VM*) is a type of VM that represents an instance on a cloud service. Cloud VMs are shown in the **Machines** list in VirtualBox Manager, in the same way as local VMs are.

By using cloud VMs you can create, manage, and control your Oracle Cloud Infrastructure instances from VirtualBox Manager.

> **Note:**
>
> Cloud VMs do not install, export, or import instances to the Oracle VirtualBox host. All operations are done remotely on the cloud service.

Cloud VMs can be used to do the following tasks in Oracle Cloud Infrastructure:

- **Create a new Oracle Cloud Infrastructure instance.** See *6.7.2 Creating a New Cloud VM on page 94*.
- **Use an existing Oracle Cloud Infrastructure instance.** See *6.7.3 Adding a Cloud VM on page 94*.
- **Copy an existing Oracle Cloud Infrastructure instance.** See *6.7.4 Cloning a Cloud VM on page 95*.
- **Configure an Oracle Cloud Infrastructure instance.** You can change settings for the instance, such as display name. See *6.7.5 Changing Settings for a Cloud VM on page 95*.
- **Control an Oracle Cloud Infrastructure instance.** Stop, start, and terminate the instance. See *6.7.6 Controlling a Cloud VM on page 95*.
- **Create a console connection to an Oracle Cloud Infrastructure instance**. See *6.7.9 Creating an Instance Console Connection for a Cloud VM on page 96*.

6.7.1 About the OCI VM Group

All cloud VMs are shown in the **Machines** list in VirtualBox Manager, in a special VM group called **OCI**.

Cloud VMs are further grouped according to the cloud profile used to connect to them. The cloud profile identifies the user and compartment for the cloud VM and includes details of the key pair used to connect to cloud instances. See *6.4 Creating a Cloud Profile on page 90*.

All cloud profiles registered with Oracle VirtualBox are listed automatically in the OCI group.

To enable or disable listing of cloud VMs in VirtualBox Manager for a specific cloud profile, follow these steps.

1. Display the **Cloud Profile Manager**.
2. Select or clear the **List VMs** check box for each cloud profile.

6.7.2 Creating a New Cloud VM

When you create a new cloud VM, a *new* Oracle Cloud Infrastructure instance is created and associated with the cloud VM.

Perform the following steps to create a new cloud VM:

1. Click a cloud profile in the **OCI** group.

   The cloud VMs for the selected cloud profile are displayed.
2. Select **Group**, **New Machine**.
3. Configure the following settings for the new cloud VM:

   - **Location:** The cloud service provider that will host the new instance. Select **Oracle Cloud Infrastructure**.
   - **Profile:** The cloud profile used to connect to the new instance. Select from the available cloud profiles.
   - **Source:** The image that the new instance is based on. Choose from the available images and boot volumes.
4. Change the **Cloud Virtual Machine Settings** as required. You will likely need to change the display name, shape, and networking configuration.

   To add an SSH key to the instance, click the **SSH Authorised Keys** field and paste the public key into the displayed dialog.
5. Click **Finish** to create a new Oracle Cloud Infrastructure instance using the selected image or boot volume. The new instance is started automatically.

   The new cloud VM is shown in the **OCI** group in VirtualBox Manager.

6.7.3 Adding a Cloud VM

When you add a cloud VM, an *existing* Oracle Cloud Infrastructure instance is associated with the cloud VM. You can only add one cloud VM for each instance.

Perform the following steps to add a cloud VM:

1. Click a cloud profile in the **OCI** group.

   The cloud VMs for the selected cloud profile are displayed.
2. Select **Group**, **Add Machine**.
3. Configure the following settings:

   - **Source:** The cloud service provider that hosts the instance used for the cloud VM. Select **Oracle Cloud Infrastructure**.
   - **Profile:** The cloud profile used to connect to the running instance. Select from the available cloud profiles.
   - **Instances:** The instance to use for the cloud VM. Choose from the available instances on your cloud service.
4. Click **Finish** to add a cloud VM based on the selected instance.

   A cloud VM with the same name as the instance is added to the **OCI** group in VirtualBox Manager.
5. (Optional) To change the display name for the instance, click **Settings** and edit the **Display Name** field.

The cloud VM name in VirtualBox Manager is updated automatically.

6.7.4 Cloning a Cloud VM

When you clone a cloud VM, a copy of the Oracle Cloud Infrastructure instance for the cloud VM is created and associated with the new cloud VM.

Perform the following steps to clone a cloud VM:

1. Click a cloud profile in the **OCI** group.

   The cloud VMs for the selected cloud profile are displayed.
2. Right-click the cloud VM you want to clone and select **Clone**.

   The **Clone Name** dialog is displayed.

   Enter a name for the clone.

   The name you enter is also used as the display name for the related Oracle Cloud Infrastructure instance. The default name for the clone consists of the _clone suffix appended to the original name. For example, ol9-dev_clone.
3. Click **OK** to create the clone and the related Oracle Cloud Infrastructure instance. The new instance is started automatically.

   The new cloud VM is shown in the **OCI** group in **Machines** in VirtualBox Manager.

6.7.5 Changing Settings for a Cloud VM

Select the cloud VM in VirtualBox Manager and click **Settings**.

- For a *new* cloud VM, you can change many settings for the Oracle Cloud Infrastructure instance, such as the display name, shape, and disk size.
- When you *add* a cloud VM based on an existing Oracle Cloud Infrastructure instance you can only change the display name.

6.7.6 Controlling a Cloud VM

You can use VirtualBox Manager to control a cloud VM as follows:

- **Start.** Use the **Start** button in the **Machines** toolbar.
- **Stop.** Click the cloud VM name and select **Machine**, **Stop**. Menu options to shut down and power off the cloud VM are available.
- **Reset.** Click the cloud VM name and select **Machine**, **Reset**. The cloud VM is stopped, then restarted automatically.
- **Terminate.** Use the **Terminate** button in the VirtualBox Manager toolbar.

  CAUTION:

  This action deletes the instance from Oracle Cloud Infrastructure.

When you control a cloud VM in VirtualBox Manager the machine list is updated automatically with the current instance state, such as **Stopped** or **Running**.

When you control an instance using the Oracle Cloud Infrastructure console, VirtualBox Manager updates the status for the corresponding cloud VM automatically.

6.7.7 Monitoring Cloud VM Performance

You can monitor the performance of cloud VM instances in the following ways:

- Use the virtual machine monitoring tools in VirtualBox Manager.
  - To show detailed performance data for a cloud VM:

    Click the cloud VM name in the **Machines** list and click **Resource Use**.

    Several time series charts are displayed, showing resource usage and performance data. To save the data to file, click **Export**.
  - To show a performance summary for all cloud VMs:

    Click **Resources** to see a summary of performance metrics for all running cloud VMs and for the host system.

  See also *5.23 Monitoring of Virtual Machines on page 85*.
- Use the **VBoxManage cloud instance** command, as follows:
  - **VBoxManage cloud instance metriclist** shows the available metrics for an instance.
  - **VBoxManage cloud instance metricdata** shows metrics data for an instance.

  See also *15.10 VBoxManage cloud on page 298*.

Note:

To monitor a cloud VM, the Compute Instance Monitoring plugin must be enabled and running on the Oracle Cloud Infrastructure instance. See the Oracle Cloud Infrastructure documentation for more details.

6.7.8 Removing a Cloud VM

You can use VirtualBox Manager to remove a cloud VM as follows:

Right-click the cloud VM name and select **Remove**.

- Click **Remove Only** to remove the cloud VM from the **Machines** list in VirtualBox Manager.
- Click **Delete Everything** to remove the cloud VM from VirtualBox Manager and also to delete the Oracle Cloud Infrastructure instance and any associated boot volumes.

6.7.9 Creating an Instance Console Connection for a Cloud VM

To create a instance console connection, the cloud VM must be in **Running** state.

1. Right-click the cloud VM name and select **Console**, **Create Connection**.
2. The **Public Key** dialog is displayed. Paste the public key used for the instance connection into the dialog and click **OK**.

   By default, either the first entry in your SSH keys folder or the public key used for your previous instance console connection is used.

3. Click **Connect** to connect to the instance. An instance console is displayed automatically on the host.
4. (Optional) Click **Show Log** to display log messages for the instance console connection.

See the Oracle Cloud Infrastructure documentation for details about how you can use an instance console connection to troubleshoot instance problems.

6.8 Exporting an Appliance to Oracle Cloud Infrastructure

Oracle VirtualBox supports the export of VMs to an Oracle Cloud Infrastructure service. The exported VM is stored on Oracle Cloud Infrastructure as a custom Linux image. You can configure whether a cloud instance is created and started after the export process has completed.

> **Note:**
>
> Before you export a VM to Oracle Cloud Infrastructure, you must prepare the VM as described in *6.8.1 Preparing a VM for Export to Oracle Cloud Infrastructure on page 98*.

Use the following steps to export a VM to Oracle Cloud Infrastructure:

1. Select **File**, **Export Appliance**.
2. Select a VM to export, and then click **Next** to display the **Format Settings** page.
3. From the **Format** drop-down list, select **Oracle Cloud Infrastructure**.
4. In the **Profile** drop-down list, select the cloud profile used for your Oracle Cloud Infrastructure account.
5. In the **Machine Creation** field, select an option to configure settings for the cloud instance created when you export to Oracle Cloud Infrastructure. The options enable you to do one of the following:

   - Configure settings for the cloud instance *after* you have finished exporting the VM.
   - Configure settings for the cloud instance *before* you start to export the VM.
   - Do not create a cloud instance when you export the VM.

   Click **Next** to make an API request to the Oracle Cloud Infrastructure service and open the **Appliance Settings** page.
6. (Optional) Edit storage settings used for the exported virtual machine in Oracle Cloud Infrastructure. You can change the following settings:

   - The name of the bucket used to store the exported files.
   - Whether to store the custom image in Oracle Cloud Infrastructure.
   - The display name for the custom image in Oracle Cloud Infrastructure.
   - The launch mode for the cloud instance.

     Paravirtualized mode gives improved performance and is suitable for most Oracle VirtualBox VMs.

     Emulated mode is suitable for legacy OS images.

   Click **Finish** to continue.
7. (Optional) Depending on the selection in the **Machine Creation** field, the **Appliance Settings** page may be displayed before or after export. This screen enables you to configure settings for the cloud instance, such as Shape and Disk Size.

Click **Finish**. The VM is exported to Oracle Cloud Infrastructure.

Depending on the **Machine Creation** setting, a cloud instance may be started after upload to Oracle Cloud Infrastructure is completed.

8. Monitor the export process by using the Oracle Cloud Console.

You can also use the VBoxManage export command to export a VM to Oracle Cloud Infrastructure. See *15.21 VBoxManage export on page 354*.

6.8.1 Preparing a VM for Export to Oracle Cloud Infrastructure

Oracle Cloud Infrastructure provides the option to import a custom Linux image. Before an Oracle VirtualBox image can be exported to Oracle Cloud Infrastructure, the custom image needs to be prepared to ensure that instances launched from the custom image can boot correctly and that network connections will work. This section provides advice on how to prepare a Linux image for export from Oracle VirtualBox.

The following list shows some tasks to consider when preparing an Oracle Linux VM for export:

- **Use DHCP for network addresses.** Configure the VM to use a DHCP server to allocate network addresses, rather than using a static IP address. The Oracle Cloud Infrastructure instance will then be allocated an IP address automatically.
- **Do not specify a MAC address.** The network interface configuration for the VM must not specify the MAC address.

  Remove the HWADDR setting from the /etc/sysconfig/ifcfg-*devicename* network script.
- **Disable persistent network device naming rules.** This means that the Oracle Cloud Infrastructure instance will use the same network device names as the VM.

  1. Change the GRUB kernel parameters.

     Add net.ifnames=0 and biosdevname=0 as kernel parameter values to the GRUB_CMDLINE_LINUX variable.
  2. Update the GRUB configuration.

     ```
     # grub2-mkconfig -o /boot/grub2/grub.cfg
     ```
  3. Disable any udev rules for network device naming.

     For example, if an automated udev rule exists for net-persistence:

     ```
     # cd /etc/udev/rules.d
     # rm -f 70-persistent-net.rules
     # ln -s /dev/null /etc/udev/rules.d/70-persistent-net.rules
     ```
- **Enable the serial console.** This enables you to troubleshoot the instance when it is running on Oracle Cloud Infrastructure.

  1. Edit the /etc/default/grub file, as follows:

     - Remove the resume setting from the kernel parameters. This setting slows down boot time significantly.
     - Replace GRUB_TERMINAL="gfxterm" with GRUB_TERMINAL="console serial". This configures use of the serial console instead of a graphical terminal.
     - Add GRUB_SERIAL_COMMAND="serial --unit=0 --speed=115200". This configures the serial connection.
     - Add console=tty0 console=ttyS0,115200 to the GRUB_CMDLINE_LINUX variable. This adds the serial console to the Linux kernel boot parameters.

2. Regenerate the GRUB configuration.

   ```
   # grub2-mkconfig -o /boot/grub2/grub.cfg
   ```

3. To verify the changes, reboot the machine and run the dmesg command to look for the updated kernel parameters.

   ```
   # dmesg |grep console=ttyS0
   ```

- **Enable paravirtualized device support.** You do this by adding the virtio drivers to the initrd for the VM.

  1. This procedure works only on machines with a Linux kernel of version 3.4 or later. Check that the VM is running a supported kernel:

     ```
     # uname -a
     ```

  2. Use the dracut tool to rebuild initrd. Add the qemu module, as follows:

     ```
     # dracut –-logfile /var/log/Dracut.log --force --add qemu
     ```

  3. Verify that the virtio drivers are now present in initrd.

     ```
     # lsinitrd |grep virtio
     ```

For more information about importing a custom Linux image into Oracle Cloud Infrastructure, see also:

Importing Custom Linux Images.

6.9 Importing an Instance from Oracle Cloud Infrastructure

Perform the following steps to import a cloud instance from Oracle Cloud Infrastructure into Oracle VirtualBox:

1. Select **File**, **Import Appliance**.

   In the **Source** drop-down list, select **Oracle Cloud Infrastructure**.

   In the **Profile** drop-down list, select the cloud profile for your Oracle Cloud Infrastructure account.

   Choose the required cloud instance from the list in the **Machines** field.

   Click **Next** to make an API request to the Oracle Cloud Infrastructure service and display the **Appliance Settings** page.

2. (Optional) Edit settings for the new local virtual machine.

   For example, you can edit the Name and Description that will be used for the VM.

   Click **Finish** to import the instance from Oracle Cloud Infrastructure.

3. Monitor the import process by using the Oracle Cloud Console.

You can also use the VBoxManage import command to import an instance from Oracle Cloud Infrastructure. See *15.28 VBoxManage import on page 380*.

6.9.1 Importing an Instance: Overview of Events

The following describes the sequence of events when you import an instance from Oracle Cloud Infrastructure.

- A custom image is created from the boot volume of the instance.

- The custom image is exported to an Oracle Cloud Infrastructure object and is stored using Object Storage in the bucket specified by the user.
- The Oracle Cloud Infrastructure object is downloaded to the local host. The object is a TAR archive which contains a boot volume of the instance in QCOW2 format and a JSON file containing metadata related to the instance.
- The boot volume of the instance is extracted from the archive and a new VMDK image is created by converting the boot volume into the VMDK format. The VMDK image is registered with Oracle VirtualBox.
- A new VM is created using the VMDK image for the cloud instance.

  By default, the new VM is not started after import from Oracle Cloud Infrastructure.
- The downloaded TAR archive is deleted after a successful import.

6.10 Using a Cloud Network

A cloud network is a type of network that can be used for connections from a local VM to a remote Oracle Cloud Infrastructure cloud instance.

To create and use a cloud network, do the following:

1. Set up a virtual cloud network on Oracle Cloud Infrastructure.

   The following steps create and configure a virtual cloud network (VCN) on Oracle Cloud Infrastructure. The VCN is used to tunnel network traffic across the cloud.

   1. Ensure that you have a cloud profile for connecting to Oracle Cloud Infrastructure. See *6.4 Creating a Cloud Profile on page 90*.
   2. Run the following VBoxManage cloud command:

      ```
      VBoxManage cloud --provider="OCI" --profile="vbox-oci" network setup
      ```

      where vbox-oci is the name of your cloud profile.

      Other options are available for the VBoxManage cloud network setup command, to enable you to configure details for the VCN. For example, you can configure the operating system used for the cloud gateway instance and the IP address range used by the tunneling network. See *15.10 VBoxManage cloud on page 298*.
2. Register the new cloud network with Oracle VirtualBox.

   Use the **Network** tool. See *9.1 Configure Networking on page 143*.
3. Add cloud network adaptors to the local VMs that will use the cloud network. See *9.12 Cloud Networks on page 157*.

6.11 Using VBoxManage Commands With Oracle Cloud Infrastructure

This section includes some examples of how VBoxManage commands can be used to integrate with Oracle Cloud Infrastructure and perform common cloud operations.

Creating a Cloud Profile

To create a cloud profile called vbox-oci for Oracle Cloud Infrastructure as the cloud provider:

```
VBoxManage cloudprofile --provider "OCI" --profile="vbox-oci" add \
--clouduser="ocid1.user.oc1..."  --keyfile="/home/username/.oci/oci_api_key.pem" \
--tenancy="ocid1.tenancy.oc1..."  --compartment="ocid1.compartment.oc1..."  --region="us-ashburn-1"
```

The new cloud profile is added to the oci_config file in your Oracle VirtualBox global configuration directory. For example, this is $HOME/.VirtualBox/oci_config on a Windows host.

Listing Cloud Instances

To list the instances in your Oracle Cloud Infrastructure compartment:

```
VBoxManage cloud --provider="OCI" --profile="vbox-oci" list instances
```

Exporting an Oracle VirtualBox VM to the Cloud

To export a VM called myVM and create a cloud instance called myVM_Cloud:

```
VBoxManage export myVM --output OCI:// --cloud 0 --vmname myVM_Cloud \
--cloudprofile "vbox-oci" --cloudbucket myBucket \
--cloudshape VM.Standard2.1 --clouddomain US-ASHBURN-AD-1 --clouddisksize 50  \
--cloudocivcn ocid1.vcn.oc1... --cloudocisubnet ocid1.subnet.oc1... \
--cloudkeepobject true --cloudlaunchinstance true --cloudpublicip true
```

Importing a Cloud Instance Into Oracle VirtualBox

To import a cloud instance and create an Oracle VirtualBox VM called oci_Import:

```
VBoxManage import OCI:// --cloud --vmname oci_Import --memory 4000
--cpus 3 --ostype FreeBSD_64 --cloudprofile "vbox-oci"
--cloudinstanceid ocid1.instance.oc1... --cloudbucket myBucket
```

Creating a New Cloud Instance From a Custom Image

To create a new cloud instance from a custom image on Oracle Cloud Infrastructure:

```
VBoxManage cloud --provider="OCI" --profile="vbox-oci" instance create \
--domain-name="oraclecloud.com" --image-id="ocid1.image.oc1..." --display-name="myInstance" \
--shape="VM.Standard2.1" --subnet="ocid1.subnet.oc1..."
```

Terminating a Cloud Instance

To terminate an instance in your compartment on Oracle Cloud Infrastructure:

```
VBoxManage cloud --provider="OCI" --profile="vbox-oci" instance terminate \
--id="ocid1.instance.oc1..."
```

Showing Cloud Instance Performance Metrics

To show CPU usage metrics for a cloud instance:

```
VBoxManage cloud --provider="OCI" --profile="vbox-oci" instance metricdata \
--id="ocid1.instance.oc1..." --metric-name="CpuUtilization"
```

For more details about the available commands for cloud operations, see *15.10 VBoxManage cloud on page 298*.

7 Guest Additions

The Guest Additions are designed to be installed *inside* a virtual machine after the guest operating system has been installed. They consist of device drivers and system applications that optimize the guest operating system for better performance and usability. See *1.3 Guest Operating Systems on page 24* for details on the guest operating systems that Oracle provides premier support for.

The available Oracle VirtualBox Guest Additions are provided as a single CD-ROM image file called VBoxGuestAdditions.iso. This image file is located in the installation directory of Oracle VirtualBox. To install the Guest Additions for a particular OS, you mount this ISO file in your VM as a virtual CD-ROM and install from there.

You can also configure unattended installation of the Oracle VirtualBox Guest Additions when you create a new VM. See *4.2 Configure Unattended Installation of Guest OS on page 48*.

7.1 Introduction to Guest Additions

The Guest Additions offer the following features:

- **Mouse pointer integration**. To overcome the limitations for mouse support described in *5.1.3 Capturing and Releasing Keyboard and Mouse on page 54*, this feature provides you with seamless mouse support. You will only have one mouse pointer and pressing the Host key is no longer required to *free* the mouse from being captured by the guest OS. To make this work, a special mouse driver is installed in the guest that communicates with the physical mouse driver on your host and moves the guest mouse pointer accordingly.
- **Shared folders.** These provide an easy way to exchange files between the host and the guest. Much like ordinary Windows network shares, you can tell Oracle VirtualBox to treat a certain host directory as a shared folder, and Oracle VirtualBox will make it available to the guest operating system as a network share, irrespective of whether the guest actually has a network. See *7.3 Shared Folders on page 111*.
- **Better video support.** While the virtual graphics card which Oracle VirtualBox emulates for any guest operating system provides all the basic features, the custom video drivers that are installed with the Guest Additions provide you with extra high and nonstandard video modes, as well as accelerated video performance.

  In addition, with Windows, Linux, and Oracle Solaris guests, you can resize the virtual machine's window if the Guest Additions are installed. The video resolution in the guest will be automatically adjusted, as if you had manually entered an arbitrary resolution in the guest's **Display** settings. See *5.1.7 Resizing the VM's Window on page 58*.

  If the Guest Additions are installed, 3D graphics for guest applications can be accelerated. See *7.6 Hardware-Accelerated Graphics on page 116*.
- **Seamless windows.** With this feature, the individual windows that are displayed on the desktop of the virtual machine can be mapped on the host's desktop, as if the underlying application was actually running on the host. See *7.7 Seamless Windows on page 117*.
- **Generic host/guest communication channels.** The Guest Additions enable you to control and monitor guest execution. The *guest properties* provide a generic string-based mechanism to exchange data bits between a guest and a host, some of which have special meanings for controlling and monitoring the guest. See *7.8 Guest Properties on page 118*.

Additionally, applications can be started in a guest from the host. See *7.10 Guest Control of Applications on page 120*.

- **Time synchronization.** With the Guest Additions installed, Oracle VirtualBox can ensure that the guest's system time is better synchronized with that of the host.

  For various reasons, the time in the guest might run at a slightly different rate than the time on the host. The host could be receiving updates through NTP and its own time might not run linearly. A VM could also be paused, which stops the flow of time in the guest for a shorter or longer period of time. When the wall clock time between the guest and host only differs slightly, the time synchronization service attempts to gradually and smoothly adjust the guest time in small increments to either catch up or lose time. When the difference is too great, for example if a VM paused for hours or restored from saved state, the guest time is changed immediately, without a gradual adjustment.

  The Guest Additions will resynchronize the time regularly. See *Tuning the Guest Additions Time Synchronization Parameters* for how to configure the parameters of the time synchronization mechanism.
- **Shared clipboard.** With the Guest Additions installed, the clipboard of the guest operating system can optionally be shared with your host operating system. See *5.12 General Settings on page 70*.
- **Drag and Drop.** Guest Additions enable you to select an object, such as a file, from the host or guest and directly copy or open it on the guest or host. See *5.12 General Settings on page 70*.
- **Automated logins.** Also called credentials passing. See *Automated Guest Logins*.

Each version of Oracle VirtualBox, even minor releases, include their own version of the Guest Additions. While the interfaces through which the Oracle VirtualBox core communicates with the Guest Additions are kept stable so that Guest Additions already installed in a VM should continue to work when Oracle VirtualBox is upgraded on the host, for best results you should keep the Guest Additions at the same version.

The Windows and Linux Guest Additions therefore check automatically whether they have to be updated. If the host is running a newer Oracle VirtualBox version than the Guest Additions, a notification with further instructions is displayed in the guest.

To disable this update check for the Guest Additions of a given virtual machine, set the value of its `/VirtualBox/GuestAdd/CheckHostVersion` guest property to `0`. See *7.8 Guest Properties on page 118*.

7.2 Installing Guest Additions

These instructions apply to all OSs. For additional information, see *7.2.1 Guest Additions for Windows on page 105*, *7.2.2 Guest Additions for Linux on page 108*, *7.2.3 Guest Additions for Oracle Solaris on page 110*, or *7.2.4 Guest Additions for OS/2 on page 111*.

Mount the Guest Additions ISO

1. Start the virtual machine. The OS must be installed.
2. From the **Devices** menu, choose **Insert Guest Additions CD Image**, which mounts the Guest Additions ISO file inside your VM.
3. If this option is not available, or if you prefer to mount the ISO manually:

1. From the **Devices** menu, choose **Optical Drives**, and then **Choose/Create a Disk Image**. This displays *8.3 The Virtual Media Manager on page 128*.
2. In the Virtual Media Manager, click **Add** and browse your host file system for the VBoxGuestAdditions.iso file.
   - On a Windows host, this file is in the Oracle VirtualBox installation directory, usually in C:\Program files\Oracle\VirtualBox.
   - On a Linux host, this file is in the additions folder where you installed Oracle VirtualBox, usually /opt/VirtualBox/.
   - On Oracle Solaris hosts, this file is in the additions folder where you installed Oracle VirtualBox, usually /opt/VirtualBox.
3. In the Virtual Media Manager, select the ISO file and click **Add**. This mounts the ISO file and presents it to your guest OS as a CD-ROM.

Run the Guest Additions Installer

1. Mount the ISO as described in the previous task.
2. Unless you have the Autostart feature disabled, or it is not supported, the OS will now autostart the Oracle VirtualBox Guest Additions installer from the Guest Additions ISO.

   If the Autostart feature has been turned off, choose VBox<OS>Additions.exe from the CD/DVD drive inside the guest to start the installer, where <OS> is Windows, Linux, OS2 or Solaris.
3. Follow the instructions in the installer.
4. Reboot the guest OS.

7.2.1 Guest Additions for Windows

The Oracle VirtualBox Windows Guest Additions are designed to be installed in a virtual machine running a Windows operating system. The Windows Guest Additions will run on VMs running these versions of Windows. See also *1.3.1 Host and Guest Combinations on page 24*.

Arm64 VMs

- Microsoft Windows 11

x86 and x86_64 VMs

- Microsoft Windows 11
- Microsoft Windows Server 2022
- Microsoft Windows 10 (all builds)
- Microsoft Windows Server 2019
- Microsoft Windows Server 2016
- Microsoft Windows 8.1 (all editions)
- Microsoft Windows Server 2012R2
- Microsoft Windows 8 (all editions)
- Microsoft Windows Server 2012
- Microsoft Windows 7 (all editions)
- Microsoft Windows Server 2008R2
- Microsoft Windows Vista (all editions)

- Microsoft Windows Server 2008
- Microsoft Windows XP (any service pack)
- Microsoft Windows Server 2003 (any service pack)
- Microsoft Windows 2000 (any service pack)
- Microsoft Windows NT 4.0 (any service pack)

7.2.1.1 Installing the Windows Guest Additions

Follow the steps in *7.2 Installing Guest Additions on page 104*.

> **Note:**
>
> For the basic Direct3D acceleration to work in a Windows guest, you have to install the WDDM video driver available for Windows Vista or later.
>
> For Windows 8 and later, only the WDDM Direct3D video driver is available.

For completely unattended guest installations, you can specify a command line parameter to the install launcher:

```
VBoxWindowsAdditions.exe /S
```

This automatically installs the right files and drivers for the corresponding platform, either 32-bit or 64-bit.

> **Note:**
>
> For Windows Aero to run correctly on a guest, the guest's VRAM size needs to be configured to at least 128 MB.

For more options regarding unattended guest installations, consult the command line help by using the command:

```
VBoxWindowsAdditions.exe /?
```

7.2.1.2 Updating the Windows Guest Additions

Windows Guest Additions can be updated by running the installation program again, or by selecting **Devices**, and then **Upgrade Guest Additions...** This replaces the previous Additions drivers with updated versions.

Alternatively, you can also open the Windows Device Manager and select **Update Driver...** for the following devices:

- Oracle VirtualBox Graphics Adapter
- Oracle VirtualBox System Device

For each, choose the option to provide your own driver, click **Have Disk** and navigate to the CD-ROM drive with the Guest Additions.

7.2.1.3 Installing Code Signing Certificates

To avoid popups when performing an unattended installation of the Oracle VirtualBox Guest Additions, the code signing certificates used to sign the drivers needs to be installed in the correct

certificate stores on the guest operating system. If you do not do this, the installation will prompt you before the installation of each driver.

The certificates are stored for you if installing Guest Additions as part of the Windows unattended installation when creating a new VM. If you are automating the installation of Guest Additions yourself, you first need to install the code signing certificates on the VM.

Use the VBoxCertUtil.exe utility from the cert folder on the Guest Additions installation CD.

Note:

On some legacy Windows versions, such as Windows 2000 and Windows XP, the user intervention popups mentioned above are always displayed, even after importing the Oracle certificates.

1. Log in as Administrator on the guest.
2. Mount the Oracle VirtualBox Guest Additions ISO.
3. Open a command line window on the guest and change to the cert folder on the Oracle VirtualBox Guest Additions CD.
4. Run the following command:

   ```
   VBoxCertUtil.exe add-trusted-publisher vbox*.cer --root vbox*.cer
   ```

   This command installs the certificates to the certificate store. When installing the same certificate more than once, an appropriate error will be displayed.

7.2.1.4 Automated Windows System Preparation

Microsoft offers a system preparation tool called Sysprep, to prepare a Windows system for deployment or redistribution. For most Windows versions, Sysprep is included in a default installation. Sysprep mainly consists of an executable called sysprep.exe which is invoked by the user to put the Windows installation into preparation mode.

The Guest Additions offer a way to launch a system preparation on the guest operating system in an automated way, controlled from the host system. See *Guest Control of Applications* for details of how to use this feature with the special identifier sysprep as the program to execute, along with the user name sysprep and password sysprep for the credentials. Sysprep is then started with the required system rights.

Note:

Specifying the location of sysprep.exe is **not possible**. Instead the following paths are used, based on the Windows release:

- C:\sysprep\sysprep.exe for Windows XP and earlier
- %WINDIR%\System32\sysprep\sysprep.exe for Windows Vista and later

The Guest Additions will automatically use the appropriate path to execute the system preparation tool.

7.2.1.5 Manual File Extraction

If you would like to install the files and drivers manually, you can extract the files from the Windows Guest Additions setup as follows:

```
VBoxWindowsAdditions.exe /extract
```

To explicitly extract the Windows Guest Additions for another platform than the current running one, such as 64-bit files on a 32-bit system, you must use the appropriate platform installer. Use VBoxWindowsAdditions-x86.exe or VBoxWindowsAdditions-amd64.exe with the /extract parameter.

7.2.2 Guest Additions for Linux

The Oracle VirtualBox Guest Additions for Linux are a set of device drivers and system applications that may be installed in the guest operating system. The Linux Guest Additions will run on VMs running these versions of Linux. See also *1.3.1 Host and Guest Combinations on page 24*.

Arm64 VMs

- Oracle Linux 8 and later, including UEK kernels

x86 and x86_64 VMs

- Oracle Linux 5 and later, including UEK kernels
- Fedora Core 4 and later
- Red Hat Enterprise Linux version 3 and later
- SUSE and openSUSE Linux version 9 and later
- Ubuntu version 5.10 and later

The guest additions may also work on other distributions.

7.2.2.1 Installing the Linux Guest Additions

To install the guest additions:

1. Prepare your guest system for building external kernel modules. Follow the steps in *2.4.2 The Oracle VirtualBox Kernel Modules on page 34*, on your Linux VM instead of on a Linux host system.
2. Insert the VBoxGuestAdditions.iso CD file into your Linux guest's virtual CD-ROM drive. See *7.2 Installing Guest Additions on page 104*.
3. Change to the directory where your CD-ROM drive is mounted and run the following command as root:

   ```
   sh ./VBoxLinuxAdditions.run
   ```
4. If you suspect that something has gone wrong, check that your VM is set up correctly and run the following command as root:

   ```
   rcvboxadd setup
   ```

   To check if drivers were loaded, and the versions of the loaded drivers match the installation version of the Guest Additions, run the following command as root:

   ```
   rcvboxadd status-kernel
   ```

   To check if the VBoxService is running, run the following command as root:

   ```
   rcvboxadd status-user
   ```

7.2.2.2 Manual Setup of Selected Guest Services on Linux

The Oracle VirtualBox Guest Additions contain several different drivers. If you do not want to configure them all, use the following command to install the Guest Additions:

```
$ sh ./VBoxLinuxAdditions.run no_setup
```

After running this script, run the `rcvboxadd setup` command as `root` to compile the kernel modules.

On some 64-bit guests, you must replace `lib` with `lib64`. On older guests that do not run the `udev` service, you must add the `vboxadd` service to the default runlevel to ensure that the modules are loaded.

To set up the time synchronization service, add the `vboxadd-service` service to the default runlevel. To set up the X11 and OpenGL part of the Guest Additions, run the `rcvboxadd-x11 setup` command. Note that you do not need to enable additional services.

Use the `rcvboxadd setup` to recompile the guest kernel modules.

If the VM is using VBoxVGA or VBoxSVGA graphics and the vboxvideo driver, reboot the VM to ensure that the new modules are loaded.

If not rebooting, log out and back in to restart the VBoxClient session service with the guest additions.

7.2.2.3 Linux Guest Screen Resizing

Linux guest screen resizing functionality for guests running VMSVGA graphics configuration uses a standalone daemon called **VBoxDRMClient** and its Desktop Environment helper counterpart.

VBoxDRMClient runs as a root process and is a bridge between the host and the guest's **vmwgfx** driver. This means that **VBoxDRMClient** listens to screen resize hints from the host and forwards them to the **vmwgfx** driver. This enables guest screen resize functionality to be available before the user has logged in using a GUI.

In order to perform Desktop Environment specific actions, such as setting the primary screen in a multimonitor setup, a Desktop Environment helper is used. Once the user has performed a graphical login operation, the helper daemon starts with user session scope and attempts to connect to **VBoxDRMClient** using an IPC connection. When **VBoxDRMClient** has received a corresponding command from the host, it is forwarded to the helper daemon over IPC and the action is then performed.

By default, **VBoxDRMClient** allows any process to connect to its IPC socket. This can be restricted by using the following steps:

1. The Guest Additions Linux installer creates a `vboxdrmipc` user group. A corresponding user needs to be added to this group.
2. You must set the `DRMIpcRestricted` guest property, as follows:

   ```
   VBoxManage guestproperty set "VM name" /VirtualBox/GuestAdd/DRMIpcRestricted 1 \
   --flags RDONLYGUEST
   ```

   It is important to set only the `RDONLYGUEST` flag for the property, so that it cannot be changed from inside the guest.

> **Note:**
>
> Both steps are required. If one of them is missing, all processes will have access to the IPC socket.

Restricted mode can be disabled by unsetting the guest property, as follows:

```
VBoxManage guestproperty unset "VM name" /VirtualBox/GuestAdd/DRMIpcRestricted
```

7.2.2.4 Updating the Linux Guest Additions

The Guest Additions can simply be updated by going through the installation procedure again with an updated CD-ROM image. This will replace the drivers with updated versions. There is no need to reboot unless the VM is using VBoxVGA or VBoxSVGA graphics.

Some Linux distributions already come with all or part of the Oracle VirtualBox Guest Additions. You may choose to keep the distribution's version of the Guest Additions but these are often out of date and limited in functionality, so we recommend replacing them with the Guest Additions that come with Oracle VirtualBox.

The Oracle VirtualBox Linux Guest Additions installer tries to detect an existing installation and replace them but depending on how the distribution integrates the Guest Additions, this may require some manual interaction. Take a snapshot of the virtual machine before replacing preinstalled Guest Additions.

7.2.2.5 Uninstalling the Linux Guest Additions

If you have a version of the Guest Additions installed on your virtual machine and want to remove it without installing new ones, you can do so by inserting the Guest Additions CD image into the virtual CD-ROM drive as described in *7.2 Installing Guest Additions on page 104*. Then run the installer for the current Guest Additions with the `uninstall` parameter from the path that the CD image is mounted on in the guest, as follows:

```
sh ./VBoxLinuxAdditions.run uninstall
```

While this will normally work without issues, you may need to do some manual cleanup of the guest in some cases, especially of the XFree86Config or xorg.conf file. In particular, if the Additions version installed or the guest operating system were very old, or if you made your own changes to the Guest Additions setup after you installed them.

You can uninstall the Additions as follows:

```
/opt/VBoxGuestAdditions-version/uninstall.sh
```

Where `/opt/VBoxGuestAdditions-`*version* is the Guest Additions installation directory.

7.2.3 Guest Additions for Oracle Solaris

The Oracle VirtualBox Guest Additions for Oracle Solaris take the form of a set of device drivers and system applications which may be installed in the guest operating system.

The Solaris Guest Additions will run on VMs running these versions of Solaris. See also *1.3.1 Host and Guest Combinations on page 24*.

- Oracle Solaris 11, including Oracle Solaris 11 Express
- Oracle Solaris 10 4/08 and later

The Guest Additions may work with other distributions that are based on comparable software releases.

7.2.3.1 Installing the Oracle Solaris Guest Additions

Follow the steps in *7.2 Installing Guest Additions on page 104*.

If the CD-ROM drive on the guest does not get mounted, as seen with some versions of Oracle Solaris 10, run the following command as root:

```
svcadm restart volfs
```

Change to the directory where your CD-ROM drive is mounted and run the following command as root:

```
pkgadd -G -d ./VBoxSolarisAdditions.pkg
```

Choose **1** and confirm installation of the Guest Additions package. After the installation is complete, log out and log in to X server on your guest, to activate the X11 Guest Additions.

7.2.3.2 Uninstalling the Oracle Solaris Guest Additions

The Oracle Solaris Guest Additions can be safely removed by removing the package from the guest. Open a root terminal session and run the following command:

```
pkgrm SUNWvboxguest
```

7.2.3.3 Updating the Oracle Solaris Guest Additions

The Guest Additions should be updated by first uninstalling the existing Guest Additions and then installing the new ones. Attempting to install new Guest Additions without removing the existing ones is not possible.

7.2.4 Guest Additions for OS/2

Oracle VirtualBox also includes a set of drivers that improve running OS/2 in a virtual machine. Due to restrictions of OS/2 itself, this variant of the Guest Additions has a limited feature set. Specifically, seamless windows and automatic guest resizing are not implemented in Guest Additions for OS/2 because of inherent limitations of the OS/2 graphics system.

The OS/2 Guest Additions are provided on the same ISO CD-ROM as those for the other platforms. Mount the ISO in OS/2 as described in *7.2 Installing Guest Additions on page 104*. The OS/2 Guest Additions are located in the directory \OS2.

We do not provide an automatic installer. See the readme.txt file in the CD-ROM directory, which describes how to install the OS/2 Guest Additions manually.

7.3 Shared Folders

With the *shared folders* feature of Oracle VirtualBox, you can access files of your host system from within one or all virtual machines. This is similar to how you would use network shares in Windows networks, except that shared folders do not require networking, only the Guest Additions. Shared folders can be used with Windows 2000 or later, Linux, and Oracle Solaris guests.

Shared folders physically reside on the host and are then shared with the guest, which uses a special file system driver in the Guest Additions to talk to the host. For Windows guests, shared folders are implemented as a pseudo-network redirector. For Linux and Oracle Solaris guests, the Guest Additions provide a virtual file system.

To share a host folder with a virtual machine in Oracle VirtualBox, you must specify the path of the folder and choose a *share name* that the guest can use to access the shared folder. This happens on the host. In the guest you can then use the share name to connect to it and access files.

There are several ways in which shared folders can be set up for a virtual machine:

- In the window of a running VM, you select **Shared Folders** from the **Devices** menu, or click the folder icon on the status bar in the bottom right corner.
- If a VM is not currently running, you can configure shared folders in the virtual machine's **Settings** window.
- From the command line, you can create shared folders using VBoxManage, as follows:

  ```
  VBoxManage sharedfolder add "VM name" --name "sharename" --hostpath "C:\test"
  ```

  See *15.42 VBoxManage sharedfolder on page 435*.

There are three types of shares:

- Permanent shares, that are saved with the VM settings.
- Transient shares, that are added at runtime and disappear when the VM is powered off. These can be created using a check box in VirtualBox Manager, or by using the --transient option of the VBoxManage sharedfolder add command.
- Global shared folders are folders shared with all VMs on the host, and stored in VirtualBox settings. Use the **Make Global** option in VirtualBox Manager VM Settings, or the global option in VBoxManage sharedfolder.

Shared folders can either be read-write or read-only. This means that the guest is either allowed to both read and write, or just read files on the host. By default, shared folders are read-write. Read-only folders can be created using a check box in the VirtualBox Manager, or with the --readonly option of the VBoxManage sharedfolder add command.

Oracle VirtualBox shared folders also support symbolic links, also called *symlinks*, under the following conditions:

- The host operating system must support symlinks. For example, a macOS, Linux, or Oracle Solaris host is required.
- The guest VM must have a version of the Guest Additions installed which supports symlinks. Currently only the Linux and Oracle Solaris Guest Additions support symlinks.
- For security reasons the guest OS is not allowed to create symlinks by default. If you trust the guest OS to not abuse this functionality, you can enable the creation of symlinks for a shared folder as follows:

  ```
  VBoxManage setextradata VM-name VBoxInternal2/SharedFoldersEnableSymlinksCreate/sharename 1
  ```

If a symbolic link is created inside a shared folder on the host and the installed Guest Additions do not support symbolic links then the guest will see the target of the symlink as a file inside the shared folder. For example, if a symlink is created to a file on a Linux host:

```
$ cd /SharedFolder && ln -s filename symlink-to-filename
```

When the shared folder is viewed on a Windows guest there will be two identical files listed, filename and symlink-to-filename.

7.3.1 Manual Mounting

You can mount the shared folder from inside a VM, in the same way as you would mount an ordinary network share:

- In a Windows guest, shared folders are browseable and therefore visible in Windows Explorer. To attach the host's shared folder to your Windows guest, open Windows Explorer and look for the folder in **My Networking Places**, **Entire Network**, **Oracle VirtualBox Shared Folders**. By right-clicking on a shared folder and selecting **Map Network Drive** from the menu that pops up, you can assign a drive letter to that shared folder.

  Alternatively, on the Windows command line, use the following command:

  ```
  net use x: \\vboxsvr\sharename
  ```

  While vboxsvr is a fixed name, note that vboxsrv would also work, replace *x:* with the drive letter that you want to use for the share, and *sharename* with the share name specified with VBoxManage.
- In a Linux guest, use the following command:

  ```
  mount -t vboxsf [-o OPTIONS] sharename mountpoint
  ```

  To mount a shared folder during boot, add the following entry to /etc/fstab:

  ```
  sharename   mountpoint   vboxsf   defaults 0   0
  ```
- In a Oracle Solaris guest, use the following command:

  ```
  mount -F vboxfs [-o OPTIONS] sharename mountpoint
  ```

  Replace *sharename*, use a lowercase string, with the share name specified with VBoxManage or VirtualBox Manager. Replace *mountpoint* with the path where you want the share to be mounted on the guest, such as /mnt/share. The usual mount rules apply. For example, create this directory first if it does not exist yet.

  Here is an example of mounting the shared folder for the user jack on Oracle Solaris:

  ```
  $ id
  uid=5000(jack) gid=1(other)
  $ mkdir /export/home/jack/mount
  $ pfexec mount -F vboxfs -o uid=5000,gid=1 jackshare /export/home/jack/mount
  $ cd ~/mount
  $ ls
  sharedfile1.mp3 sharedfile2.txt
  $
  ```

  Beyond the standard options supplied by the mount command, the following are available:

  ```
  iocharset CHARSET
  ```

  This option sets the character set used for I/O operations. Note that on Linux guests, if the iocharset option is not specified, then the Guest Additions driver will attempt to use the character set specified by the CONFIG_NLS_DEFAULT kernel option. If this option is not set either, then UTF-8 is used.

  ```
  convertcp CHARSET
  ```

  This option specifies the character set used for the shared folder name. This is UTF-8 by default.

  The generic mount options, documented in the mount manual page, apply also. Especially useful are the options uid, gid and mode, as they can allow access by normal users in read/write mode, depending on the settings, even if root has mounted the filesystem.
- In an OS/2 guest, use the VBoxControl command to manage shared folders. For example:

```
VBoxControl sharedfolder use D: MyShareName
VBoxControl sharedfolder unuse D:
VBoxControl sharedfolder list
```

As with Windows guests, shared folders can also be accessed using UNC , with \\VBoxSF\, \\VBoxSvr\ or \\VBoxSrv\ as the server name and the shared folder name as *sharename*.

7.3.2 Automatic Mounting

Oracle VirtualBox provides the option to mount shared folders automatically. When automatic mounting is enabled for a shared folder, the Guest Additions service will mount it for you automatically. For Windows or OS/2, a preferred drive letter can also be specified. For Linux or Oracle Solaris, a mount point directory can also be specified.

If a drive letter or mount point is not specified, or is in use already, an alternative location is found by the Guest Additions service. The service searches for an alternative location depending on the guest OS, as follows:

- **Windows and OS/2 guests.** Search for a free drive letter, starting at Z:. If all drive letters are assigned, the folder is not mounted.
- **Linux and Oracle Solaris guests.** Folders are mounted under the /media directory. The folder name is normalized (no spaces, slashes or colons) and is prefixed with sf_.

  For example, if you have a shared folder called myfiles, it will appear as /media/sf_myfiles in the guest.

  The guest properties /VirtualBox/GuestAdd/SharedFolders/MountDir and the more generic /VirtualBox/GuestAdd/SharedFolders/MountPrefix can be used to override the automatic mount directory and prefix. See *7.8 Guest Properties on page 118*.

Access to an automatically mounted shared folder is granted to everyone in a Windows guest, including the guest user. For Linux and Oracle Solaris guests, access is restricted to members of the group vboxsf and the root user.

7.4 Clipboard

Oracle VirtualBox enables you to copy text, image and html content from the GUI on the host to the GUI on a VM, and vice versa. You can also copy content between VMs, with other VMs treated as other host applications when configuring the options. For this to work the latest version of the Guest Additions must be installed on the VM.

For security reasons, clipboard access can be configured at runtime on a per-VM basis either using the **Shared Clipboard** menu item in the **Devices** menu of the VM or the VBoxManage command.

The following shared clipboard settings are available:

- **Disabled**. Disables the copy feature entirely. This is the default when creating a new VM.
- **Host To Guest**. Enables copying from the host to the guest only.
- **Guest To Host**. Enables copying from the guest to the host only.
- **Bidirectional**. Enables copying in both directions: from the host to the guest, and from the guest to the host.
- **Enable Clipboard File Transfers**. Allows files (in addition to text, images and html) to be copied to or from the VM.

- On Linux hosts and guests, Shared Clipboard file transfers are limited to files only, one file per transfer. Transferring symbolic links is not supported.
- Shared Clipboard file transfers are only tested and supported with the official default file managers of the guest and host operating systems.

To use the VBoxManage command to control the current clipboard mode, see *15 VBoxManage on page 271*. The modifyvm and controlvm commands enable setting of a VM's current clipboard mode from the command line.

7.5 Drag and Drop

Oracle VirtualBox enables you to drag and drop content from the host to the guest, and vice versa. For this to work the latest version of the Guest Additions must be installed on the guest.

Drag and drop transparently allows copying or opening files, directories, and even certain clipboard formats from one end to the other. For example, from the host to the guest or from the guest to the host. You then can perform drag and drop operations between the host and a VM, as it would be a native drag and drop operation on the host OS.

At the moment drag and drop is implemented for Windows-based and X Window-based systems, both on the host and guest side. As X Window supports many different drag and drop protocols only the most common one, XDND, is supported for now. Applications using other protocols, such as Motif or OffiX, will not be recognized by Oracle VirtualBox.

In the context of using drag and drop, the origin of the data is called the *source*. That is, where the actual data comes from and is specified. The *destination* specifies where the data from the source should go to. Transferring data from the source to the destination can be done in various ways, such as copying, moving, or linking.

Note:

At the moment only copying of data is supported. Moving or linking is not yet implemented.

When transferring data from the host to the guest OS, the host in this case is the source, whereas the guest OS is the destination. However, when transferring data from the guest OS to the host, the guest OS this time became the source and the host is the destination.

For security reasons drag and drop can be configured at runtime on a per-VM basis either using the **Drag and Drop** menu item in the **Devices** menu of the virtual machine, or the VBoxManage command.

On Windows hosts, dragging content between UAC-elevated (User Account Control) programs and non UAC-elevated programs isn't allowed. For example, if you start Oracle VirtualBox with Administrator privileges then dragging to or from Windows Explorer, which runs with regular user privileges by default, is not possible.

The following drag and drop modes are available:

- **Disabled.** Disables the drag and drop feature entirely. This is the default when creating a new VM.
- **Host To Guest.** Enables drag and drop operations from the host to the guest only.
- **Guest To Host.** Enables drag and drop operations from the guest to the host only.

- **Bidirectional.** Enables drag and drop operations in both directions: from the host to the guest, and from the guest to the host.

> **Note:**
>
> Drag and drop support depends on the frontend being used. At the moment, only the VirtualBox Manager frontend provides this functionality.

To use the VBoxManage command to control the current drag and drop mode, see *15 VBoxManage on page 271*. The modifyvm and controlvm commands enable setting of a VM's current drag and drop mode from the command line.

7.5.1 Supported Formats

As Oracle VirtualBox can run on a variety of host operating systems and also supports a wide range of guests, certain data formats must be translated after transfer. This is so that the destination operating system, which receives the data, is able to handle them in an appropriate manner.

> **Note:**
>
> When dragging files no data conversion is done in any way. For example, when transferring a file from a Linux guest to a Windows host the Linux-specific line endings are not converted to Windows line endings.

The following formats are handled by the Oracle VirtualBox drag and drop service:

- **Plain text:** From applications such as text editors, internet browsers and terminal windows.
- **Files:** From file managers such as Windows Explorer, Nautilus, and Finder.
- **Directories:** For directories, the same formats apply as for files.

7.6 Hardware-Accelerated Graphics

The Oracle VirtualBox Guest Additions contain hardware 3D support for Windows, Linux, and Oracle Solaris guests. Video decoding acceleration is also used if the host can use it.

With this feature, if an application inside your virtual machine uses 3D features through the OpenGL or Direct3D programming interfaces, instead of emulating them in software, which would be slow, Oracle VirtualBox will attempt to use your host's 3D hardware. This works for all supported host platforms, provided that your host operating system can make use of your accelerated 3D hardware in the first place. The Guest Additions must be installed on your VM.

The 3D acceleration feature is only available for certain Windows, Linux, and Oracle Solaris guests:

- 3D acceleration with Windows guests requires Windows Vista or later. Vista and Windows 7 guests have Direct3D 9, Windows 8 and newer guests have Direct3D 11.0 or 11.1 depending on the host capabilities. Windows guests also have OpenGL 4.1 support.
- Linux guests have OpenGL 4.1 support with Mesa3D drivers. OpenGL on Linux requires kernel 2.6.27 or later, as well as X.org server version 1.5 or later. Ubuntu 10.10 and Fedora 14 have been tested and confirmed as working.

- OpenGL on Oracle Solaris guests requires X.org server version 1.5 or later.

The video decoding feature is available if the host is x86_64 running Windows or Linux, and the VM is x86_64 running Windows 10 or Windows 11. The VM can use video decoding of all media formats that are supported by the host, and CPU load is reduced during playback of these media formats.

On Linux hosts, you must have one of the following graphics drivers, with Vulkan 1.3 or later, to use video decoding:

- NVIDIA Linux Graphics Driver
- Mesa 3D Driver, for AMD and Intel graphics hardware

Video decoding capabilities are disabled by default in Mesa 3D drivers (AMD and Intel), so you must set the following environment variables on the host:

Intel: `export ANV_VIDEO_DECODE=1`

AMD: `export RADV_PERFTEST=video_decode`

7.7 Seamless Windows

With seamless windows enabled, Oracle VirtualBox enlarges the size of the VM's display to the size of the host desktop, and masks out the guest OS's background, so the windows of the guest appear seamlessly next to the windows of the host.

In *Figure 2: Seamless Windows on a Host Desktop on page 117* you can see two calculator applications side by side, one running on the host and the other running on the VM.

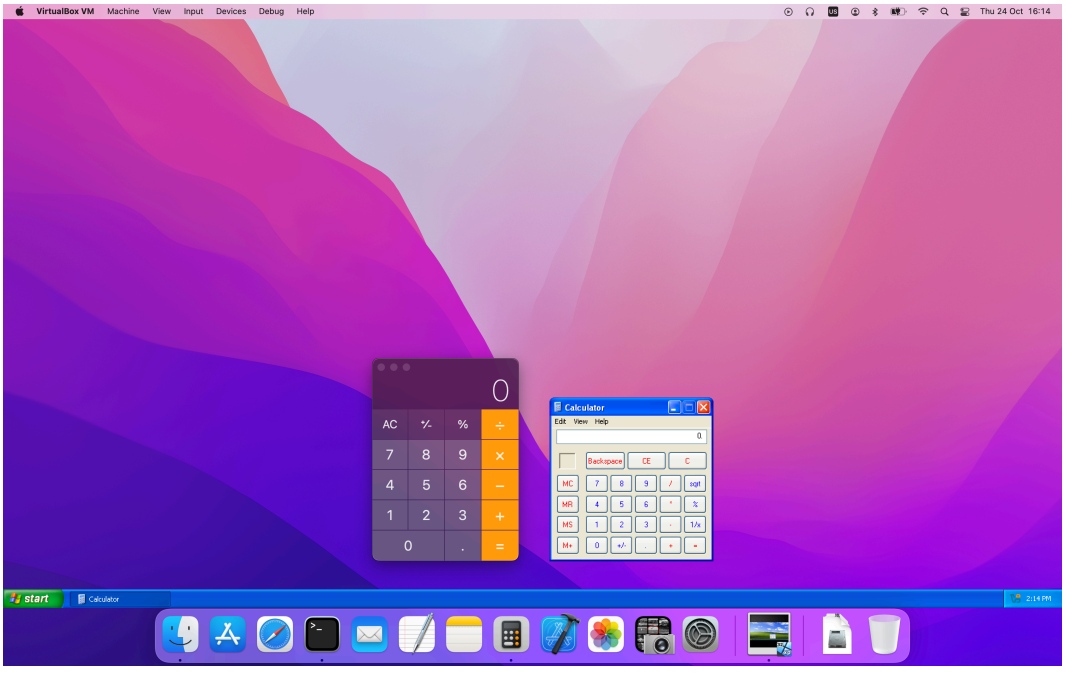


Figure 2: Seamless Windows on a Host Desktop

To enable seamless windows, on the virtual machine, press the **Host key + L**. The Host key is displayed on the taskbar and is normally the right control key.

To disable seamless windows and go back to the normal VM display, press the **Host key + L** again.

7.8 Guest Properties

Oracle VirtualBox enables requests of some properties from a running guest, provided that the Oracle VirtualBox Guest Additions are installed and the VM is running. This provides the following advantages:

- A number of predefined VM characteristics are automatically maintained by Oracle VirtualBox and can be retrieved on the host. For example, to monitor VM performance and statistics.
- Arbitrary string data can be exchanged between guest and host. This works in both directions.

To accomplish this, Oracle VirtualBox establishes a private communication channel between the Oracle VirtualBox Guest Additions and the host, and software on both sides can use this channel to exchange string data for arbitrary purposes. Guest properties are simply string keys to which a value is attached. They can be set, or written to, by either the host and the guest. They can also be read from both sides.

In addition to establishing the general mechanism of reading and writing values, a set of predefined guest properties is automatically maintained by the Oracle VirtualBox Guest Additions to allow for retrieving interesting guest data such as the guest's exact operating system and service pack level, the installed version of the Guest Additions, users that are currently logged into the guest OS, network statistics and more. These predefined properties are all prefixed with `/VirtualBox/` and organized into a hierarchical tree of keys.

Some of this runtime information is shown when you select **Session Information Dialog** from a virtual machine's **Machine** menu.

A more flexible way to use this channel is with the VBoxManage guestproperty command. See *15.25 VBoxManage guestproperty on page 373*. For example, to have *all* the available guest properties for a given running VM listed with their respective values, use this command:

```
$ VBoxManage guestproperty enumerate "Windows Vista III"
Name: /VirtualBox/GuestInfo/OS/Product, value: Windows Vista Business Edition,
   timestamp: 1229098278843087000, flags:
Name: /VirtualBox/GuestInfo/OS/Release, value: 6.0.6001,
   timestamp: 1229098278950553000, flags:
Name: /VirtualBox/GuestInfo/OS/ServicePack, value: 1,
   timestamp: 1229098279122627000, flags:
Name: /VirtualBox/GuestAdd/InstallDir,
   value: C:/Program Files/Oracle/VirtualBox
   Guest Additions, timestamp: 1229098279269739000, flags:
Name: /VirtualBox/GuestAdd/Revision, value: 40720,
   timestamp: 1229098279345664000, flags:
Name: /VirtualBox/GuestAdd/Version, value: version-number,
   timestamp: 1229098279479515000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxControl.exe, value: version-numberr40720,
   timestamp: 1229098279651731000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxHook.dll, value: version-numberr40720,
   timestamp: 1229098279804835000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxDisp.dll, value: version-numberr40720,
   timestamp: 1229098279880611000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxMRXNP.dll, value: version-numberr40720,
   timestamp: 1229098279882618000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxService.exe, value: version-numberr40720,
   timestamp: 1229098279883195000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxTray.exe, value: version-numberr40720,
   timestamp: 1229098279885027000, flags:
```

```
Name: /VirtualBox/GuestAdd/Components/VBoxGuest.sys, value: version-numberr40720,
   timestamp: 1229098279886838000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxMouse.sys, value: version-numberr40720,
   timestamp: 1229098279890600000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxSF.sys, value: version-numberr40720,
   timestamp: 1229098279893056000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxVideo.sys, value: version-numberr40720,
   timestamp: 1229098279895767000, flags:
Name: /VirtualBox/GuestInfo/OS/LoggedInUsers, value: 1,
   timestamp: 1229099826317660000, flags:
Name: /VirtualBox/GuestInfo/OS/NoLoggedInUsers, value: false,
   timestamp: 1229098455580553000, flags:
Name: /VirtualBox/GuestInfo/Net/Count, value: 1,
   timestamp: 1229099826299785000, flags:
Name: /VirtualBox/HostInfo/GUI/LanguageID, value: C,
   timestamp: 1229098151272771000, flags:
Name: /VirtualBox/GuestInfo/Net/0/V4/IP, value: 192.168.2.102,
   timestamp: 1229099826300088000, flags:
Name: /VirtualBox/GuestInfo/Net/0/V4/Broadcast, value: 255.255.255.255,
   timestamp: 1229099826300220000, flags:
Name: /VirtualBox/GuestInfo/Net/0/V4/Netmask, value: 255.255.255.0,
   timestamp: 1229099826300350000, flags:
Name: /VirtualBox/GuestInfo/Net/0/Status, value: Up,
   timestamp: 1229099826300524000, flags:
Name: /VirtualBox/GuestInfo/OS/LoggedInUsersList, value: username,
   timestamp: 1229099826317386000, flags:
```

To query the value of a single property, use the `get` subcommand as follows:

```
$ VBoxManage guestproperty get "Windows Vista III" "/VirtualBox/GuestInfo/OS/Product"
Value: Windows Vista Business Edition
```

To add or change guest properties from the guest, use the tool `VBoxControl`. This tool is included in the Guest Additions. When started from a Linux guest, this tool requires root privileges for security reasons.

```
$ sudo VBoxControl guestproperty enumerate
Oracle VirtualBox Guest Additions Command Line Management Interface Version version-number
Copyright (C) 2005-2025 Oracle and/or its affiliates

Name: /VirtualBox/GuestInfo/OS/Release, value: 2.6.28-18-generic,
   timestamp: 1265813265835667000, flags: <NULL>
Name: /VirtualBox/GuestInfo/OS/Version, value: #59-Ubuntu SMP Thu Jan 28 01:23:03 UTC 2010,
   timestamp: 1265813265836305000, flags: <NULL>
     ...
```

For more complex needs, you can use the Oracle VirtualBox programming interfaces. See *Oracle VirtualBox Programming Interfaces*.

7.8.1 Using Guest Properties to Wait on VM Events

The properties `/VirtualBox/HostInfo/VBoxVer`, `/VirtualBox/HostInfo/VBoxVerExt` or `/VirtualBox/HostInfo/VBoxRev` can be waited on to detect that the VM state was restored from saved state or snapshot:

```
$ VBoxControl guestproperty wait /VirtualBox/HostInfo/VBoxVer
```

Similarly the `/VirtualBox/HostInfo/ResumeCounter` can be used to detect that a VM was resumed from the paused state or saved state.

7.9 Guest Control File Manager

If you have Guest Additions installed, you can use the Guest Control File Manager to copy files between a virtual machine (VM) and the host system. You can also create new folders, rename files and delete files.

This feature is useful when the VM window of a guest is not visible. For example, when the guest is running in headless mode.

> **Note:**
>
> To use the Guest Control File Manager, the guest must be running. For powered-off guests, it is disabled automatically.

7.9.1 Transferring Files

To use the Guest Control File Manager to transfer files, follow these steps.

1. Ensure you have the username and password for an account on the guest system, with appropriate permissions on the files you need to access.
2. Open the Guest Control File Manager. Do either of the following:
   - In the guest VM, select **Machine**, **File Manager**.
   - In VirtualBox Manager, **Machines** list, click the machine name, and then select **File Manager**.

   The **Host File System** pane shows the files on the host system.
3. In the **Guest File System** pane, enter the **User Name** and **Password** for the user you want to log in as.

   Click **Open Session**.

   The VM file system appears in the **Guest File System** pane.
4. To transfer from the VM to the host, select the file(s) and click **Copy From Guest to Host**.

   To transfer from the host to the VM, select the file(s) and click **Copy From Host to Guest**.
5. Check the progress of the transfer in the **Operations** pane.
6. Click **Close** to end the guest session and the Guest Control File Manager.

7.10 Guest Control of Applications

The Guest Additions enable starting of applications inside a guest VM from the host system. This feature can be used to automate deployment of software within the guest.

For this to work, the application needs to be installed on the guest. No additional software needs to be installed on the host. Additionally, text mode output to stdout and stderr can be shown on the host for further processing. There are options to specify user credentials and a timeout value, in milliseconds, to limit the time the application is able to run.

The Guest Additions for Windows allow for automatic updating. This applies for already installed Guest Additions versions. Also, copying files from host to the guest as well as remotely creating guest directories is available.

To use these features, use the Oracle VirtualBox command line. See *15.24 VBoxManage guestcontrol on page 360*.

7.11 Memory Overcommitment

In server environments with many VMs, the Guest Additions can be used to share physical host memory between several VMs. This reduces the total amount of memory in use by the VMs. If memory usage is the limiting factor and CPU resources are still available, this can help with running more VMs on each host.

7.11.1 Memory Ballooning

The Guest Additions can change the amount of host memory that a VM uses, while the machine is running. Because of how this is implemented, this feature is called *memory ballooning*.

Note:

- Oracle VirtualBox supports memory ballooning only on 64-bit hosts. It is not supported on macOS hosts.
- Memory ballooning does not work well with large pages enabled. To turn off large pages support for a VM, run VBoxManage modifyvm *vmname* --large-pages off

Normally, to change the amount of memory allocated to a virtual machine, you have to shut down the virtual machine entirely and modify its settings. With memory ballooning, memory that was allocated for a virtual machine can be given to another virtual machine without having to shut the machine down.

When memory ballooning is requested, the Oracle VirtualBox Guest Additions, which run inside the guest, allocate physical memory from the guest operating system on the kernel level and lock this memory down in the guest. This ensures that the guest will not use that memory any longer. No guest applications can allocate it, and the guest kernel will not use it either. Oracle VirtualBox can then reuse this memory and give it to another virtual machine.

The memory made available through the ballooning mechanism is only available for reuse by Oracle VirtualBox. It is *not* returned as free memory to the host. Requesting balloon memory from a running guest will therefore not increase the amount of free, unallocated memory on the host. Effectively, memory ballooning is therefore a memory overcommitment mechanism for multiple virtual machines while they are running. This can be useful to temporarily start another machine, or in more complicated environments, for sophisticated memory management of many virtual machines that may be running in parallel depending on how memory is used by the guests.

At this time, memory ballooning is only supported through VBoxManage. Use the following command to increase or decrease the size of the memory balloon within a running virtual machine that has Guest Additions installed:

```
VBoxManage controlvm "VM name" guestmemoryballoon n
```

where *VM name* is the name or UUID of the virtual machine in question and *n* is the amount of memory to allocate from the guest in megabytes. See *15.12 VBoxManage controlvm on page 309*.

You can also set a default balloon that will automatically be requested from the VM every time after it has started up with the following command:

```
VBoxManage modifyvm "VM name" --guest-memory-balloon n
```

By default, no balloon memory is allocated. This is a VM setting, like other modifyvm settings, and therefore can only be set while the machine is shut down. See *15.35 VBoxManage modifyvm on page 402*.

7.11.2 Page Fusion

Whereas memory ballooning simply reduces the amount of RAM that is available to a VM, Page Fusion works differently. It avoids memory duplication between several similar running VMs.

In a server environment running several similar VMs on the same host, lots of memory pages are identical. For example, if the VMs are using identical operating systems. Oracle VirtualBox's Page Fusion technology can efficiently identify these identical memory pages and share them between multiple VMs.

> **Note:**
>
> Oracle VirtualBox supports Page Fusion only on 64-bit hosts, and it is not supported on macOS hosts. Page Fusion currently works only with Windows 2000 and later guests.

The more similar the VMs on a given host are, the more efficiently Page Fusion can reduce the amount of host memory that is in use. It therefore works best if all VMs on a host run identical operating systems. Instead of having a complete copy of each operating system in each VM, Page Fusion identifies the identical memory pages in use by these operating systems and eliminates the duplicates, sharing host memory between several machines. This is called *deduplication*. If a VM tries to modify a page that has been shared with other VMs, a new page is allocated again for that VM with a copy of the shared page. This is called *copy on write*. All this is fully transparent to the virtual machine.

You may be familiar with this kind of memory overcommitment from other hypervisor products, which call this feature *page sharing* or *same page merging*. However, Page Fusion differs significantly from those other solutions, whose approaches have several drawbacks:

- Traditional hypervisors scan *all* guest memory and compute checksums, also called hashes, for every single memory page. Then, they look for pages with identical hashes and compare the entire content of those pages. If two pages produce the same hash, it is very likely that the pages are identical in content. This process can take rather long, especially if the system is not idling. As a result, the additional memory only becomes available after a significant amount of time, such as hours or sometimes days. Even worse, this kind of page sharing algorithm generally consumes significant CPU resources and increases the virtualization overhead by 10 to 20%.

  Page Fusion in Oracle VirtualBox uses logic in the Oracle VirtualBox Guest Additions to quickly identify memory cells that are most likely identical across VMs. It can therefore achieve most of the possible savings of page sharing almost immediately and with almost no overhead.
- Page Fusion is also much less likely to be confused by identical memory that it will eliminate, just to learn seconds later that the memory will now change and having to perform a highly expensive and often service-disrupting reallocation.

At this time, Page Fusion can only be controlled with VBoxManage, and only while a VM is shut down. To enable Page Fusion for a VM, use the following command:

```
VBoxManage modifyvm "VM name" --page-fusion on
```

You can observe Page Fusion operation using some metrics. RAM/VMM/Shared shows the total amount of fused pages, whereas the per-VM metric Guest/RAM/Usage/Shared will return the amount of fused memory for a given VM. See *15.32 VBoxManage metrics on page 393* for information on how to query metrics.

Note:

Enabling Page Fusion might indirectly increase the chances for malicious guests to successfully attack other VMs running on the same host. See *Potentially Insecure Operations*.

7.12 Controlling Virtual Monitor Topology

7.12.1 X11/XWayland Desktop Environments

The Guest Additions provide services for controlling the guest system's monitor topology. Monitor topology means the resolution of each virtual monitor and its state (disabled/enabled). The resolution of a virtual monitor can be modified on the VM by using the **View** menu, or from the host side by resizing the window that hosts the virtual monitor, or the VBoxManage controlvm *vmname* setscreenlayout command. See *15.12.2.34 Specify the Screen Layout for a Display on the Guest VM on page 318*. Screens enabled must be contiguous or the command will have no effect.

On guest operating systems with X11/XWayland desktops this is put into effect by any of the following services:

```
VBoxClient --vmsvga
```

```
VBoxClient --vmsvga-session
```

```
VBoxDRMClient
```

On X11/XWayland desktops the resizing service is started during desktop session initialization, that is desktop login. On X11 desktops VBoxClient --vmsvga handles screen topology through the RandR extension. On XWayland clients VBoxDRMClient is used. The decision is made automatically at each desktop session start.

On 32-bit guest operating systems VBoxDRMClient is always used, in order to work around bugs.

8 Virtual Storage

As the virtual machine will most probably expect to see a hard disk built into its virtual computer, Oracle VirtualBox must be able to present real storage to the guest as a virtual hard disk. There are presently three methods by which to achieve this:

- Oracle VirtualBox can use large image files on a real hard disk and present them to a guest as a virtual hard disk. This is the most common method, described in *8.2 Disk Image Files (VDI, VMDK, VHD, HDD) on page 128*.
- iSCSI storage servers can be attached to Oracle VirtualBox. This is described in *8.10 iSCSI Servers on page 138*.
- You can allow a virtual machine to access one of your host disks directly. This is an advanced feature, described in *Using a Raw Host Hard Disk From a Guest*.

Each such virtual storage device, such as an image file, iSCSI target, or physical hard disk, needs to be connected to the virtual hard disk controller that Oracle VirtualBox presents to a virtual machine. This is explained in the next section.

8.1 Hard Disk Controllers

In a computing device, hard disks and CD/DVD drives are connected to a device called a hard disk controller, which drives hard disk operation and data transfers. Oracle VirtualBox can emulate the most common types of hard disk controllers typically found in computing devices: IDE, SATA (AHCI), SCSI, SAS, USB-based, and NVMe mass storage devices.

- **IDE (ATA)** controllers are a backward-compatible yet very advanced extension of the disk controller in the IBM PC/AT (1984). Initially, this interface worked only with hard disks, but was later extended to also support CD-ROM drives and other types of removable media. In physical PCs, this standard uses flat ribbon parallel cables with 40 or 80 wires. Each such cable can connect two devices, called device 0 and device 1, to a controller. Typical PCs had two connectors for such cables. As a result, support for up to four IDE devices was most common: primary device 0, primary device 1, secondary device 0, and secondary device 1.

  In Oracle VirtualBox, each virtual machine may have one IDE controller enabled, which gives you up to four virtual storage devices that you can attach to the machine. By default, one of these virtual storage devices, device 0 on the secondary channel, is preconfigured to be the virtual machine's virtual CD/DVD drive. However, you can change the default setting.

  Even if your guest OS has no support for SCSI or SATA devices, it should always be able to see an IDE controller.

  You can also select which exact type of IDE controller hardware Oracle VirtualBox should present to the virtual machine: PIIX3, PIIX4, or ICH6. This makes no difference in terms of performance, but if you import a virtual machine from another virtualization product, the OS in that machine may expect a particular controller type and crash if it is not found.

  After you have created a new virtual machine in VirtualBox Manager, you will typically see one IDE controller in the machine's **Storage** settings. The virtual CD/DVD drive will be attached to one of the four ports of this controller.
- **Serial ATA (SATA)** is a more recent standard than IDE. Compared to IDE, it supports both much higher speeds and more devices per controller. Also, with physical hardware, devices

can be added and removed while the system is running. The standard interface for SATA controllers is called Advanced Host Controller Interface (AHCI).

Like a real SATA controller, Oracle VirtualBox's virtual SATA controller operates faster and also consumes fewer CPU resources than the virtual IDE controller. Also, this enables you to connect up to 30 virtual hard disks to one machine instead of just three, when compared to the Oracle VirtualBox IDE controller with a DVD drive attached.

For this reason, depending on the selected guest OS, Oracle VirtualBox uses SATA as the default for newly created virtual machines. One virtual SATA controller is created by default, and the default disk that is created with a new VM is attached to this controller.

Note:

The entire SATA controller and the virtual disks attached to it, including those in IDE compatibility mode, will not be seen by OSes that do not have device support for AHCI. In particular, *there is no support for AHCI in Windows versions before Windows Vista*. Legacy Windows versions such as Windows XP, even with SP3 installed, will not see such disks unless you install additional drivers. It is possible to switch from IDE to SATA after installation by installing the SATA drivers and changing the controller type in the VM **Settings** window.

Oracle VirtualBox recommends the Intel Matrix Storage drivers, which can be downloaded from http://downloadcenter.intel.com/Product_Filter.aspx?ProductID=2101.

To add a SATA controller to a machine for which it has not been enabled by default, either because it was created by an earlier version of Oracle VirtualBox, or because SATA is not supported by default by the selected guest OS, do the following. Go to the **Storage** page of the machine's **Settings** window, click **Add Controller** under the Storage Tree box and then select **Add SATA Controller**. The new controller appears as a separate PCI device in the virtual machine, and you can add virtual disks to it.

To change the IDE compatibility mode settings for the SATA controller, see *15.49 VBoxManage storagectl on page 454*.

- **SCSI** is another established industry standard, standing for Small Computer System Interface. SCSI is as a generic interface for data transfer between all kinds of devices, including storage devices. SCSI is still used for connecting some hard disks and tape devices, but it has mostly been displaced in commodity hardware. It is still in common use in high-performance workstations and servers.

  Primarily for compatibility with other virtualization software, Oracle VirtualBox optionally supports LSI Logic and BusLogic SCSI controllers, to each of which up to fifteen virtual hard disks can be attached.

  To enable a SCSI controller, on the **Storage** page of a virtual machine's **Settings** window, click **Add Controller** under the Storage Tree box and then select **Add SCSI Controller**. The new controller appears as a separate PCI device in the virtual machine.

  Note:

  As with the other controller types, a SCSI controller will only be seen by OSes with device support for it. Windows 2003 and later ships with drivers for the LSI Logic controller, while Windows NT 4.0 and Windows 2000 ships with drivers for the BusLogic controller. Windows XP ships with drivers for neither.

- **Serial Attached SCSI (SAS)** is another bus standard which uses the SCSI command set. As opposed to SCSI physical devices, serial cables are used instead of parallel cables. This simplifies physical device connections. In some ways, therefore, SAS is to SCSI what SATA is to IDE: it enables more reliable and faster connections.

  To support high-end guests which require SAS controllers, Oracle VirtualBox emulates a LSI Logic SAS controller, which can be enabled much the same way as a SCSI controller. At this time, up to 255 devices can be connected to the SAS controller.

  > **Note:**
  >
  > As with SATA, the SAS controller will only be seen by OSes with device support for it. In particular, *there is no support for SAS in Windows before Windows Vista*. So Windows XP, even SP3, will not see such disks unless you install additional drivers.

- The **USB mass storage device class** is a standard to connect external storage devices like hard disks or flash drives to a host through USB. All major OSes support these devices and ship generic drivers making third-party drivers superfluous. In particular, legacy OSes without support for SATA controllers may benefit from USB mass storage devices.

  The virtual USB storage controller offered by Oracle VirtualBox works differently to the other storage controller types. While most storage controllers appear as a single PCI device to the guest with multiple disks attached to it, the USB-based storage controller does not appear as virtual storage controller. Each disk attached to the controller appears as a dedicated USB device to the guest.

  > **Note:**
  >
  > Booting from drives attached using USB is only supported when EFI is used as the BIOS lacks USB support.

- **Non volatile memory express (NVMe)** is a standard for connecting non volatile memory (NVM) directly over PCI Express to lift the bandwidth limitation of the previously used SATA protocol for solid-state devices. Unlike other standards the command set is very simple in order to achieve maximum throughput and is not compatible with ATA or SCSI. OSes need to support NVMe devices to make use of them. For example, Windows 8.1 added native NVMe support. For Windows 7, native support was added with an update.

  > **Note:**
  >
  > Booting from drives attached using NVMe is only supported when EFI is used as the BIOS lacks the appropriate driver.

In summary, Oracle VirtualBox gives you the following categories of virtual storage slots:

- Four slots attached to the traditional IDE controller, which are always present. One of these is typically a virtual CD/DVD drive.
- 30 slots attached to the SATA controller, if enabled and supported by the guest OS.
- 15 slots attached to the SCSI controller, if enabled and supported by the guest OS.
- Up to 255 slots attached to the SAS controller, if enabled and supported by the guest OS.
- Eight slots attached to the virtual USB controller, if enabled and supported by the guest OS.
- Up to 255 slots attached to the NVMe controller, if enabled and supported by the guest OS.

Given this large choice of storage controllers, you may not know which one to choose. In general, you should avoid IDE unless it is the only controller supported by your guest. Whether you use SATA, SCSI, or SAS does not make any real difference. The variety of controllers is only supplied by Oracle VirtualBox for compatibility with existing hardware and other hypervisors.

8.2 Disk Image Files (VDI, VMDK, VHD, HDD)

Disk image files reside on the host system and are seen by the guest systems as hard disks of a certain geometry. When a guest OS reads from or writes to a hard disk, Oracle VirtualBox redirects the request to the image file.

Like a physical disk, a virtual disk has a size, or capacity, which must be specified when the image file is created. As opposed to a physical disk however, Oracle VirtualBox enables you to expand an image file after creation, even if it has data already. See *15.33 VBoxManage modifymedium on page 397*.

Oracle VirtualBox supports the following types of disk image files:

- **VDI.** Normally, Oracle VirtualBox uses its own container format for guest hard disks. This is called a Virtual Disk Image (VDI) file. This format is used when you create a new virtual machine with a new disk.
- **VMDK.** Oracle VirtualBox also fully supports the popular and open VMDK container format that is used by many other virtualization products, such as VMware.
- **VHD.** Oracle VirtualBox also fully supports the VHD format used by Microsoft.
- **HDD.** Image files of Parallels version 2 (HDD format) are also supported.

  Due to lack of documentation of the format, newer versions such as 3 and 4 are not supported. You can however convert such image files to version 2 format using tools provided by Parallels.

Irrespective of the disk capacity and format, as mentioned in *4 Creating a New Virtual Machine on page 47*, there are two options for creating a disk image: fixed-size or dynamically allocated.

- **Fixed-size.** If you create a fixed-size image, an image file will be created on your host system which has roughly the same size as the virtual disk's capacity. So, for a 10 GB disk, you will have a 10 GB file. Note that the creation of a fixed-size image can take a long time depending on the size of the image and the write performance of your hard disk.
- **Dynamically allocated.** For more flexible storage management, use a dynamically allocated image. This will initially be very small and not occupy any space for unused virtual disk sectors, but will grow every time a disk sector is written to for the first time, until the drive reaches the maximum capacity chosen when the drive was created. While this format takes less space initially, the fact that Oracle VirtualBox needs to expand the image file consumes additional computing resources, so until the disk file size has stabilized, write operations may be slower than with fixed size disks. However, after a time the rate of growth will slow and the average penalty for write operations will be negligible.

8.3 The Virtual Media Manager

Oracle VirtualBox keeps track of all the hard disk, CD/DVD-ROM, and floppy disk images which are in use by virtual machines. These are often referred to as *known media* and come from two sources:

- All media currently attached to virtual machines.
- Registered media, for compatibility with legacy Oracle VirtualBox versions.

To view and change the known media, click **Media** in VirtualBox Manager.

The known media are conveniently grouped in separate tabs for the supported formats. These formats are:

- Hard disk images, either in Oracle VirtualBox's own Virtual Disk Image (VDI) format, or in the third-party formats listed in *8.2 Disk Image Files (VDI, VMDK, VHD, HDD) on page 128*.
- CD/DVD images in standard ISO format.
- Floppy images in standard RAW format.

For each image, the Virtual Media Manager shows you the full path of the image file and other information, such as the virtual machine the image is currently attached to.

The Virtual Media Manager enables you to do the following:

- **Add** an image to the known media.
- **Create** a new disk image.
  - For hard disks, the **Create Virtual Hard Disk** wizard is shown. See *8.3.1 Creating a Virtual Hard Disk Image on page 130*.
  - For optical disks, the **VISO Creator** tool is shown. See *8.3.2 Creating a Virtual Optical Disk Image on page 131*.
  - For floppy disks, the **Floppy Disk Creator** tool is shown. See *8.3.3 Creating a Virtual Floppy Disk Image on page 131*.
- **Copy** an image to create another one.

  For virtual hard disks, you can specify one of the following target types: VDI, VHD, or VMDK.
- **Move** an image to another location.

  A file dialog prompts you for the new image file location.

  When you use the Virtual Media Manager to move a disk image, Oracle VirtualBox updates all related configuration files automatically.

  Note:

  Always use the Virtual Media Manager or the VBoxManage modifymedium command to move a disk image.

  If you use a file management feature of the host OS to move a disk image to a new location, run the VBoxManage modifymedium --setlocation command to configure the new path of the disk image on the host file system. This command updates the Oracle VirtualBox configuration automatically.
- **Remove** an image from the known media. You can optionally delete the image file when removing the image.
- **Release** an image to detach it from a VM. This action only applies if the image is currently attached to a VM as a virtual hard disk.
- **Clear** all inaccessible disk images from the list. The disk images are released from the VMs they are attached to and removed from the known media.

> **Note:**
>
> This option is for optical disks and floppy disks only.

- **Search** for an image by name or UUID.
- View and edit the **Properties** of a disk image.

  Available properties include the following:

  - **Type:** Specifies the snapshot behavior of the disk. See *8.4 Special Image Write Modes on page 132*.
  - **Location:** Specifies the location of the disk image file on the host system. You can use a file dialog to browse for the disk image location.
  - **Description:** Specifies a short description of the disk image.
  - **Size:** Specifies the size of the disk image. You can use the slider to increase or decrease the disk image size.
  - **Information:** Specifies detailed information about the disk image.
- **Refresh** the property values of the selected disk image.

To perform these actions, highlight the medium in the Virtual Media Manager and then do one of the following:

- Click an icon in the Virtual Media Manager toolbar.
- Right-click the medium and select an option.

Use the **Storage** page in a VM's **Settings** window to create a new disk image. By default, disk images are stored in the VM's folder.

You can copy hard disk image files to other host systems and then import them in to VMs from the host system. However, some Windows guest OSes may require that you configure the new VM in a similar way to the old one.

> **Note:**
>
> Do not simply make copies of virtual disk images. If you import such a second copy into a VM, Oracle VirtualBox issues an error because Oracle VirtualBox assigns a universally unique identifier (UUID) to each disk image to ensure that it is only used one time. See *8.6 Cloning Disk Images on page 136*. Also, if you want to copy a VM to another system, use the Oracle VirtualBox import and export features. See *5.3 Importing and Exporting Virtual Machines on page 60*.

8.3.1 Creating a Virtual Hard Disk Image

1. Display the **Hard Disks** tab in Virtual Media Manager and click **Create**.
2. Select a file type for the new virtual hard disk image.
3. Select dynamically allocated or fixed size storage for the virtual hard disk.
4. Configure the location of the virtual hard disk file and use the slider to set the size limit for the virtual hard disk.

   Click **Finish** to create the virtual hard disk file.

   The virtual hard disk image is created in the specified location and added to the **Hard Disks** tab in Virtual Media Manager.

8.3.2 Creating a Virtual Optical Disk Image

Use the **VISO Creator** tool to create a virtual optical disk image from selected files on the host.

A virtual ISO (VISO) differs from a real ISO because the files remain on the host, unless you choose to copy the files to the guest. This makes a VISO faster to create and use, and you do not need guest additions. A VISO is read-only and is ideal for use as installation media or reference data.

1. Display the **Optical Disks** tab in Virtual Media Manager and click **Create**.

   The **VISO Creator** tool is shown.
2. Create the virtual ISO file.
   1. Configure the name of the ISO file.

      Click **Settings** and select the **VISO Options** tab. Enter the name in the **Viso Name** field.
   2. Add files to your virtual ISO.

      In the **Host File System** pane, select files to copy from the host system to the virtual ISO.

      Click **Add Items To VISO**. The files are displayed in the **VISO Content** pane.

      The following file operations are also available:

      - To create folders on the virtual ISO, click **Create New Directory**.
      - To remove files from the virtual ISO, select files in the **VISO Content** pane and click **Remove Items From VISO**.
      - To remove *all* files from the virtual ISO, click **Reset the VISO Content**.
      - To import *all* file content from an existing ISO into the virtual ISO, highlight the ISO file name and click **Import Selected ISO into the VISO Content**. The imported ISO is opened and content is listed in the **VISO Content** pane.

        To remove files from the imported ISO, select the files in the **Viso Content** pane and click **Remove Selected Item(s) from VISO**.
3. Create the virtual ISO image.

   Click **Save and Close**.

   A virtual ISO file with the specified name and content is created.

8.3.3 Creating a Virtual Floppy Disk Image

Use the **Floppy Disk Creator** tool to create a floppy disk image.

1. Display the **Floppy Disks** tab in Virtual Media Manager and click **Create**.

   The **Floppy Disk Creator** tool is shown.
2. Configure the following settings:

   - **File Path:** The name and location of the floppy disk image.
   - **Size:** Select from the list of supported floppy disk sizes.
   - **Format Disk as FAT 12:** This is the default format used for most floppy disks. For an unformatted disk, do not select this option.
3. Create the floppy disk image file.

   Click **Create**.

The floppy disk image is created in the specified location and added to the **Floppy Disks** tab in Virtual Media Manager.

8.4 Special Image Write Modes

For each virtual disk image supported by Oracle VirtualBox, you can determine separately how it should be affected by write operations from a virtual machine and snapshot operations. This applies to all of the aforementioned image formats (VDI, VMDK, VHD, or HDD) and irrespective of whether an image is fixed-size or dynamically allocated.

By default, images are in *normal* mode. To mark an existing image with one of the nonstandard modes listed below, use VBoxManage modifymedium. See *15.33 VBoxManage modifymedium on page 397*. Alternatively, use VBoxManage storageattach to attach the image to a VM and specify the --mtype argument. See *15.48 VBoxManage storageattach on page 448*.

The available virtual disk image modes are as follows:

- **Normal images** have no restrictions on how guests can read from and write to the disk. This is the default image mode.

  When you take a snapshot of your virtual machine as described in *5.7 Snapshots on page 65*, the state of a normal hard disk is recorded together with the snapshot, and when reverting to the snapshot, its state will be fully reset.

  The image file itself is not reset. Instead, when a snapshot is taken, Oracle VirtualBox *freezes* the image file and no longer writes to it. For the write operations from the VM, a second, *differencing* image file is created which receives only the changes to the original image. See *8.5 Differencing Images on page 134*.

  While you can attach the same normal image to more than one virtual machine, only one of these virtual machines attached to the same image file can be executed simultaneously, as otherwise there would be conflicts if several machines write to the same image file.
- **Write-through hard disks** are completely unaffected by snapshots. Their state is *not* saved when a snapshot is taken, and not restored when a snapshot is restored.
- **Shareable hard disks** are a variant of write-through hard disks. In principle they behave exactly the same. Their state is *not* saved when a snapshot is taken, and not restored when a snapshot is restored. The difference only shows if you attach such disks to several VMs. Shareable disks may be attached to several VMs which may run concurrently. This makes them suitable for use by cluster filesystems between VMs and similar applications which are explicitly prepared to access a disk concurrently. Only fixed size images can be used in this way, and dynamically allocated images are rejected.

  CAUTION:

  This is an expert feature, and misuse can lead to data loss, as regular filesystems are not prepared to handle simultaneous changes by several parties.
- **Immutable images** only remember write accesses temporarily while the virtual machine is running. All changes are lost when the virtual machine is powered on the next time. As a result, as opposed to Normal images, the same immutable image can be used with several virtual machines without restrictions.

Creating an immutable image makes little sense since it would be initially empty and lose its contents with every machine restart. You would have a disk that is always unformatted when the machine starts up. Instead, you can first create a normal image and then later mark it as immutable when you decide that the contents are useful.

If you take a snapshot of a machine with immutable images, then on every machine power-up, those images are reset to the state of the last (current) snapshot, instead of the state of the original immutable image.

Note:

As a special exception, immutable images are *not* reset if they are attached to a machine in a saved state or whose last snapshot was taken while the machine was running. This is called an *online snapshot*. As a result, if the machine's current snapshot is an online snapshot, its immutable images behave exactly like the a normal image. To reenable the automatic resetting of such images, delete the current snapshot of the machine.

Oracle VirtualBox never writes to an immutable image directly at all. All write operations from the machine are directed to a differencing image. The next time the VM is powered on, the differencing image is reset so that every time the VM starts, its immutable images have exactly the same content.

The differencing image is only reset when the machine is powered on from within Oracle VirtualBox, not when you reboot by requesting a reboot from within the machine. This is also why immutable images behave as described above when snapshots are also present, which use differencing images as well.

If the automatic discarding of the differencing image on VM startup does not fit your needs, you can turn it off using the autoreset parameter of VBoxManage modifymedium. See *15.33 VBoxManage modifymedium on page 397*.

- **Multiattach mode images** can be attached to more than one virtual machine at the same time, even if these machines are running simultaneously. For each virtual machine to which such an image is attached, a differencing image is created. As a result, data that is written to such a virtual disk by one machine is not seen by the other machines to which the image is attached. Each machine creates its own write history of the multiattach image.

  Technically, a multiattach image behaves identically to an immutable image except the differencing image is not reset every time the machine starts.

  This mode is useful for sharing files which are almost never written, for instance picture galleries, where every guest changes only a small amount of data and the majority of the disk content remains unchanged. The modified blocks are stored in differencing images which remain relatively small and the shared content is stored only once at the host.
- **Read-only images** are used automatically for CD/DVD images, since CDs/DVDs can never be written to.

The following scenario illustrates the differences between the various image modes, with respect to snapshots.

Assume you have installed your guest OS in your VM, and you have taken a snapshot. Later, your VM is infected with a virus and you would like to go back to the snapshot. With a normal hard disk image, you simply restore the snapshot, and the earlier state of your hard disk image will be restored as well and your virus infection will be undone. With an immutable hard disk, all it takes is to shut down and power on your VM, and the virus infection will be discarded. With a write-

through image however, you cannot easily undo the virus infection by means of virtualization, but will have to disinfect your virtual machine like a real computer.

You might find write-through images useful if you want to preserve critical data irrespective of snapshots. As you can attach more than one image to a VM, you may want to have one immutable image for the OS and one write-through image for your data files.

8.5 Differencing Images

The previous section mentioned differencing images and how they are used with snapshots, immutable images, and multiple disk attachments. This section describes in more detail how differencing images work.

A differencing image is a special disk image that only holds the differences to another image. A differencing image by itself is useless, it must always refer to another image. The differencing image is then typically referred to as a *child*, which holds the differences to its *parent*.

When a differencing image is active, it receives all write operations from the virtual machine instead of its parent. The differencing image only contains the sectors of the virtual hard disk that have changed since the differencing image was created. When the machine reads a sector from such a virtual hard disk, it looks into the differencing image first. If the sector is present, it is returned from there. If not, Oracle VirtualBox looks into the parent. In other words, the parent becomes *read-only*. It is never written to again, but it is read from if a sector has not changed.

Differencing images can be chained. If another differencing image is created for a virtual disk that already has a differencing image, then it becomes a *grandchild* of the original parent. The first differencing image then becomes read-only as well, and write operations only go to the second-level differencing image. When reading from the virtual disk, Oracle VirtualBox needs to look into the second differencing image first, then into the first if the sector was not found, and then into the original image.

There can be an unlimited number of differencing images, and each image can have more than one child. As a result, the differencing images can form a complex tree with parents, siblings, and children, depending on how complex your machine configuration is. Write operations always go to the one *active* differencing image that is attached to the machine, and for read operations, Oracle VirtualBox may need to look up all the parents in the chain until the sector in question is found. You can view such a tree in the Virtual Media Manager.

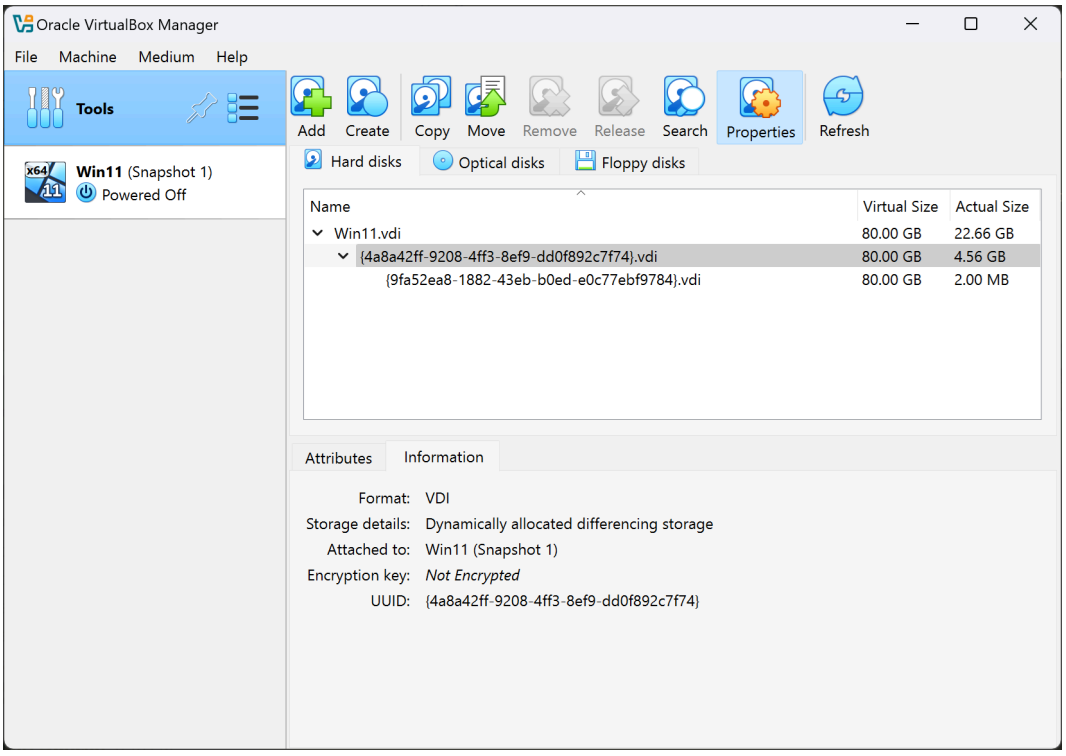


Figure 3: Differencing Images, Shown in Virtual Media Manager

In all of these situations, from the point of view of the virtual machine, the virtual hard disk behaves like any other disk. While the virtual machine is running, there is a slight runtime I/O overhead because Oracle VirtualBox might need to look up sectors several times. This is not noticeable however since the tables with sector information are always kept in memory and can be looked up quickly.

Differencing images are used in the following situations:

- **Snapshots.** When you create a snapshot, as explained in the previous section, Oracle VirtualBox *freezes* the images attached to the virtual machine and creates differencing images for each image that is not in *write-through* mode. From the point of view of the virtual machine, the virtual disks continue to operate before, but all write operations go into the differencing images. Each time you create another snapshot, for each hard disk attachment, another differencing image is created and attached, forming a chain or tree.

  In the above screenshot, you see that the original disk image is now attached to a snapshot, representing the state of the disk when the snapshot was taken.

  If you *restore* a snapshot, and want to go back to the exact machine state that was stored in the snapshot, the following happens:

  - Oracle VirtualBox copies the virtual machine settings that were copied into the snapshot back to the virtual machine. As a result, if you have made changes to the machine configuration since taking the snapshot, they are undone.
  - If the snapshot was taken while the machine was running, it contains a saved machine state, and that state is restored as well. After restoring the snapshot, the machine will then be in Saved state and resume execution from there when it is next started. Otherwise the machine will be in Powered Off state and do a full boot.
  - For each disk image attached to the machine, the differencing image holding all the write operations since the current snapshot was taken is thrown away, and the original parent

image is made active again. If you restored the root snapshot, then this will be the root disk image for each attachment. Otherwise, some other differencing image descended from it. This effectively restores the old machine state.

If you later *delete* a snapshot in order to free disk space, for each disk attachment, one of the differencing images becomes obsolete. In this case, the differencing image of the disk attachment cannot simply be deleted. Instead, Oracle VirtualBox needs to look at each sector of the differencing image and needs to copy it back into its parent. This is called "merging" images and can be a potentially lengthy process, depending on how large the differencing image is. It can also temporarily need a considerable amount of extra disk space, before the differencing image obsoleted by the merge operation is deleted.

- **Immutable images.** When an image is switched to immutable mode, a differencing image is created as well. As with snapshots, the parent image then becomes read-only, and the differencing image receives all the write operations. Every time the virtual machine is started, all the immutable images which are attached to it have their respective differencing image thrown away, effectively resetting the virtual machine's virtual disk with every restart.

8.6 Cloning Disk Images

You can duplicate hard disk image files on the same host to quickly produce a second virtual machine with the same OS setup. However, you should *only* make copies of virtual disk images using the utility supplied with Oracle VirtualBox. See *15.7 VBoxManage clonemedium on page 292*. This is because Oracle VirtualBox assigns a UUID to each disk image, which is also stored inside the image, and Oracle VirtualBox will refuse to work with two images that use the same number. If you do accidentally try to reimport a disk image which you copied normally, you can make a second copy using the VBoxManage clonevm command and import that instead.

Note that Linux distributions identify the boot hard disk from the ID of the drive. The ID Oracle VirtualBox reports for a drive is determined from the UUID of the virtual disk image. So if you clone a disk image and try to boot the copied image the guest might not be able to determine its own boot disk as the UUID changed. In this case you have to adapt the disk ID in your boot loader script, for example /boot/grub/menu.lst. The disk ID looks like the following:

```
scsi-SATA_VBOX_HARDDISK_VB5cfdb1e2-c251e503
```

The ID for the copied image can be determined as follows:

```
hdparm -i /dev/sda
```

8.7 Host Input/Output Caching

Oracle VirtualBox can optionally disable the I/O caching that the host OS would otherwise perform on disk image files.

Traditionally, Oracle VirtualBox has opened disk image files as normal files, which results in them being cached by the host OS like any other file. The main advantage of this is speed: when the guest OS writes to disk and the host OS cache uses delayed writing, the write operation can be reported as completed to the guest OS quickly while the host OS can perform the operation asynchronously. Also, when you start a VM a second time and have enough memory available for the OS to use for caching, large parts of the virtual disk may be in system memory, and the VM can access the data much faster.

Note that this applies only to image files. Buffering does not occur for virtual disks residing on remote iSCSI storage, which is the more common scenario in enterprise-class setups. See *8.10 iSCSI Servers on page 138*.

While buffering is a useful default setting for virtualizing a few machines on a desktop computer, there are some disadvantages to this approach:

- Delayed writing through the host OS cache is less secure. When the guest OS writes data, it considers the data written even though it has not yet arrived on a physical disk. If for some reason the write does not happen, such as power failure or host crash, the likelihood of data loss increases.
- Disk image files tend to be very large. Caching them can therefore quickly use up the entire host OS cache. Depending on the efficiency of the host OS caching, this may slow down the host immensely, especially if several VMs run at the same time. For example, on Linux hosts, host caching may result in Linux delaying all writes until the host cache is nearly full and then writing out all these changes at once, possibly stalling VM execution for minutes. This can result in I/O errors in the guest as I/O requests time out there.
- Physical memory is often wasted as guest OSes typically have their own I/O caches, which may result in the data being cached twice, in both the guest and the host caches, for little effect.

If you decide to disable host I/O caching for the above reasons, Oracle VirtualBox uses its own small cache to buffer writes, but no read caching since this is typically already performed by the guest OS. In addition, Oracle VirtualBox fully supports asynchronous I/O for its virtual SATA, SCSI, and SAS controllers through multiple I/O threads.

Since asynchronous I/O is not supported by IDE controllers, for performance reasons, you may want to leave host caching enabled for your VM's virtual IDE controllers.

For this reason, Oracle VirtualBox enables you to configure whether the host I/O cache is used for each I/O controller separately. Either select the **Use Host I/O Cache** check box in the **Storage** settings for a given virtual storage controller, or use the following VBoxManage command to disable the host I/O cache for a virtual storage controller:

```
VBoxManage storagectl "VM name" --name <controllername> --hostiocache off
```

See *15.49 VBoxManage storagectl on page 454*.

For the above reasons, Oracle VirtualBox uses SATA controllers by default for new virtual machines.

8.8 Limiting Bandwidth for Disk Images

Oracle VirtualBox supports limiting of the maximum bandwidth used for asynchronous I/O. Additionally it supports sharing limits through bandwidth groups for several images. It is possible to have more than one such limit.

Limits are configured using VBoxManage. The example below creates a bandwidth group named Limit, sets the limit to 20 MB per second, and assigns the group to the attached disks of the VM:

```
VBoxManage bandwidthctl "VM name" add Limit --type disk --limit 20M
VBoxManage storageattach "VM name" --storagectl "SATA" --port 0 --device 0 --type hdd
                                   --medium disk1.vdi --bandwidthgroup Limit
VBoxManage storageattach "VM name" --storagectl "SATA" --port 1 --device 0 --type hdd
                                   --medium disk2.vdi --bandwidthgroup Limit
```

All disks in a group share the bandwidth limit, meaning that in the example above the bandwidth of both images combined can never exceed 20 MBps. However, if one disk does not require bandwidth the other can use the remaining bandwidth of its group.

The limits for each group can be changed while the VM is running, with changes being picked up immediately. The example below changes the limit for the group created in the example above to 10 MBps:

```
VBoxManage bandwidthctl "VM name" set Limit --limit 10M
```

8.9 CD/DVD Support

Virtual CD/DVD drives by default support only reading. The medium configuration is changeable at runtime. You can select between the following options to provide the medium data:

- **Host Drive** defines that the guest can read from the medium in the host drive.
- **Image file** gives the guest read-only access to the data in the image. This is typically an ISO file.
- **Empty** means a drive without an inserted medium.

Changing between the above, or changing a medium in the host drive that is accessed by a machine, or changing an image file will signal a medium change to the guest OS. The guest OS can then react to the change, for example by starting an installation program.

Medium changes can be prevented by the guest, and Oracle VirtualBox reflects that by locking the host drive if appropriate. You can force a medium removal in such situations by using the VirtualBox Manager or the VBoxManage command line tool. Effectively this is the equivalent of the emergency eject which many CD/DVD drives provide, with all associated side effects. The guest OS can issue error messages, just like on real hardware, and guest applications may misbehave. Use this with caution.

Note:

The identification string of the drive provided to the guest, displayed by configuration tools such as the Windows Device Manager, is always VBOX CD-ROM, irrespective of the current configuration of the virtual drive. This is to prevent hardware detection from being triggered in the guest OS every time the configuration is changed.

8.10 iSCSI Servers

iSCSI stands for *Internet SCSI* and is a standard that supports use of the SCSI protocol over Internet (TCP/IP) connections. Especially with the advent of Gigabit Ethernet, it has become affordable to attach iSCSI storage servers simply as remote hard disks to a computer network. In iSCSI terminology, the server providing storage resources is called an *iSCSI target*, while the client connecting to the server and accessing its resources is called an *iSCSI initiator*.

Oracle VirtualBox can transparently present iSCSI remote storage to a virtual machine as a virtual hard disk. The guest OS will not see any difference between a virtual disk image (VDI file) and an iSCSI target. To achieve this, Oracle VirtualBox has an integrated iSCSI initiator.

Oracle VirtualBox's iSCSI support has been developed according to the iSCSI standard and should work with all standard-conforming iSCSI targets. To use an iSCSI target with Oracle

VirtualBox, you must use the command line. See *15.48 VBoxManage storageattach on page 448*.

8.11 vboximg-mount: A Utility for FUSE Mounting a Virtual Disk Image

vboximg-mount is a command line utility for Mac OS and Linux hosts that provides raw access to an Oracle VirtualBox virtual disk image on the host system. Use this utility to mount, view, and optionally modify the disk image contents.

The utility is based on Filesystem in Userspace (FUSE) technology and uses the VirtualBox runtime engine. Ensure that Oracle VirtualBox is running on the host system.

Note:

When using vboximg-mount, ensure that the following conditions apply:

- The disk image is not being used by any other systems, such as by guest VMs.
- No VMs are running on the host system.

Raw access using FUSE is preferred over direct loopback mounting of virtual disk images, because it is snapshot aware. It can selectively merge disk differencing images in an exposed virtual hard disk, providing historical or up-to-date representations of the virtual disk contents.

vboximg-mount enables you to view information about registered VMs, their attached disk media, and any snapshots. Also, you can view partition information for a disk image.

The vboximg-mount command includes experimental read-only access to file systems inside a VM disk image. This feature enables you to extract some files from the disk image without starting the VM and without requiring third-party file system drivers on the host system. FAT, NTFS, ext2, ext3, and ext4 file systems are supported.

Use the --help option to view information about the vboximg-mount command usage. The complete command reference is described in *15.55 vboximg-mount on page 464*.

When vboximg-mount mounts an Oracle VirtualBox disk image, it creates a one level deep file system at a mount point that you specify. The file system includes a device node that represents the synthesized disk image as a readable or readable-writeable bytestream. This bytestream can be mounted either by using the host OS or by using other FUSE-based file systems.

8.11.1 Viewing Detailed Information About a Virtual Disk Image

The following examples show how to use the vboximg-mount command to view information about virtual disk images.

The following command outputs detailed information about all registered VMs and associated snapshots:

```
$ vboximg-mount --list --verbose

  ------------------------------------------------------
  VM Name:   "macOS High Sierra 10.13"
  UUID:      3887d96d-831c-4187-a55a-567c504ff0e1
  Location:  /Volumes/work/vm_guests/macOS High Sierra 10.13/macOS High Sierra 10.13.vbox
    ----------------------
```

```
HDD base:   "macOS High Sierra 10.13.vdi"
UUID:       f9ea7173-6869-4aa9-b487-68023a655980
Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/macOS High Sierra 10.13.vdi

  Diff 1:
     UUID:       98c2bac9-cf37-443d-a935-4e879b70166d
     Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/
     Snapshots/{98c2bac9-cf37-443d-a935-4e879b70166d}.vdi
  Diff 2:
     UUID:       f401f381-7377-40b3-948e-3c61241b1a42
     Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/
     Snapshots/{f401f381-7377-40b3-948e-3c61241b1a42}.vdi
----------------------
HDD base:   "simple_fixed_disk.vdi"
UUID:       ffba4d7e-1277-489d-8173-22ca7660773d
Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/simple_fixed_disk.vdi

  Diff 1:
     UUID:       aecab681-0d2d-468b-8682-93f79dc97a48
     Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/
     Snapshots/{aecab681-0d2d-468b-8682-93f79dc97a48}.vdi
  Diff 2:
     UUID:       70d6b34d-8422-47fa-8521-3b6929a1971c
     Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/
     Snapshots/{70d6b34d-8422-47fa-8521-3b6929a1971c}.vdi
-----------------------------------------------------------
VM Name:   "debian"
UUID:      5365ab5f-470d-44c0-9863-dad532ee5905
Location:  /Volumes/work/vm_guests/debian/debian.vbox
  ----------------------
  HDD base:   "debian.vdi"
  UUID:       96d2e92e-0d4e-46ab-a0f1-008fdbf997e7
  Location:   /Volumes/work/vm_guests/debian/ol7.vdi

    Diff 1:
       UUID:       f9cc866a-9166-42e9-a503-bbfe9b7312e8
       Location:   /Volumes/work/vm_guests/debian/Snapshots/
       {f9cc866a-9166-42e9-a503-bbfe9b7312e8}.vdi
```

The following command outputs partition information about the specified disk image:

```
$ vboximg-mount --image=f9ea7173-6869-4aa9-b487-68023a655980 --list

  Virtual disk image:

    Path: /Volumes/work/vm_guests/macOS High Sierra 10.13/macOS High Sierra 10.13.vdi
    UUID: f9ea7173-6869-4aa9-b487-68023a655980

    #     Start  Sectors     Size       Offset  Type
    1        40  409599    199.9M        20480  EFI System
    2    409640  67453071   32.1G    209735680  Hierarchical File System Plus (HFS+)
    3  67862712  1269535   107.8M  34745708544  Apple Boot (Recovery HD)
```

8.11.2 Mounting a Virtual Disk Image

The following steps show how to use the vboximg-mount command to mount a partition of a virtual disk image on the host OS.

1. Create a mount point on the host OS. For example:

   ```
   $ mkdir macos_sysdisk
   ```

2. Show partition information about the virtual disk image.

   ```
   $ vboximg-mount --image=uuid --list
   ```

   where *uuid* is the UUID of the disk image.

3. Use vboximg-mount to perform a FUSE mount of a partition on the virtual disk image. For example:

```
$ vboximg-mount --image=uuid -p 2 macos_sysdisk
```

where *uuid* is the UUID for the disk image.

In this example, partition 2 is mounted on the macos_sysdisk mount point. The mount includes all snapshots for the disk image.

4. Use the host OS to mount the vhdd device node. The FUSE-mounted device node represents the virtual disk image.

```
$ ls macos_sysdisk
  macOS High Sierra 10.13.vdi  vhdd
$ sudo mount macos_sysdisk/vhdd /mnt
```

9 Virtual Networking

Oracle VirtualBox provides up to eight virtual PCI Ethernet cards for each virtual machine. For each such card, you can individually select the following:

- The hardware that will be virtualized.
- The virtualization mode that the virtual card operates in, with respect to your physical networking hardware on the host.

Four of the network cards can be configured in the **Settings** for a virtual machine, listed in **Machines** in VirtualBox Manager.

You can configure all eight network cards on the command line using VBoxManage modifyvm. See *15.35 VBoxManage modifyvm on page 402*.

9.1 Configure Networking

Use the **Network** tool in VirtualBox Manager to create and manage the networks used by Oracle VirtualBox VMs to communicate each other, the host machine, and external resources.

Note: You also need to enable the virtual networks to use with each VM you create. See *5.17 Network Settings on page 78*.

The network types available are:

- **Host-only**. A network for VMs to communicate internally on this machine, but not with external networks.
- **NAT**. The default network used by VirtualBox, suitable for most communication between VMs and external networks.
- **Cloud**. A network used to connect to Oracle Cloud Infrastructure.

9.1.1 Create a Network

1. Open the **Network** tool, or from the **File** menu select **Tools** and then click **Network Manager**.
2. Click the tab corresponding to the type of network you need to create.
3. Click **Create**. A new network adapter will be created with default properties, and shown in the list.
4. Click **Properties** and configure the network as required. For more information, see *9.1.3 Edit a Network on page 144*.

9.1.2 Remove a Network

Ensure the network is not in use by an virtual machines (VMs) before removing it.

1. Open the **Network** tool, or from the **File** menu select **Tools** and then click **Network Manager**.
2. Click the tab corresponding to the type of network you need to delete.

3. Select the network to remove, and then click **Remove**. The adapter is deleted and the network interface can't be used by VMs.

9.1.3 Edit a Network

1. Open the **Network** tool, or from the **File** menu select **Tools** and then click **Network Manager**.
2. Click the tab corresponding to the type of network you need to edit.
3. Select the network you need to edit.
4. Click **Properties** and configure the network as required.

   Cloud Networks have the following properties.

   - **Name**. The name used for the cloud network.
   - **Provider**. The cloud service provider, such as Oracle Cloud Infrastructure.
   - **Profile**. The cloud profile used to connect to the cloud network. See *6.4 Creating a Cloud Profile on page 90*.
   - **ID**. The OCID for the cloud tunneling network. Click **Network**to view the subnets on Oracle Cloud Infrastructure that are available for tunneling traffic.

   Host-only Networks have the following properties.

   - **Adapter**. The the network adapter for the host-only network.
   - **DHCP Server**. Settings for the DHCP server used by the host-only network. The DHCP server is built into Oracle VirtualBox and manages IP addresses for the network automatically.

   NAT Networks have the following properties.

   - **General Options**. Network settings used by the NAT network including the network address and mask of the NAT service interface.
   - **Port Forwarding**. Port forwarding rules used by the NAT network.

9.2 Virtual Networking Hardware

For each card, you can individually select what kind of *hardware* will be presented to the virtual machine. Oracle VirtualBox can virtualize the following types of networking hardware:

- AMD PCNet PCI II (Am79C970A) Not available on Arm guests.
- AMD PCNet FAST III (Am79C973), the default setting on x86 guests. Not available on Arm guests.
- Intel PRO/1000 MT Desktop (82540EM)
- Intel PRO/1000 T Server (82543GC)
- Intel PRO/1000 MT Server (82545EM)
- Paravirtualized network adapter (virtio-net)
- Ethernet over USB network adapter (usbnet)

The PCNet FAST III is the default because it is supported by nearly all operating systems, as well as by the GNU GRUB boot manager. As an exception, the Intel PRO/1000 family adapters are chosen for some guest operating system types that no longer ship with drivers for the PCNet card, such as Windows Vista.

The Intel PRO/1000 MT Desktop type works with Windows Vista and later versions. The T Server variant of the Intel PRO/1000 card is recognized by Windows XP guests without additional driver installation. The MT Server variant facilitates OVF imports from other platforms.

The Paravirtualized network adapter (virtio-net) is special. If you select this adapter, then Oracle VirtualBox does *not* virtualize common networking hardware that is supported by common guest operating systems. Instead, Oracle VirtualBox expects a special software interface for virtualized environments to be provided by the guest, thus avoiding the complexity of emulating networking hardware and improving network performance. Oracle VirtualBox provides support for the industry-standard *virtio* networking drivers, which are part of the open source KVM project.

The virtio networking drivers are available for the following guest operating systems:

- Linux kernels version 2.6.25 or later can be configured to provide virtio support. Some distributions have also back-ported virtio to older kernels.
- For Windows 2000, XP, and Vista, virtio drivers can be downloaded and installed from the KVM project web page:

  http://www.linux-kvm.org/page/WindowsGuestDrivers.

Oracle VirtualBox also has limited support for *jumbo frames*. These are networking packets with more than 1500 bytes of data, provided that you use the Intel card virtualization and bridged networking. Jumbo frames are not supported with the AMD networking devices. In those cases, jumbo packets will silently be dropped for both the transmit and the receive direction. Guest operating systems trying to use this feature will observe this as a packet loss, which may lead to unexpected application behavior in the guest. This does not cause problems with guest operating systems in their default configuration, as jumbo frames need to be explicitly enabled.

9.3 Introduction to Networking Modes

Each of the networking adapters can be separately configured to operate in one of the following modes:

- **Not attached**. In this mode, Oracle VirtualBox reports to the guest that a network card is present, but that there is no connection. This is as if no Ethernet cable was plugged into the card. Using this mode, it is possible to *pull* the virtual Ethernet cable and disrupt the connection, which can be useful to inform a guest operating system that no network connection is available and enforce a reconfiguration.
- **Network Address Translation (NAT)**. If all you want is to browse the Web, download files, and view email inside the guest, then this default mode should be sufficient for you, and you can skip the rest of this section. Please note that there are certain limitations when using Windows file sharing. See *9.4.3 NAT Limitations on page 148*.
- **NAT Network**. This mode allows you to use NAT between your VMs, as well as with external connections. You first have to create the NAT Network service that you want to use, and then select NAT Network as the network mode. See *9.5 Oracle VirtualBox NAT Network Service on page 149*.
- **Bridged networking**. This is for more advanced networking needs, such as network simulations and running servers in a guest. When enabled, Oracle VirtualBox connects to one of your installed network cards and exchanges network packets directly, circumventing your host operating system's network stack.

- **Internal networking**. This can be used to create a different kind of software-based network which is visible to selected virtual machines, but not to applications running on the host or to the outside world.
- **Host-only networking**. This can be used to create a network containing the host and a set of virtual machines, without the need for the host's physical network interface. Instead, a virtual network interface, similar to a loopback interface, is created on the host, providing connectivity among virtual machines and the host.
- **Cloud networking.** This can be used to connect a local VM to a subnet on a remote cloud service.
- **Generic networking.** Rarely used modes that share the same generic network interface, by allowing the user to select a driver which can be included with Oracle VirtualBox or be distributed in an extension pack.

  The following submodes are available:

  - **UDP Tunnel:** Used to interconnect virtual machines running on different hosts directly, easily, and transparently, over an existing network infrastructure.
  - **VDE (Virtual Distributed Ethernet) networking:** Used to connect to a Virtual Distributed Ethernet switch on a Linux or a FreeBSD host. At the moment this option requires compilation of Oracle VirtualBox from sources, as the Oracle packages do not include it.

The following table provides an overview of the most important networking modes.

Table 6: Overview of Networking Modes

Overview of Networking Modes

Mode	VM#Host	VM#Host	VM1#VM2	VM#Net/LAN	VM#Net/LAN
Host-only	+	+	+	–	–
Internal	–	–	+	–	–
Bridged	+	+	+	+	+
NAT	+	*Port forward*	–	+	*Port forward*
NAT Network	+	*Port forward*	+	+	*Port forward*

The following sections describe the available network modes in more detail.

9.4 Network Address Translation (NAT)

Network Address Translation (NAT) is the simplest way of accessing an external network from a virtual machine. Usually, it does not require any configuration on the host network and guest system. For this reason, it is the default networking mode in Oracle VirtualBox.

A virtual machine with NAT enabled acts much like a real computer that connects to the Internet through a router. The router, in this case, is the Oracle VirtualBox networking engine, which maps traffic from and to the virtual machine transparently. In Oracle VirtualBox this router is placed between each virtual machine and the host. This separation maximizes security since by default virtual machines cannot talk to each other.

The disadvantage of NAT mode is that, much like a private network behind a router, the virtual machine is invisible and unreachable from the outside internet. You cannot run a server this way unless you set up port forwarding. See *9.4.1 Configuring Port Forwarding with NAT on page 147*.

The network frames sent out by the guest operating system are received by Oracle VirtualBox's NAT engine, which extracts the TCP/IP data and resends it using the host operating system. To an application on the host, or to another computer on the same network as the host, it looks like the data was sent by the Oracle VirtualBox application on the host, using an IP address belonging to the host. Oracle VirtualBox listens for replies to the packages sent, and repacks and resends them to the guest machine on its private network.

The virtual machine receives its network address and configuration on the private network from a DHCP server integrated into Oracle VirtualBox. The IP address thus assigned to the virtual machine is usually on a completely different network than the host. As more than one card of a virtual machine can be set up to use NAT, the first card is connected to the private network 10.0.2.0, the second card to the network 10.0.3.0 and so on. If you need to change the guest-assigned IP range, see *Fine Tuning the Oracle VirtualBox NAT Engine*.

9.4.1 Configuring Port Forwarding with NAT

As the virtual machine is connected to a private network internal to Oracle VirtualBox and invisible to the host, network services on the guest are not accessible to the host machine or to other computers on the same network. However, like a physical router, Oracle VirtualBox can make selected services available to the world outside the guest through *port forwarding*. This means that Oracle VirtualBox listens to certain ports on the host and resends all packets which arrive there to the guest, on the same or a different port.

To an application on the host or other physical or virtual machines on the network, it looks as though the service being proxied is actually running on the host. This also means that you cannot run the same service on the same ports on the host. However, you still gain the advantages of running the service in a virtual machine. For example, services on the host machine or on other virtual machines cannot be compromised or crashed by a vulnerability or a bug in the service, and the service can run in a different operating system than the host system.

To configure port forwarding, go to **Network**, select the NAT Networks tab, and click the network. On the Port Forwarding tab, click **Add**. Here, you can map host ports to guest ports to allow network traffic to be routed to a specific port in the guest.

Alternatively, the command line tool VBoxManage can be used. See *15.35 VBoxManage modifyvm on page 402*.

You will need to know which ports on the guest the service uses and to decide which ports to use on the host. You may want to use the same ports on the guest and on the host. You can use any ports on the host which are not already in use by a service. For example, to set up incoming NAT connections to an ssh server in the guest, use the following command:

```
VBoxManage modifyvm "VM name" --nat-pf1 "guestssh,tcp,,2222,,22"
```

In the above example, all TCP traffic arriving on port 2222 on any host interface will be forwarded to port 22 in the guest. The protocol name tcp is a mandatory attribute defining which protocol should be used for forwarding, udp could also be used. The name guestssh is purely descriptive and will be auto-generated if omitted. The number after --nat-pf denotes the network card, as with other VBoxManage commands.

To remove this forwarding rule, use the following command:

```
VBoxManage modifyvm "VM name" --natpf1 delete "guestssh"
```

If for some reason the guest uses a static assigned IP address not leased from the built-in DHCP server, it is required to specify the guest IP when registering the forwarding rule, as follows:

```
VBoxManage modifyvm "VM name" --natpf1 "guestssh,tcp,,2222,10.0.2.19,22"
```

This example is identical to the previous one, except that the NAT engine is being told that the guest can be found at the 10.0.2.19 address.

To forward *all* incoming traffic from a specific host interface to the guest, specify the IP of that host interface as follows:

```
VBoxManage modifyvm "VM name" --natpf1 "guestssh,tcp,127.0.0.1,2222,,22"
```

This example forwards all TCP traffic arriving on the localhost interface at 127.0.0.1 through port 2222 to port 22 in the guest.

It is possible to configure incoming NAT connections while the VM is running, see *15.12 VBoxManage controlvm on page 309*.

9.4.2 PXE Booting with NAT

PXE booting is now supported in NAT mode. The NAT DHCP server provides a boot file name of the form *vmname*.pxe if the directory TFTP exists in the directory where the user's VirtualBox.xml file is kept. It is the responsibility of the user to provide *vmname*.pxe.

9.4.3 NAT Limitations

There are some limitations of NAT mode which users should be aware of, as follows:

- **ICMP protocol limitations.** Some frequently used network debugging tools, such as ping or traceroute, rely on the ICMP protocol for sending and receiving messages. Oracle VirtualBox ICMP support has some limitations, meaning ping should work but some other tools may not work reliably.
- **Receiving of UDP broadcasts.** The guest does not reliably receive UDP broadcasts. In order to save resources, it only listens for a certain amount of time after the guest has sent UDP data on a particular port. As a consequence, NetBios name resolution based on broadcasts does not always work, but WINS always works. As a workaround, you can use the numeric IP of the required server in the *\\server\share* notation.
- **Some protocols are not supported.** Protocols other than TCP and UDP are not supported. GRE is not supported. This means some VPN products, such as PPTP from Microsoft, cannot be used. There are other VPN products which use only TCP and UDP.
- **Forwarding host ports below 1024.** On UNIX-based hosts, such as Linux, Oracle Solaris, and macOS, it is not possible to bind to ports below 1024 from applications that are not run by root. As a result, if you try to configure such a port forwarding, the VM will refuse to start.

These limitations normally do not affect standard network use. But the presence of NAT has also subtle effects that may interfere with protocols that are normally working. One example is NFS, where the server is often configured to refuse connections from non-privileged ports, which are those ports above 1024.

9.5 Oracle VirtualBox NAT Network Service

The Network Address Translation (NAT) Network service works in a similar way to a home router, grouping the systems using it into a network and preventing systems outside of this network from directly accessing systems inside it, but letting systems inside communicate with each other and with systems outside using TCP and UDP over IPv4 and IPv6.

A NAT Network service is attached to an internal network. Virtual machines which are to make use of it should be attached to that internal network. The name of internal network is chosen when the NAT service is created and the internal network will be created if it does not already exist. The following is an example command to create a NAT network:

```
VBoxManage natnetwork add --netname natnet1 --network "192.168.15.0/24" --enable
```

Here, natnet1 is the name of the internal network to be used and 192.168.15.0/24 is the network address and mask of the NAT Network service interface. By default in this static configuration the gateway will be assigned the address 192.168.15.1, the address following the interface address, though this is subject to change. To attach a DHCP server to the internal network, modify the example command as follows:

```
VBoxManage natnetwork add --netname natnet1 --network "192.168.15.0/24" --enable --dhcp on
```

To add a DHCP server to an existing network, use the following command:

```
VBoxManage natnetwork modify --netname natnet1 --dhcp on
```

To disable the DHCP server, use the following command:

```
VBoxManage natnetwork modify --netname natnet1 --dhcp off
```

A DHCP server provides a list of registered name servers, but does not map servers from the 127/8 network.

To start the NAT Network service, use the following command:

```
VBoxManage natnetwork start --netname natnet1
```

If the network has a DHCP server attached then it will start together with the NAT Network service.

To stop the NAT Network service, together with any DHCP server:

```
VBoxManage natnetwork stop --netname natnet1
```

To delete the NAT Network service:

```
VBoxManage natnetwork remove --netname natnet1
```

This command does not remove the DHCP server if one is enabled on the internal network.

Port-forwarding is supported, using the --port-forward-4 switch for IPv4 and --port-forward-6 for IPv6. For example:

```
VBoxManage natnetwork modify \
  --netname natnet1 --port-forward-4 "ssh:tcp:[]:1022:[192.168.15.5]:22"
```

This adds a port-forwarding rule from the host's TCP 1022 port to the port 22 on the guest with IP address 192.168.15.5. Host port, guest port and guest IP are mandatory. To delete the rule, use the following command:

```
VBoxManage natnetwork modify --netname natnet1 --port-forward-4 delete ssh
```

It is possible to bind a NAT Network service to specified interface. For example:

```
VBoxManage setextradata global "NAT/win-nat-test-0/SourceIp4" 192.168.1.185
```

To see the list of registered NAT Network services, use the following command:

```
VBoxManage list natnetworks
```

NAT network services can also be created, deleted, and configured using the Network Manager tool in VirtualBox Manager. Click **File**, **Tools**, **Network Manager**. See *9.1 Configure Networking on page 143*.

Note:

Even though the NAT service separates the VM from the host, the VM has access to the host's loopback interface and the network services running on it. The host's loopback interface is accessible as IP address 10.0.2.2 (assuming the default configuration, in other configurations it's the respective address in the configured IPv4 or IPv6 network range). This access to the host's loopback interface can be extremely useful in some cases, for example when running a web application under development in the VM and the database server on the loopback interface on the host. To enable traffic to pass to the host's loopback interface, see *15.3 VBoxManage on page 286*, NAT Networking Settings.

9.6 Fine Tuning the Oracle VirtualBox NAT Engine

9.6.1 Configuring the Address of a NAT Network Interface

In NAT mode, the guest network interface is assigned to the IPv4 range 10.0.*x*.0/24 by default where *x* corresponds to the instance of the NAT interface +2. So *x* is 2 when there is only one NAT instance active. In that case the guest is assigned to the address 10.0.2.15, the gateway is set to 10.0.2.2 and the name server can be found at 10.0.2.3.

If the NAT network needs to be changed, use the following command:

```
$ VBoxManage modifyvm VM-name \
--natnet1 "192.168/16"
```

This command would reserve the network addresses from 192.168.0.0 to 192.168.254.254 for the first NAT network instance of *VM-name* The guest IP would be assigned to 192.168.0.15 and the default gateway could be found at 192.168.0.2.

9.6.2 Configuring the Boot Server (Next Server) of a NAT Network Interface

For network booting in NAT mode, by default Oracle VirtualBox uses a built-in TFTP server at the IP address 10.0.2.4. This default behavior should work fine for typical remote-booting scenarios. However, it is possible to change the boot server IP and the location of the boot image with the following commands:

```
$ VBoxManage modifyvm VM-name \
--nattftpserver1 10.0.2.2
$ VBoxManage modifyvm VM-name \
--nattftpfile1 /srv/tftp/boot/MyPXEBoot.pxe
```

9.6.3 Enabling DNS Proxy in NAT Mode

The NAT engine by default offers the same DNS servers to the guest that are configured on the host. In some scenarios, it can be appropriate to hide the DNS server IPs from the guest, for

example when this information can change on the host due to expiring DHCP leases. In this case, you can tell the NAT engine to act as DNS proxy using the following command:

```
$ VBoxManage modifyvm VM-name --natdnsproxy1 on
```

9.6.4 Using the Host's Resolver as a DNS Proxy in NAT Mode

For resolving network names, the DHCP server of the NAT engine offers a list of registered DNS servers of the host. If for some reason you need to hide this DNS server list and use the host's resolver settings, thereby forcing the Oracle VirtualBox NAT engine to intercept DNS requests and forward them to host's resolver, use the following command:

```
$ VBoxManage modifyvm VM-name --natdnshostresolver1 on
```

Note that this setting is similar to the DNS proxy mode, however whereas the proxy mode just forwards DNS requests to the appropriate servers, the resolver mode will interpret the DNS requests and use the host's DNS API to query the information and return it to the guest.

9.6.4.1 User-Defined Host Name Resolving

In some cases it might be useful to intercept the name resolving mechanism, providing a user-defined IP address on a particular DNS request. The intercepting mechanism enables the user to map not only a single host but domains and even more complex naming conventions if required.

The following command sets a rule for mapping a name to a specified IP:

```
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name-of-interception-rule/HostIP" IPv4

VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostName" hostname
```

The following command sets a rule for mapping a pattern name to a specified IP:

```
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostIP" IPv4

VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostNamePattern" hostpattern
```

The host name pattern can include the following wildcard characters: pipe (|), question mark (?), and asterisk (*).

This example demonstrates how to instruct the host-resolver mechanism to resolve all domain and probably some mirrors of www.blocked-site.info site with IP 127.0.0.1:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/e1000/0/LUN#0/AttachedDriver/Config/HostResolverMappings/all_blocked_site/HostIP"
 127.0.0.1
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/e1000/0/LUN#0/AttachedDriver/Config/HostResolverMappings/all_blocked_site/
HostNamePattern" "*.blocked-site.*|*.fb.org"
```

The host resolver mechanism should be enabled to use user-defined mapping rules, otherwise they do not have any effect.

9.6.5 Configuring Aliasing of the NAT Engine

By default, the NAT core uses aliasing and uses random ports when generating an alias for a connection. This works well for the most protocols like SSH, FTP and so on. Though some protocols might need a more transparent behavior or may depend on the real port number the packet was sent from. You can change the NAT mode by using the following commands:

```
$ VBoxManage modifyvm VM-name \
--nataliasmode1 proxyonly

$ VBoxManage modifyvm "Linux Guest" --nataliasmode1 sameports
```

The first example disables aliasing and switches NAT into transparent mode, the second example enforces preserving of port values. These modes can be combined if necessary.

9.7 Bridged Networking

With bridged networking, Oracle VirtualBox uses a device driver on your *host* system that filters data from your physical network adapter. This driver is therefore called a *net filter* driver. This enables Oracle VirtualBox to intercept data from the physical network and inject data into it, effectively creating a new network interface in software. When a guest is using such a new software interface, it looks to the host system as though the guest were physically connected to the interface using a network cable. The host can send data to the guest through that interface and receive data from it. This means that you can set up routing or bridging between the guest and the rest of your network.

Note:

Even though TAP interfaces are no longer necessary on Linux for bridged networking, you *can* still use TAP interfaces for certain advanced setups, since you can connect a VM to any host interface.

To enable bridged networking, open the **Settings** for a virtual machine, go to the **Network** page and select **Bridged Network** for the **Attached To** field. Select a host interface from the list at the bottom of the page, which contains the physical network interfaces of your systems. On a typical MacBook, for example, this will allow you to select between en1: AirPort, which is the wireless interface, and en0: Ethernet, which represents the interface with a network cable.

Note:

Bridging to a wireless interface is done differently from bridging to a wired interface, because most wireless adapters do not support promiscuous mode. All traffic has to use the MAC address of the host's wireless adapter, and therefore Oracle VirtualBox needs to replace the source MAC address in the Ethernet header of an outgoing packet to make sure the reply will be sent to the host interface. When Oracle VirtualBox sees an incoming packet with a destination IP address that belongs to one of the virtual machine adapters it replaces the destination MAC address in the Ethernet header with the VM adapter's MAC address and passes it on. Oracle VirtualBox examines ARP and DHCP packets in order to learn the IP addresses of virtual machines.

Depending on your host operating system, the following limitations apply:

macOS hosts

- Functionality is limited when using AirPort, the Mac's wireless networking system, for bridged networking. Currently, Oracle VirtualBox supports only IPv4 and IPv6 over AirPort. For other protocols, such as IPX, you must choose a wired interface.

Linux hosts

- Functionality is limited when using wireless interfaces for bridged networking. Currently, Oracle VirtualBox supports only IPv4 and IPv6 over wireless. For other protocols, such as IPX, you must choose a wired interface.
- Also, setting the MTU to less than 1500 bytes on wired interfaces provided by the sky2 driver on the Marvell Yukon II EC Ultra Ethernet NIC is known to cause packet losses under certain conditions.
- Some adapters strip VLAN tags in hardware. This does not allow you to use VLAN trunking between VM and the external network with Linux kernels before 2.6.27, or with host operating systems other than Linux.

Oracle Solaris hosts

- There is no support for using wireless interfaces. Filtering guest traffic using IPFilter is also not completely supported due to technical restrictions of the Oracle Solaris networking subsystem. These issues may be addressed in later releases of Oracle Solaris 11.
- On Oracle Solaris 11 hosts build 159 and above, it is possible to use Oracle Solaris Crossbow Virtual Network Interfaces (VNICs) directly with Oracle VirtualBox without any additional configuration other than each VNIC must be exclusive for every guest network interface.
- When using VLAN interfaces with Oracle VirtualBox, they must be named according to the PPA-hack naming scheme, such as e1000g513001. Otherwise, the guest may receive packets in an unexpected format.
- VirtualBox guests can't use bridged networking over an aggregate link (also known as a single link aggregation) on Oracle Solaris 11 FCS hosts. However, you can use `dladm` to manually create a VNIC over the aggregate link and use that with a VM. This limitation does not exist in Oracle Solaris 11 update 1 (11.1) and later.

9.8 Internal Networking

Internal Networking is similar to bridged networking in that the VM can directly communicate with the outside world. However, the outside world is limited to other VMs on the same host which connect to the same internal network.

Even though technically, everything that can be done using internal networking can also be done using bridged networking, there are security advantages with internal networking. In bridged networking mode, all traffic goes through a physical interface of the host system. It is therefore possible to attach a packet sniffer such as Wireshark to the host interface and log all traffic that goes over it. If, for any reason, you prefer two or more VMs on the same machine to communicate privately, hiding their data from both the host system and the user, bridged networking therefore is not an option.

Internal networks are created automatically as needed. There is no central configuration. Every internal network is identified simply by its name. Once there is more than one active virtual network card with the same internal network ID, the Oracle VirtualBox support driver will automatically *wire* the cards and act as a network switch. The Oracle VirtualBox support driver implements a complete Ethernet switch and supports both broadcast/multicast frames and promiscuous mode.

In order to attach a VM's network card to an internal network, set its networking mode to Internal Networking. There are two ways to accomplish this:

- Use the VM's **Settings** in VirtualBox Manager. In the **Network** section, select **Internal Network** as the networking mode. Select the name of an existing internal network from the drop-down list below, or enter a new name into the **Name** field.
- Use the command line, for example:

  VBoxManage modifyvm "VM name" --nic<x> intnet

  Optionally, you can specify a network name with the command:

  VBoxManage modifyvm "VM name" --intnet<x> "network name"

  If you do not specify a network name, the network card will be attached to the network intnet by default.

Unless you configure the virtual network cards in the guest operating systems that are participating in the internal network to use static IP addresses, you may want to use the DHCP server that is built into Oracle VirtualBox to manage IP addresses for the internal network. See *15.17 VBoxManage dhcpserver on page 339*.

As a security measure, by default, the Linux implementation of internal networking only allows VMs running under the same user ID to establish an internal network. However, it is possible to create a shared internal networking interface, accessible by users with different user IDs.

9.9 Host-Only Networking

Host-only networking can be thought of as a hybrid between the bridged and internal networking modes. As with bridged networking, the virtual machines can talk to each other and the host as if they were connected through a physical Ethernet switch. As with internal networking, a physical networking interface need not be present, and the virtual machines cannot talk to the world outside the host since they are not connected to a physical networking interface.

When host-only networking is used, Oracle VirtualBox creates a new software interface on the host which then appears next to your existing network interfaces. In other words, whereas with bridged networking an existing physical interface is used to attach virtual machines to, with host-only networking a new *loopback* interface is created on the host. And whereas with internal networking, the traffic between the virtual machines cannot be seen, the traffic on the loopback interface on the host can be intercepted.

Note:

Hosts running recent macOS versions do not support host-only adapters. These adapters are replaced by host-only networks, which define a network mask and an IP address range, where the host network interface receives the lowest address in the range.

The host network interface gets added and removed dynamically by the operating system, whenever a host-only network is used by virtual machines.

On macOS hosts, choose the **Host-Only Network** option when configuring a network adapter. The **Host-Only Adapter** option is provided for legacy support.

Host-only networking is particularly useful for preconfigured virtual appliances, where multiple virtual machines are shipped together and designed to cooperate. For example, one virtual

machine may contain a web server and a second one a database, and since they are intended to talk to each other, the appliance can instruct Oracle VirtualBox to set up a host-only network for the two. A second, bridged, network would then connect the web server to the outside world to serve data to, but the outside world cannot connect to the database.

To enable a host-only network interface for a virtual machine, do either of the following:

- Go to the **Network** section in the virtual machine's **Settings** and select an **Adapter** tab. Ensure that the **Enable Network Adapter** check box is selected and choose **Host-Only Adapter** for the **Attached To** field.
- On the command line, use

  VBoxManage modifyvm *VM-name* --nic*N*=hostonly --host-only-adapter*N*=*interface-name*.

  See *15.35 VBoxManage modifyvm on page 402*.

For host-only networking, as with internal networking, you may find the DHCP server useful that is built into Oracle VirtualBox. This is enabled by default and manages the IP addresses in the host-only network. Without the DHCP server you would need to configure all IP addresses statically.

- In VirtualBox Manager you can configure the DHCP server by choosing **File**, **Tools**, **Network**. The Network Manager window lists all host-only networks which are presently in use. Select the network name and then use the **DHCP Server** tab to configure DHCP server settings. See *9.1 Configure Networking on page 143*.
- Alternatively, you can use the VBoxManage dhcpserver command. See *15.17 VBoxManage dhcpserver on page 339*.

Note:

On Linux and macOS hosts the number of host-only interfaces is limited to 128. There is no such limit for Oracle Solaris and Windows hosts.

On Linux, macOS and Solaris Oracle VirtualBox will only allow IP addresses in 192.168.56.0/21 range to be assigned to host-only adapters. For IPv6 only link-local addresses are allowed. If other ranges are required, they can be enabled by creating /etc/vbox/networks.conf and specifying allowed ranges there. For example, to allow 10.0.0.0/8 and 192.168.0.0/16 IPv4 ranges as well as 2001::/64 range put the following lines into /etc/vbox/networks.conf:

```
* 10.0.0.0/8 192.168.0.0/16
* 2001::/64
```

Lines starting with the hash # are ignored. The following example allows any addresses, effectively disabling range control:

```
* 0.0.0.0/0 ::/0
```

If the file exists, but no ranges are specified in it, no addresses will be assigned to host-only adapters. The following example effectively disables all ranges:

```
# No addresses are allowed for host-only adapters
```

9.10 UDP Tunnel Networking

This networking mode enables you to interconnect virtual machines running on different hosts.

Technically this is done by encapsulating Ethernet frames sent or received by the guest network card into UDP/IP datagrams, and sending them over any network available to the host.

UDP Tunnel mode has the following parameters:

- **Source UDP port:** The port on which the host listens. Datagrams arriving on this port from any source address will be forwarded to the receiving part of the guest network card.
- **Destination address:** IP address of the target host of the transmitted data.
- **Destination UDP port:** Port number to which the transmitted data is sent.

When interconnecting two virtual machines on two different hosts, their IP addresses must be swapped. On a single host, source and destination UDP ports must be swapped.

In the following example, host 1 uses the IP address 10.0.0.1 and host 2 uses IP address 10.0.0.2. To configure using the command-line:

```
VBoxManage modifyvm "VM 01 on host 1" --nic<x> generic
VBoxManage modifyvm "VM 01 on host 1" --nic-generic-drv<x> UDPTunnel
VBoxManage modifyvm "VM 01 on host 1" --nic-property<x> dest=10.0.0.2
VBoxManage modifyvm "VM 01 on host 1" --nic-property<x> sport=10001
VBoxManage modifyvm "VM 01 on host 1" --nic-property<x> dport=10002

VBoxManage modifyvm "VM 02 on host 2" --nic<y> generic
VBoxManage modifyvm "VM 02 on host 2" --nic-generic-drv<y> UDPTunnel
VBoxManage modifyvm "VM 02 on host 2" --nic-property<y> dest=10.0.0.1
VBoxManage modifyvm "VM 02 on host 2" --nic-property<y> sport=10002
VBoxManage modifyvm "VM 02 on host 2" --nic-property<y> dport=10001
```

Of course, you can always interconnect two virtual machines on the same host, by setting the destination address parameter to 127.0.0.1 on both. It will act similarly to an internal network in this case. However, the host can see the network traffic which it could not in the normal internal network case.

Note:

On UNIX-based hosts, such as Linux, Oracle Solaris, and Mac OS X, it is not possible to bind to ports below 1024 from applications that are not run by root. As a result, if you try to configure such a source UDP port, the VM will refuse to start.

9.11 VDE Networking

Virtual Distributed Ethernet (VDE) is a flexible, virtual network infrastructure system, spanning across multiple hosts in a secure way. It enables L2/L3 switching, including spanning-tree protocol, VLANs, and WAN emulation. It is an optional part of Oracle VirtualBox which is only included in the source code.

VDE is a project developed by Renzo Davoli, Associate Professor at the University of Bologna, Italy.

The basic building blocks of the infrastructure are VDE switches, VDE plugs, and VDE wires which interconnect the switches.

The Oracle VirtualBox VDE driver has a single parameter: VDE network. This is the name of the VDE network switch socket to which the VM will be connected.

The following basic example shows how to connect a virtual machine to a VDE switch.

1. Create a VDE switch:

   ```
   vde_switch -s /tmp/switch1
   ```

2. Configure VMs using the command-line:

   ```
   VBoxManage modifyvm "VM name" --nic<x> generic
   VBoxManage modifyvm "VM name" --nic-generic-drv<x> VDE
   ```

   To connect to an automatically allocated switch port:

   ```
   VBoxManage modifyvm "VM name" --nic-property<x> network=/tmp/switch1
   ```

   To connect to a specific switch port *n*:

   ```
   VBoxManage modifyvm "VM name" --nic-property<x> network=/tmp/switch1[<n>]
   ```

   This command can be useful for VLANs.

3. (Optional) Map between a VDE switch port and a VLAN.

   Using the switch command line:

   ```
   vde$ vlan/create <VLAN>
   vde$ port/setvlan <port> <VLAN>
   ```

VDE is available on Linux and FreeBSD hosts only. It is only available if the VDE software and the VDE plugin library from the VirtualSquare project are installed on the host system.

> **Note:**
>
> For Linux hosts, the shared library libvdeplug.so must be available in the search path for shared libraries.

For more information on setting up VDE networks, please see the documentation accompanying the software. See also http://wiki.virtualsquare.org.

9.12 Cloud Networks

Cloud networks can be used for connections from a local VM to a subnet on a remote Oracle Cloud Infrastructure instance. See *9.1 Configure Networking on page 143* for details of how to create and configure a cloud network using the **Network** tool in VirtualBox Manager.

To enable a cloud network interface for a virtual machine, do either of the following:

- Go to the **Settings** for a virtual machine, and under **Network**, select an **Adapter** tab. Ensure that the **Enable Network Adapter** check box is selected and choose **Cloud Network** for the **Attached To** field.
- On the command line, use VBoxManage modifyvm vmname --nic *x* cloud. See *15.35 VBoxManage modifyvm on page 402*.

9.13 Limiting Bandwidth for Network Input/Output

Oracle VirtualBox supports limiting of the maximum bandwidth used for network transmission. Several network adapters of one VM may share limits through bandwidth groups. It is possible to have more than one such limit.

> **Note:**
>
> Oracle VirtualBox shapes VM traffic only in the transmit direction, delaying the packets being sent by virtual machines. It does not limit the traffic being received by virtual machines.

Limits are configured through VBoxManage. The following example creates a bandwidth group named Limit, sets the limit to 20 Mbps and assigns the group to the first and second adapters of the VM:

```
VBoxManage bandwidthctl "VM name" add Limit --type network --limit 20m
VBoxManage modifyvm "VM name" --nicbandwidthgroup1 Limit
VBoxManage modifyvm "VM name" --nicbandwidthgroup2 Limit
```

All adapters in a group share the bandwidth limit, meaning that in the example above the bandwidth of both adapters combined can never exceed 20 Mbps. However, if one adapter does not require bandwidth the other can use the remaining bandwidth of its group.

The limits for each group can be changed while the VM is running, with changes being picked up immediately. The following example changes the limit for the group created in the previous example to 100 Kbps:

```
VBoxManage bandwidthctl "VM name" set Limit --limit 100k
```

To completely disable shaping for the first adapter of VM use the following command:

```
VBoxManage modifyvm "VM name" --nicbandwidthgroup1 none
```

It is also possible to disable shaping for all adapters assigned to a bandwidth group while VM is running, by specifying the zero limit for the group. For example, for the bandwidth group named Limit:

```
VBoxManage bandwidthctl "VM name" set Limit --limit 0
```

9.14 Improving Network Performance

Oracle VirtualBox provides a variety of virtual network adapters that can be attached to the host's network in a number of ways. Depending on which types of adapters and attachments are used the network performance will be different. Performance-wise the virtio network adapter is preferable over Intel PRO/1000 emulated adapters, which are preferred over the PCNet family of adapters. Both virtio and Intel PRO/1000 adapters enjoy the benefit of segmentation and checksum offloading. Segmentation offloading is essential for high performance as it allows for less context switches, dramatically increasing the sizes of packets that cross the VM/host boundary.

Note:

Neither virtio nor Intel PRO/1000 drivers for Windows XP support segmentation offloading. Therefore Windows XP guests never reach the same transmission rates as other guest types. Refer to MS Knowledge base article 842264 for additional information.

Three attachment types: Internal, Bridged, and Host-Only, have nearly identical performance. The Internal type is slightly faster and uses less CPU cycles as the packets never reach the host's network stack. The NAT attachment type is the slowest and most secure of all attachment types, as it provides network address translation. The generic driver attachment is special and cannot be considered as an alternative to other attachment types.

The number of CPUs assigned to VM does not improve network performance and in some cases may hurt it due to increased concurrency in the guest.

Here is a short summary of things to check in order to improve network performance:

- Whenever possible use the virtio network adapter. Otherwise, use one of the Intel PRO/1000 adapters.
- Use a Bridged attachment instead of NAT.
- Ensure segmentation offloading is enabled in the guest OS. Usually it will be enabled by default. You can check and modify offloading settings using the ethtool command on Linux guests.
- Perform a full detailed analysis of network traffic on the VM's network adaptor using a third party tool such as Wireshark. To do this, a promiscuous mode policy needs to be used on the VM's network adaptor. Use of this mode is only possible on the following network types: NAT Network, Bridged Adapter, Internal Network, and Host-Only Adapter.

  To setup a promiscuous mode policy, either set the **Promiscuous Mode** in the **Network** section of the VM's **Settings** for the network adaptor, or use the command line tool VBoxManage. See *15.35 VBoxManage modifyvm on page 402*.

  Promiscuous mode policies are as follows:

  - deny, which hides any traffic not intended for the VM's network adaptor. This is the default setting.
  - allow-vms, which hides all host traffic from the VM's network adaptor, but allows it to see traffic from and to other VMs.
  - allow-all, which removes all restrictions. The VM's network adaptor sees all traffic.

10 Remote Virtual Machines

10.1 Remote Display (VRDP Support)

Oracle VirtualBox can display virtual machines remotely, meaning that a virtual machine can execute on one computer even though the machine will be displayed on a second computer, and the machine will be controlled from there as well, as if the virtual machine was running on that second computer.

For maximum flexibility, Oracle VirtualBox implements remote machine display through a generic extension interface called the VirtualBox Remote Desktop Extension (VRDE). The base open source Oracle VirtualBox package only provides this interface, while implementations can be supplied by third parties with Oracle VirtualBox extension packages, which must be installed separately from the base package. See *3.1.1 Install the Oracle VirtualBox Extension Pack on page 43*.

Oracle provides support for the VirtualBox Remote Display Protocol (VRDP) in such an Oracle VirtualBox extension package.

VRDP is a backward-compatible extension to Microsoft's Remote Desktop Protocol (RDP). As a result, you can use any standard RDP client to control the remote VM.

Even when the extension is installed, the VRDP server is disabled by default. It can easily be enabled on a per-VM basis either from VirtualBox Manager in the VM **Settings**, see *Display Settings*, or with the VBoxManage command, as follows:

```
$ VBoxManage modifyvm VM-name --vrde on
```

The RDP server in the Oracle VirtualBox extension pack supports only audio streams in format 22.05kHz stereo 16-bit. If the RDP client requests any other audio format there will be no audio.

By default, the VRDP server uses TCP port 3389. You will need to change the default port if you run more than one VRDP server, since the port can only be used by one server at a time. You might also need to change it on Windows hosts since the default port might already be used by the RDP server that is built into Windows itself. Ports 5000 through 5050 are typically not used and might be a good choice.

The port can be changed either in the display settings of the graphical user interface or with the --vrde-port option of the VBoxManage modifyvm command. You can specify a comma-separated list of ports or ranges of ports. Use a dash between two port numbers to specify a range. The VRDP server will bind to *one* of the available ports from the specified list. For example, VBoxManage modifyvm *VM-name* --vrde-port 5000,5010-5012 configures the server to bind to one of the ports 5000, 5010, 5011, or 5012. See *15.35 VBoxManage modifyvm on page 402*.

The actual port used by a running VM can be either queried with the VBoxManage showvminfo command or seen in VirtualBox Manager on the **Runtime** tab of the **Session Information** dialog, which is accessible from the **Machine** menu of the VM window.

Oracle VirtualBox supports IPv6. If the host OS supports IPv6 the VRDP server will automatically listen for IPv6 connections in addition to IPv4.

10.1.1 Common Third-Party RDP Viewers

Since VRDP is backward-compatible to RDP, you can use any standard RDP viewer to connect to such a remote virtual machine. For this to work, you must specify the IP address of your *host* system, not of the virtual machine, as the server address to connect to. You must also specify the port number that the VRDP server is using.

The following examples are for the most common RDP viewers:

- On Windows, you can use the Microsoft Terminal Services Connector, mstsc.exe, that is included with Windows. Press the Windows key + R, to display the **Run** dialog. Enter mstsc to start the program. You can also find the program in **Start**, **All Programs**, **Accessories**, **Remote Desktop Connection**. If you use the **Run** dialog, you can enter options directly. For example:

  ```
  mstsc 1.2.3.4:3389
  ```

  Replace 1.2.3.4 with the host IP address, and 3389 with a different port, if necessary.

  Note:

  - IPv6 addresses must be enclosed in square brackets to specify a port. For example: mstsc [fe80::1:2:3:4]:3389
  - When connecting to localhost in order to test the connection, the addresses localhost and 127.0.0.1 might not work using mstsc.exe. Instead, the address 127.0.0.2[:3389] has to be used.

- On other systems, you can use the standard open source rdesktop program. This ships with most Linux distributions.

  With rdesktop, use a command line such as the following:

  ```
  $ rdesktop -a 16 -N 1.2.3.4:3389
  ```

  Replace 1.2.3.4 with the host IP address, and 3389 with a different port, if necessary. The -a 16 option requests a color depth of 16 bits per pixel, which we recommend. For best performance, after installation of the guest operating system, you should set its display color depth to the same value. The -N option enables use of the NumPad keys.
- You can use the Remmina remote desktop client with VRDP. This application is included with some Linux distributions, such as Debian and Ubuntu.
- If you run the KDE desktop, you can use krdc, the KDE RDP viewer. A typical command line is as follows:

  ```
  $ krdc rdp://1.2.3.4:3389
  ```

  Replace 1.2.3.4 with the host IP address, and 3389 with a different port, if necessary. The rdp:// prefix is required with krdc to switch it into RDP mode.
- With Sun Ray thin clients you can use uttsc, which is part of the Sun Ray Windows Connector package. See the Sun Ray documentation for details.

10.1.2 VBoxHeadless, the Remote Desktop Server

While any VM started from VirtualBox Manager is capable of running virtual machines remotely, it is not convenient to have to run the full GUI if you never want to have VMs displayed locally in the first place. In particular, if you are running server hardware whose only purpose is to host VMs, and all your VMs are supposed to run remotely over VRDP, then it is pointless to have a

graphical user interface on the server at all. This is especially true for Linux or Oracle Solaris hosts, as the VirtualBox Manager comes with dependencies on the Qt and SDL libraries. This is inconvenient if you would rather not have the X Window system on your server at all.

Oracle VirtualBox therefore comes with a front end called VBoxHeadless, which produces no visible output on the host at all, but still can optionally deliver VRDP data. This front end has no dependencies on the X Window system on Linux and Oracle Solaris hosts.

Note:

In legacy releases of Oracle VirtualBox, the headless server was called VBoxVRDP. For backward compatibility, the Oracle VirtualBox installation still includes an executable with that name.

To start a virtual machine with VBoxHeadless, you have the following options:

- Use the VBoxManage command, as follows:

  $ VBoxManage startvm *VM-name* --type headless

  The --type option causes Oracle VirtualBox to use VBoxHeadless as the front end to the internal virtualization engine, instead of the Qt front end.
- Use the VBoxHeadless command, as follows:

  VBoxHeadless --startvm *uuid*|*vmname*

  This way of starting the VM helps troubleshooting problems reported by VBoxManage startvm, because you can sometimes see more detailed error messages, especially for early failures before the VM execution is started. In normal situations VBoxManage startvm is preferred, since it runs the VM directly as a background process which has to be done explicitly when directly starting with VBoxHeadless.
- Start VBoxHeadless from VirtualBox Manager, by pressing the Shift key when starting a virtual machine or by selecting **Headless Start** from the **Machine** menu.

When you use the VBoxHeadless command to start a VM, the VRDP server will be enabled according to the VM configuration. You can override the VM's setting using --vrde command line parameter. To enable the VRDP server, start the VM as follows:

VBoxHeadless --startvm *uuid*|*vmname* --vrde on

To disable the VRDP server:

VBoxHeadless --startvm *uuid*|*vmname* --vrde off

To have the VRDP server enabled depending on the VM configuration, as for other front ends:

VBoxHeadless --startvm *uuid*|*vmname* --vrde config

This command is the same as the following:

VBoxHeadless --startvm *uuid*|*vmname*

If you start the VM with VBoxManage startvm then the configuration settings of the VM are always used.

10.1.3 Step by Step: Creating a Virtual Machine on a Headless Server

The following instructions describe how to create a virtual machine on a headless server over a network connection. This example creates a virtual machine, establishes an RDP connection and installs a guest operating system. All of these tasks are done without having to touch the headless server. You need the following prerequisites:

- Oracle VirtualBox on a server machine with a supported host operating system. The Oracle VirtualBox Extension Pack for the VRDP server must be installed, see *10.1 Remote Display (VRDP Support) on page 161*. The procedures assume a Linux server is used.
- An ISO file accessible from the server, containing the installation data for the guest operating system to install. Windows XP is used in the example.
- A terminal connection to that host through which you can access a command line, such as ssh.
- An RDP viewer on the remote client. See *10.1.1 Common Third-Party RDP Viewers on page 162* for examples.

Note that on the server machine, since we will only use the headless server, Qt and the X Window system are not required.

1. On the headless server, create a new virtual machine. For example:

   ```
   VBoxManage createvm --name "Windows XP" --ostype WindowsXP --register
   ```

   If you do not specify --register, you will have to manually use the registervm command later.

   You do not need to specify --ostype, but doing so selects some sensible default values for certain VM parameters. For example, the RAM size and the type of the virtual network device. To get a complete list of supported operating systems you can use the following command:

   ```
   VBoxManage list ostypes
   ```

2. Ensure the settings for the VM are appropriate for the guest operating system that we will install. For example:

   ```
   VBoxManage modifyvm "Windows XP" --memory 256 --acpi on --boot1 dvd --nic1 nat
   ```

3. Create a virtual hard disk for the VM. For example, to create a 10 GB virtual hard disk:

   ```
   VBoxManage createhd --filename "WinXP.vdi" --size 10000
   ```

4. Add an IDE Controller to the new VM. For example:

   ```
   VBoxManage storagectl "Windows XP" --name "IDE Controller"
     --add ide --controller PIIX4
   ```

5. Set the VDI file you created as the first virtual hard disk of the new VM. For example:

   ```
   VBoxManage storageattach "Windows XP" --storagectl "IDE Controller"
    --port 0 --device 0 --type hdd --medium "WinXP.vdi"
   ```

6. Attach the ISO file that contains the operating system installation that you want to install later to the virtual machine. This is done so that the VM can boot from it.

   ```
   VBoxManage storageattach "Windows XP" --storagectl "IDE Controller"
    --port 0 --device 1 --type dvddrive --medium /full/path/to/iso.iso
   ```

7. Enable the VirtualBox Remote Desktop Extension, the VRDP server, as follows:

   ```
   VBoxManage modifyvm "Windows XP" --vrde on
   ```

8. Start the virtual machine using the VBoxHeadless command:

   ```
   VBoxHeadless --startvm "Windows XP"
   ```

   If the configuration steps worked, you should see a copyright notice. If you are returned to the command line, then something did not work correctly.

9. On the client machine, start the RDP viewer and connect to the server. See *10.1.1 Common Third-Party RDP Viewers on page 162* for details of how to use various common RDP viewers.

   The installation routine of your guest operating system should be displayed in the RDP viewer.

10.1.4 Separate Mode

Separate mode is an alternative front end for local and remote virtual machines. Separate mode is based on the VBoxHeadless front end but uses the VirtualBox Manager user interface to control and display virtual machines, rather than an RDP viewer program. The VirtualBox Remote Desktop Extension (VRDE) is not required for separate mode.

Separate mode enables the guest graphical user interface to easily attach to and detach from a running VM. Users with several running VMs can use separate mode to display the required VM, while keeping all other VMs in the background until they are needed.

Separate mode has some security advantages, compared to using the VBoxHeadless front end.

Using Separate Mode

The following list describes some typical operations in separate mode.

- To start a virtual machine in separate mode:

  In VirtualBox Manager, click **Machines** and select the machine you want to start. Choose **Start with detachable GUI** from the **Start** options on the toolbar or right-click menu.
- To **detach** from a virtual machine in separate mode:

  On the virtual machine's **Machine** menu, select **Detach GUI**.
- To **attach** to a virtual machine in separate mode:

  Select the VM name in the **Machines** list in VirtualBox Manager and then click **Show**.
- To **stop** a virtual machine that is running in separate mode:

  Right-click the VM name in the machine list in VirtualBox Manager and select an option in the **Stop** menu.

10.1.5 Remote USB

As a special feature additional to the VRDP support, Oracle VirtualBox also supports remote USB devices over the wire. That is, an Oracle VirtualBox guest that runs on one computer can access the USB devices of the remote computer on which the VRDP data is being displayed the same way as USB devices that are connected to the actual host. This enables running of virtual machines on an Oracle VirtualBox host that acts as a server, where a client can connect from elsewhere that needs only a network adapter and a display capable of running an RDP viewer. When USB devices are plugged into the client, the remote Oracle VirtualBox server can access them.

For these remote USB devices, the same filter rules apply as for other USB devices. See *USB Settings*. All you have to do is specify Remote, or Any, when setting up these rules.

Accessing remote USB devices is only possible if the RDP client supports this extension. Some versions of uttsc, a client tailored for the use with Sun Ray thin clients, support accessing remote

USB devices. RDP clients for other platforms will be provided in future Oracle VirtualBox versions.

10.1.6 RDP Authentication

For each virtual machine that is remotely accessible using RDP, you can individually determine if and how client connections are authenticated. For this, use the VBoxManage modifyvm command with the --vrde-auth-type option. See *15.35 VBoxManage modifyvm on page 402*. The following methods of authentication are available:

- The **null** method means that there is no authentication at all. Any client can connect to the VRDP server and thus the virtual machine. This is very insecure and only to be recommended for private networks.
- The **external** method provides external authentication through a special authentication library. Oracle VirtualBox ships with two special authentication libraries:

  1. The default authentication library, VBoxAuth, authenticates against user credentials of the hosts. Depending on the host platform, this means the following:

     - On Linux and Oracle Solaris hosts, VBoxAuth.so authenticates users against the host's PAM system.
     - On Windows hosts, VBoxAuth.dll authenticates users against the host's WinLogon system.
     - On macOS hosts, VBoxAuth.dylib authenticates users against the host's directory service.

     In other words, the external method by default performs authentication with the user accounts that exist on the host system. Any user with valid authentication credentials is accepted. For example, the username does not have to correspond to the user running the VM.
  2. An additional library called VBoxAuthSimple performs authentication against credentials configured in the extradata section of a virtual machine's XML settings file. This is probably the simplest way to get authentication that does not depend on a running and supported guest. The following steps are required:

     1. Enable VBoxAuthSimple with the following command:

        VBoxManage setproperty vrdeauthlibrary "VBoxAuthSimple"
     2. To enable the library for a particular VM, you must switch authentication to external, as follows:

        VBoxManage modifyvm *VM-name* --vrde-auth-type external

        Replace *VM-name* with the VM name or UUID.
     3. You then need to configure users and passwords by writing items into the machine's extradata. Since the XML machine settings file, into whose extradata section the password needs to be written, is a plain text file, Oracle VirtualBox uses hashes to encrypt passwords. The following command must be used:

        VBoxManage setextradata *VM-name* "VBoxAuthSimple/users/*user*" *hash*

        Replace *VM-name* with the VM name or UUID, *user* with the user name who should be allowed to log in and *hash* with the encrypted password. The following command example obtains the hash value for the password secret:

        ```
        $ VBoxManage internalcommands passwordhash "secret"
        2bb80d537b1da3e38bd30361aa855686bde0eacd7162fef6a25fe97bf527a25b
        ```

You then use VBoxManage setextradata to store this value in the machine's extradata section.

As a combined example, to set the password for the user john and the machine My VM to secret, use this command:

```
VBoxManage setextradata "My VM" "VBoxAuthSimple/users/john"
  2bb80d537b1da3e38bd30361aa855686bde0eacd7162fef6a25fe97bf527a25b
```

- The **guest** authentication method performs authentication with a special component that comes with the Guest Additions. As a result, authentication is not performed on the host, but with the guest user accounts.

  This method is currently still in testing and not yet supported.

In addition to the methods described above, you can replace the default external authentication module with any other module. For this, Oracle VirtualBox provides a well-defined interface that enables you to write your own authentication module. This is described in detail in the Oracle VirtualBox Software Development Kit (SDK) reference. See *12.1 Oracle VirtualBox Programming Interfaces on page 235*.

10.1.7 RDP Encryption

RDP features data stream encryption, which is based on the RC4 symmetric cipher, with keys up to 128-bit. The RC4 keys are replaced at regular intervals, every 4096 packets.

RDP provides the following different server authentication methods:

- **RDP 4** authentication was used historically. With RDP 4, the RDP client does not perform any checks in order to verify the identity of the server it connects to. Since user credentials can be obtained using a man in the middle (MITM) attack, RDP4 authentication is insecure and should not be used.
- **RDP 5.1** authentication employs a server certificate for which the client possesses the public key. This way it is guaranteed that the server possess the corresponding private key. However, as this hard-coded private key became public some years ago, RDP 5.1 authentication is also insecure.
- **RDP 5.2 or later** authentication uses Enhanced RDP Security, which means that an external security protocol is used to secure the connection. RDP 4 and RDP 5.1 use Standard RDP Security. The VRDP server supports Enhanced RDP Security with TLS protocol and, as a part of the TLS handshake, sends the server certificate to the client.

  The Security/Method VRDE property sets the required security method that is used for a connection. You can also change this in the VM Settings, Remote Display tab. Valid values are as follows:

  - **Negotiate.** Both Enhanced (TLS) and Standard RDP Security connections are allowed. The security method is negotiated with the client.
  - **RDP.** Only Standard RDP Security is accepted.
  - **TLS.** Only Enhanced RDP Security is accepted. The client must support TLS. This is the default setting.

    The version of OpenSSL used by Oracle VirtualBox supports TLS versions 1.0, 1.1, 1.2, and 1.3.

  For example, the following command configures a client to use either Standard or Enhanced RDP Security connection:

```
VBoxManage modifyvm VM-name --vrde-property "Security/Method=negotiate"
```

If the Security/Method property is set to either Negotiate or TLS, the server uses TLS if the client supports it. However, to use TLS the server must have the Server Certificate and the Server Private Key. A Certificate Authority (CA) Certificate is optional.

If you choose TLS as the security method, Oracle VirtualBox generates a server key and certificate pair called VRDEAutoGeneratedPrivateKey.pem and VRDEAutoGeneratedCert.pem) for the VM. Oracle VirtualBox also recreates the auto-generated certificate and key if they are about to expire, or if one or both are deleted or corrupted.

To generate a custom server key and certificate pair, with a CA certificate, follow these steps.

1. Create a CA self signed certificate.

```
openssl req -new -x509 -days 365 -extensions v3_ca \
  -keyout ca_key_private.pem -out ca_cert.pem
```

2. Generate a server private key and a request for signing.

```
openssl genrsa -out server_key_private.pem
openssl req -new -key server_key_private.pem -out server_req.pem
```

3. Generate the server certificate.

```
openssl x509 -req -days 365 -in server_req.pem \
  -CA ca_cert.pem -CAkey ca_key_private.pem -set_serial 01 -out server_cert.pem
```

Configure the server to access the required files. For example:

```
VBoxManage modifyvm VM-name \
  --vrde-property "Security/CACertificate=path/ca_cert.pem"
VBoxManage modifyvm VM-name \
  --vrde-property "Security/ServerCertificate=path/server_cert.pem"
VBoxManage modifyvm VM-name \
  --vrde-property "Security/ServerPrivateKey=path/server_key_private.pem"
```

Note that Oracle VirtualBox does not maintain custom certificates. You are responsible for keeping these updated.

As the client that connects to the server determines what type of encryption will be used, with rdesktop, the Linux RDP viewer, use the -4 or -5 options.

10.1.8 Multiple Connections to the VRDP Server

The VRDP server of Oracle VirtualBox supports multiple simultaneous connections to the same running VM from different clients. All connected clients see the same screen output and share a mouse pointer and keyboard focus. This is similar to several people using the same computer at the same time, taking turns at the keyboard.

The following command enables multiple connection mode:

```
VBoxManage modifyvm VM-name --vrde-multi-con on
```

10.1.9 Multiple Remote Monitors

To access two or more remote VM displays you have to enable the VRDP multiconnection mode. See *10.1.8 Multiple Connections to the VRDP Server on page 168*.

The RDP client can select the virtual monitor number to connect to using the domain login parameter (-d). If the parameter ends with @ followed by a number, Oracle VirtualBox interprets

this number as the screen index. The primary guest screen is selected with @1, the first secondary screen is @2, and so on.

The Microsoft RDP 6 client does not let you specify a separate domain name. Instead, enter *domain\username* in the **Username** field. For example, @2*name* . *name* must be supplied, and must be the name used to log in if the VRDP server is set up to require credentials. If it is not, you may use any text as the username.

10.1.10 VRDP Video Redirection

The VRDP server can redirect video streams from the guest to the RDP client. Video frames are compressed using the JPEG algorithm allowing a higher compression ratio than standard RDP bitmap compression methods. It is possible to increase the compression ratio by lowering the video quality.

The VRDP server automatically detects video streams in a guest as frequently updated rectangular areas. As a result, this method works with any guest operating system without having to install additional software in the guest. In particular, the Guest Additions are not required.

On the client side, however, currently only the Windows 7 Remote Desktop Connection client supports this feature. If a client does not support video redirection, the VRDP server falls back to regular bitmap updates.

The following command enables video redirection:

VBoxManage modifyvm *VM-name* --vrde-video-channel on

The quality of the video is defined as a value from 10 to 100 percent, representing a JPEG compression level, where lower numbers mean lower quality but higher compression. The quality can be changed using the following command:

VBoxManage modifyvm *VM-name* --vrde-video-channel-quality 75

10.1.11 VRDP Customization

You can disable display output, mouse and keyboard input, audio, remote USB, or clipboard individually in the VRDP server.

The following commands change the corresponding server settings:

```
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableDisplay=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableInput=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableUSB=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableAudio=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableClipboard=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableUpstreamAudio=1
```

To reenable a feature, use a similar command without the trailing 1. For example:

$ VBoxManage modifyvm *VM-name* --vrde-property Client/DisableDisplay=

10.2 Teleporting

Oracle VirtualBox supports *teleporting*. Teleporting is moving a virtual machine over a network from one Oracle VirtualBox host to another, while the virtual machine is running. This works regardless of the host operating system that is running on the hosts. You can teleport virtual machines between Oracle Solaris and macOS hosts, for example.

Teleporting requires that a machine be currently running on one host, which is called the *source*. The host to which the virtual machine will be teleported is called the *target*. The machine on the target is then configured to wait for the source to contact the target. The machine's running state will then be transferred from the source to the target with minimal downtime.

Teleporting happens over any TCP/IP network. The source and the target only need to agree on a TCP/IP port which is specified in the teleporting settings.

At this time, there are a few prerequisites for this to work, as follows:

- On the target host, you must configure a virtual machine in Oracle VirtualBox with exactly the same hardware settings as the machine on the source that you want to teleport. This does not apply to settings which are merely descriptive, such as the VM name, but obviously for teleporting to work, the target machine must have the same amount of memory and other hardware settings. Otherwise teleporting will fail with an error message.
- The two virtual machines on the source and the target must share the same storage, hard disks as well as floppy disks and CD/DVD images. This means that they either use the same iSCSI targets or that the storage resides somewhere on the network and both hosts have access to it using NFS or SMB/CIFS.

  This also means that neither the source nor the target machine can have any snapshots.

To configure teleporting, perform the following steps:

1. On the *target* host, configure the virtual machine to wait for a teleport request to arrive when it is started, instead of actually attempting to start the machine. This is done with the following VBoxManage command:

   VBoxManage modifyvm *targetvmname* --teleporter on --teleporter-port *port*

   targetvmname is the name of the virtual machine on the target host and *port* is a TCP/IP port number to be used on both the source and the target hosts. For example, use 6000. See *15.35 VBoxManage modifyvm on page 402*.
2. Start the VM on the target host. Instead of running, the VM shows a progress dialog, indicating that it is waiting for a teleport request to arrive.
3. Start the VM on the *source* host as usual. When it is running and you want it to be teleported, issue the following command on the source host:

   VBoxManage controlvm *sourcevmname* teleport --host *targethost* --port *port*

   where *sourcevmname* is the name of the virtual machine on the source host, which is the machine that is currently running. *targethost* is the host or IP name of the target host on which the machine is waiting for the teleport request, and *port* must be the same number as specified in the command on the target host. See *15.12 VBoxManage controlvm on page 309*.

For testing, you can also teleport machines on the same host. In that case, use localhost as the hostname on both the source and the target host.

Note:

In rare cases, if the CPUs of the source and the target are very different, teleporting can fail with an error message, or the target may hang. This may happen especially if the VM is running application software that is highly optimized to run on a particular CPU without correctly checking that certain CPU features are actually present. Oracle VirtualBox filters what CPU capabilities are presented to the guest operating system. Advanced users can attempt to restrict these virtual CPU capabilities with the VBoxManage modifyvm --cpuid-portability-level command. See *15.35 VBoxManage modifyvm on page 402*.

10.3 VBoxHeadless

Oracle VirtualBox remote desktop server

10.3.1 Synopsis

VBoxHeadless [##startvm=<*uuid* | *vmname*>] [##vrde=on | off | config] [##vrdeproperty=*prop#name*=[*prop#value*]] [##settingspw=*password*] [##settingspwfile=*password#file*] [##start#paused] [##capture] [##width=*width*] [##height=*height*] [##bitrate=*bit#rate*] [##filename=*filename*]

10.3.2 Description

The **VBoxHeadless** command is an alternate front end that enables you to remotely manage virtual machines (VMs). The front end is a CLI rather than the VirtualBox Manager graphical user interface (GUI).

For information about using this command, see *10.1.2 VBoxHeadless, the Remote Desktop Server on page 162*.

10.3.2.1 Command Options

--startvm=*uuid* | *vmname*

Specifies the Universally Unique Identifier (UUID) or name of the VM to start.

Use the **VBoxManage list vms** command to obtain VM information.

The short versions of this option is -s.

--vrde=on | off | config

Specifies how to use the VRDP server. The default value is config. Valid values are as follows:

- on enables the VRDP server.

  ```
  VBoxHeadless --startvm=vmname --vrde=on
  ```
- off disables the VRDP server.

  ```
  VBoxHeadless --startvm=vmname --vrde=off
  ```
- config enables the VRDP server depending on the VM configuration.

  ```
  VBoxHeadless --startvm=vmname --vrde=config
  ```

The short version of this option is -v.

--vrdeproperty=*prop-name*=[*prop-value*]

Specifies a value for one of the following properties:

- The TCP/Ports property value is a comma-separated list of ports to which the VRDE server can bind. Use a hyphen (-) between two port numbers to specify a range of ports.
- The TCP/Address property value is the interface IP address to which to bind the VRDE server.

--settingspw=*password*

Specifies a settings password to access encrypted settings. If you do not specify the password on the command line, **VBoxHeadless** prompts you for the password.

--settingspwfile=*password-file*

Specifies the file that contains the settings password.

--start-paused

Starts the specified VM in the paused state.

--capture

Records the VM screen output to a file. In addition to this option, you must use the --filename option to specify the name of the file.

--width=*width*

Specifies the frame width of the recording in pixels. This option is associated with the --capture option.

--height=*height*

Specifies the frame height of the recording in pixels. This option is associated with the --capture option.

--bitrate=*bit-rate*

Specifies the bit rate of the recording in kilobits per second. This option is associated with the --capture option.

--filename=*filename*

Specifies the name of the file in which to store the recording. The codec used is based on the file extension that you choose. You must specify this option if you use the --capture option.

10.3.3 Examples

The following command starts the ol7u4 VM:

```
$ VBoxHeadless --startvm "ol7u4"
```

The following command starts the ol7u6 VM in the Paused state.

```
$ VBoxHeadless --startvm "ol7u6" --start-paused
```

The following command starts the ol7u6 VM and records the session. The recording is saved to the ol7u6-recording WebM file.

```
$ VBoxHeadless --startvm "ol7u6" --capture --filename ol7u6-recording.webm
```

10.3.4 See Also

15.29 VBoxManage list on page 384, *15.47 VBoxManage startvm on page 446*

11 Advanced Topics

11.1 Automated Guest Logins

Oracle VirtualBox provides Guest Addition modules for Windows, Linux, and Oracle Solaris to enable automated logins on the guest.

When a guest operating system is running in a virtual machine, it might be required to perform coordinated and automated logins using credentials passed from the host. Credentials are user name, password, and domain name, where each value might be empty.

11.1.1 Automated Windows Guest Logins

Windows provides a modular system login subsystem, called Winlogon, which can be customized and extended by means of so-called GINA (Graphical Identification and Authentication) modules. In Windows Vista and later releases, the GINA modules were replaced with a new mechanism called credential providers. The Oracle VirtualBox Guest Additions for Windows come with both, a GINA and a credential provider module, and therefore enable any Windows guest to perform automated logins.

To activate the Oracle VirtualBox GINA or credential provider module, install the Guest Additions using the command line switch /with_autologon. All the following manual steps required for installing these modules will be then done by the installer.

To manually install the Oracle VirtualBox GINA module, extract the Guest Additions as shown in *Manual File Extraction*, and copy the VBoxGINA.dll file to the Windows SYSTEM32 directory. In the registry, create the following key with a value of VBoxGINA.dll:

HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon\GinaDLL

Note:

The Oracle VirtualBox GINA module is implemented as a wrapper around the MSGINA.DLL standard Windows GINA module. As a result, it might not work correctly with third-party GINA modules.

To manually install the Oracle VirtualBox credential provider module, extract the Guest Additions as shown in *Manual File Extraction* and copy the VBoxCredProv.dll file to the Windows SYSTEM32 directory. In the registry, create the following keys:

HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\
Authentication\Credential Providers\{275D3BCC-22BB-4948-A7F6-3A3054EBA92B}

HKEY_CLASSES_ROOT\CLSID\{275D3BCC-22BB-4948-A7F6-3A3054EBA92B}

HKEY_CLASSES_ROOT\CLSID\{275D3BCC-22BB-4948-A7F6-3A3054EBA92B}\InprocServer32

All default values, the key named Default, must be set to VBoxCredProv.

Create the following string and assign it a value of Apartment.

HKEY_CLASSES_ROOT\CLSID\{275D3BCC-22BB-4948-
A7F6-3A3054EBA92B}\InprocServer32\ThreadingModel

To set credentials, use the following command on a *running* VM:

```
$ VBoxManage controlvm "Windows XP" setcredentials "John Doe" "secretpassword" "DOMTEST"
```

While the VM is running, the credentials can be queried by the Oracle VirtualBox login modules, GINA or credential provider, using the Oracle VirtualBox Guest Additions device driver. When Windows is in *logged out* mode, the login modules will constantly poll for credentials and if they are present, a login will be attempted. After retrieving the credentials, the login modules will erase them so that the above command will have to be repeated for subsequent logins.

For security reasons, credentials are not stored in any persistent manner and will be lost when the VM is reset. Also, the credentials are write-only. There is no way to retrieve the credentials from the host side. Credentials can be reset from the host side by setting empty values.

Depending on the Windows guest version, the following restrictions apply:

- For **Windows XP guests.** The login subsystem needs to be configured to use the classic login dialog, as the Oracle VirtualBox GINA module does not support the Windows XP-style welcome dialog.
- **Windows Vista, Windows 7, Windows 8, Windows 10 and Windows 11 guests.** The login subsystem does not support the so-called Secure Attention Sequence, Ctrl+Alt+Del. As a result, the guest's group policy settings need to be changed to not use the Secure Attention Sequence. Also, the user name given is only compared to the true user name, not the user friendly name. This means that when you rename a user, you still have to supply the original user name as Windows never renames user accounts internally.
- Automatic login handling of the built-in **Windows Remote Desktop Service**, formerly known as Terminal Services, is disabled by default. To enable it, create the following registry key with a DWORD value of 1.

  HKEY_LOCAL_MACHINE\SOFTWARE\Oracle\VirtualBox Guest Additions\AutoLogon

The following command forces Oracle VirtualBox to keep the credentials after they were read by the guest and on VM reset:

```
$ VBoxManage setextradata "Windows XP" VBoxInternal/Devices/VMMDev/0/Config/KeepCredentials 1
```

Note that this is a potential security risk, as a malicious application running on the guest could request this information using the proper interface.

11.1.2 Automated Linux and UNIX Guest Logins

Oracle VirtualBox provides a custom PAM module (Pluggable Authentication Module) which can be used to perform automated guest logins on platforms which support this framework. Virtually all modern Linux and UNIX distributions rely on PAM.

For automated logins on Ubuntu, or Ubuntu-derived, distributions using LightDM as the display manager. See *11.1.2.1 Oracle VirtualBox Greeter for Ubuntu/LightDM on page 178*.

The pam_vbox.so module itself *does not* do an actual verification of the credentials passed to the guest OS. Instead it relies on other modules such as pam_unix.so or pam_unix2.so down in the PAM stack to do the actual validation using the credentials retrieved by pam_vbox.so. Therefore pam_vbox.so has to be on top of the authentication PAM service list.

Note:

The pam_vbox.so module only supports the auth primitive. Other primitives such as account, session, or password are not supported.

The pam_vbox.so module is shipped as part of the Guest Additions but it is not installed or activated on the guest OS by default. In order to install it, it has to be copied from /opt/VBoxGuestAdditions-*version*/other/ to the security modules directory. This is usually /lib/security/ on 32-bit Linux guests or /lib64/security/ on 64-bit Linux guests. Please refer to your guest OS documentation for the correct PAM module directory.

For example, to use pam_vbox.so with a Ubuntu Linux guest OS and the GNOME Desktop Manager (GDM) to log in users automatically with the credentials passed by the host, configure the guest OS as follows:

1. Copy the pam_vbox.so module to the security modules directory. In this case, /lib/security.
2. Edit the PAM configuration file for GDM, found at /etc/pam.d/gdm. Add the line auth requisite pam_vbox.so at the top. Additionally, in most Linux distributions there is a file called /etc/pam.d/common-auth. This file is included in many other services, like the GDM file mentioned above. There you also have to add the line auth requisite pam_vbox.so.
3. If authentication against the shadow database using pam_unix.so or pam_unix2.so is required, the argument try_first_pass for pam_unix.so or use_first_pass for pam_unix2.so is needed in order to pass the credentials from the Oracle VirtualBox module to the shadow database authentication module. For Ubuntu, this must be added to /etc/pam.d/common-auth, to the end of the line referencing pam_unix.so. This argument tells the PAM module to use credentials already present in the stack, such as the ones provided by the Oracle VirtualBox PAM module.

CAUTION:

An incorrectly configured PAM stack can effectively prevent you from logging into your guest system.

To make deployment easier, you can pass the argument debug right after the pam_vbox.so statement. Debug log output will then be recorded using syslog.

Note:

By default, pam_vbox does not wait for credentials to arrive from the host. When a login prompt is shown, for example by GDM/KDM or the text console, and pam_vbox does not yet have credentials it does not wait until they arrive. Instead the next module in the PAM stack, depending on the PAM configuration, will have the chance for authentication.

pam_vbox supports various guest property parameters that are located in /VirtualBox/GuestAdd/PAM/. These parameters allow pam_vbox to wait for credentials to be provided by the host and optionally can show a message while waiting for those. The following guest properties can be set:

- CredsWait: Set to 1 if pam_vbox should start waiting until credentials arrive from the host. Until then no other authentication methods such as manually logging in will be available. If this property is empty or gets deleted no waiting for credentials will be performed and pam_vbox will act like before. This property must be set read-only for the guest (RDONLYGUEST).
- CredsWaitAbort: Aborts waiting for credentials when set to any value. Can be set from host and the guest.
- CredsWaitTimeout: Timeout, in seconds, to let pam_vbox wait for credentials to arrive. When no credentials arrive within this timeout, authentication of pam_vbox will be set to failed and the next PAM module in chain will be asked. If this property is not specified, set to 0 or an invalid value, an infinite timeout will be used. This property must be set read-only for the guest (RDONLYGUEST).

To customize pam_vbox further there are the following guest properties:

- CredsMsgWaiting: Custom message showed while pam_vbox is waiting for credentials from the host. This property must be set read-only for the guest (RDONLYGUEST).
- CredsMsgWaitTimeout: Custom message showed when waiting for credentials by pam_vbox has timed out. For example, they did not arrive within time. This property must be set read-only for the guest (RDONLYGUEST).

Note:

If a pam_vbox guest property does not have the correct flag set (RDONLYGUEST) the property is ignored and, depending on the property, a default value will be used. This can result in pam_vbox not waiting for credentials. Consult the appropriate syslog file for more information and use the debug option.

11.1.2.1 Oracle VirtualBox Greeter for Ubuntu/LightDM

Oracle VirtualBox comes with a greeter module, named vbox-greeter, that can be used with LightDM. LightDM is the default display manager for Ubuntu Linux and therefore can also be used for automated guest logins.

vbox-greeter does not need the pam_vbox module described in *11.1.2 Automated Linux and UNIX Guest Logins on page 176*in order to function. It comes with its own authentication mechanism provided by LightDM. However, to provide maximum flexibility both modules can be used together on the same guest.

As with the pam_vbox module, vbox-greeter is shipped as part of the Guest Additions but it is not installed or activated on the guest OS by default. To install vbox-greeter automatically upon Guest Additions installation, use the --with-autologon option when starting the VBoxLinuxAdditions.run file:

```
# ./VBoxLinuxAdditions.run -- --with-autologon
```

For manual or postponed installation, copy the vbox-greeter.desktop file from /opt/VBoxGuestAdditions-*version*/other/ to the xgreeters directory, which is usually /usr/share/xgreeters/. See your guest OS documentation for the name of the correct LightDM greeter directory.

The vbox-greeter module is installed by the Oracle VirtualBox Guest Additions installer and is located in /usr/sbin/. To enable vbox-greeter as the standard greeter module, edit the file /etc/lightdm/lightdm.conf as follows:

```
[SeatDefaults]
greeter-session=vbox-greeter
```

Note:

- The LightDM server must be fully restarted in order for vbox-greeter to be used as the default greeter. As root on Ubuntu, run service lightdm --full-restart or restart the guest.
- vbox-greeter is independent of the graphical session you choose, such as Gnome, KDE, or Unity. However, vbox-greeter does require FLTK 1.3 or later to implement its own user interface.

There are numerous guest properties which can be used to further customize the login experience. For automatically logging in users, the same guest properties apply as for pam_vbox. See *11.1.2 Automated Linux and UNIX Guest Logins on page 176*.

In addition to the previously mentioned guest properties, vbox-greeter enables you to further customize its user interface. The following guest properties are located in the /VirtualBox/GuestAdd/Greeter/ directory:

- HideRestart: Set to 1 if vbox-greeter should hide the button to restart the guest. This property must be set read-only for the guest (RDONLYGUEST).
- HideShutdown: Set to 1 if vbox-greeter should hide the button to shutdown the guest. This property must be set read-only for the guest (RDONLYGUEST).
- BannerPath: Path to a .PNG file to use as a banner image on the top of the greeter. The image size must be 460 x 90 pixels, any bit depth. This property must be set read-only for the guest (RDONLYGUEST).
- UseTheming: Set to 1 for turning on the following theming options. This property must be set read-only for the guest (RDONLYGUEST).
- Theme/BackgroundColor: Hexadecimal RRGGBB color for the background. This property must be set read-only for the guest (RDONLYGUEST).
- Theme/LogonDialog/HeaderColor: Hexadecimal RRGGBB foreground color for the header text. This property must be set read-only for the guest (RDONLYGUEST).
- Theme/LogonDialog/BackgroundColor: Hexadecimal RRGGBB color for the login dialog background. This property must be set read-only for the guest (RDONLYGUEST).
- Theme/LogonDialog/ButtonColor: Hexadecimal RRGGBB background color for the login dialog button. This property must be set read-only for the guest (RDONLYGUEST).

Note:

The same restrictions for the guest properties above apply as for the ones specified in the pam_vbox section.

11.2 CPU Hot-Plugging

With virtual machines running modern server operating systems, Oracle VirtualBox supports CPU hot-plugging.

On a physical computer CPU hot-plugging would mean that a CPU can be added or removed while the machine is running. Oracle VirtualBox supports adding and removing of virtual CPUs while a virtual machine is running.

CPU hot-plugging works only with guest operating systems that support the feature. So far this applies only to Linux and Windows Server. Windows supports only hot-add, while Linux supports hot-add and hot-remove. To use this feature with more than 8 CPUs, a 64-bit Linux guest is required.

CPU hot-plugging is done using the VBoxManage command-line interface. First, hot-plugging needs to be enabled for a virtual machine:

```
$ VBoxManage modifyvm VM-name --cpu-hotplug on
```

The --cpus option is used to specify the maximum number of CPUs that the virtual machine can have:

```
$ VBoxManage modifyvm VM-name --cpus 8
```

When the VM is off, you can then add and remove virtual CPUs with the VBoxManage modifyvm --plug-cpu and VBoxManage modifyvm --unplug-cpu commands, which take the number of the virtual CPU as a parameter, as follows:

```
$ VBoxManage modifyvm VM-name --plug-cpu 3
$ VBoxManage modifyvm VM-name --unplug-cpu 3
```

Note that CPU 0 can never be removed.

While the VM is running, CPUs can be added and removed with the VBoxManage controlvm plugcpu and VBoxManage controlvm unplugcpu commands instead, as follows:

```
$ VBoxManage controlvm VM-name plugcpu 3
$ VBoxManage controlvm VM-name unplugcpu 3
```

See *15.35 VBoxManage modifyvm on page 402* and *15.12 VBoxManage controlvm on page 309* for details.

With Linux guests, the following applies:

To prevent ejection while the CPU is still used it has to be ejected from within the guest before. The Linux Guest Additions contain a service which receives hot-remove events and ejects the CPU. Also, after a CPU is added to the VM it is not automatically used by Linux. The Linux Guest Additions service will take care of that if installed. If not a CPU can be started with the following command:

```
$ echo 1 > /sys/devices/system/cpu/cpu<id>/online
```

11.3 Webcam Passthrough

11.3.1 Using a Host Webcam in the Guest

Oracle VirtualBox includes a feature called *webcam passthrough*, which enables a guest to use a host webcam. This complements the general USB passthrough support which was the typical way of using host webcams in legacy releases. The webcam passthrough support can handle non-USB video sources in theory, but this is completely untested.

> **Note:**
>
> The webcam passthrough module is shipped as part of the Oracle VirtualBox Extension Pack, which must be installed separately. See *3.1.1 Install the Oracle VirtualBox Extension Pack on page 43*.

The host webcam can be attached to the VM using the **Devices** menu in the VM menu bar. The **Webcams** menu contains a list of available video input devices on the host. Clicking on a webcam name attaches or detaches the corresponding host device.

The VBoxManage command line tool can be used to enable webcam passthrough. Please see the host-specific sections below for additional details. The following commands are available:

- Get a list of host webcams, or other video input devices:

  ```
  $ VBoxManage list webcams
  ```

  The output format is as follows:

alias "user friendly name"
host path or identifier

The alias can be used as a shortcut in other commands. Alias '.0' means the default video input device on the host. Alias '.1', '.2'means first, second video input device, and so on. The device order is host-specific.

- Attach a webcam to a running VM, as follows:

  VBoxManage controlvm *VM name* webcam attach [*host_path*|*alias* [*settings*]]

  This attaches a USB webcam device to the guest.

  The settings parameter is a string Setting1=Value1;Setting2=Value2, which enables you to configure the emulated webcam device. The following settings are supported:

  - MaxFramerate: The highest rate at which video frames are sent to the guest. A higher frame rate requires more CPU power. Therefore sometimes it is useful to set a lower limit. Default is no limit and allow the guest to use all frame rates supported by the host webcam.
  - MaxPayloadTransferSize: How many bytes the emulated webcam can send to the guest at a time. Default value is 3060 bytes, which is used by some webcams. Higher values can slightly reduce CPU load, if the guest is able to use larger buffers. However, a high MaxPayloadTransferSize might be not supported by some guests.
- Detach a webcam from a running VM, as follows:

  VBoxManage controlvm *VM-name* webcam detach [*host_path*|*alias*]
- List the webcams attached to a running VM, as follows:

  VBoxManage controlvm *VM-name* webcam list

  The output contains the path or alias which was used in the webcam attach command for each attached webcam.

11.3.2 Windows Hosts

When the webcam device is detached from the host, the emulated webcam device is automatically detached from the guest.

11.3.3 macOS Hosts

When the webcam device is detached from the host, the emulated webcam device remains attached to the guest and must be manually detached using the VBoxManage controlvm *VM-name* webcam detach command.

11.3.4 Linux and Oracle Solaris Hosts

Host Webcam passthrough is restricted to 640x480 frames at 20 frames per second due to limitations in the Oracle Solaris V4L2 API. This may be addressed in a future Oracle Solaris release.

When the webcam is detached from the host the emulated webcam device is automatically detached from the guest only if the webcam is streaming video. If the emulated webcam is inactive it should be manually detached using the VBoxManage controlvm *VM-name* webcam detach command.

Aliases .0 and .1 are mapped to /dev/video0, alias .2 is mapped to /dev/video1 and so forth.

11.4 Advanced Display Configuration

11.4.1 Custom VESA Resolutions

Apart from the standard VESA resolutions, the Oracle VirtualBox VESA BIOS enables you to add up to 16 custom video modes which will be reported to the guest operating system. When using Windows guests with the Oracle VirtualBox Guest Additions, a custom graphics driver will be used instead of the fallback VESA solution so this information does not apply.

Additional video modes can be configured for each VM using the extra data facility. The extra data key is called CustomVideoMode*x* with *x* being a number from 1 to 16. Please note that modes will be read from 1 until either the following number is not defined or 16 is reached. The following example adds a video mode that corresponds to the native display resolution of many notebook computers:

```
$ VBoxManage setextradata VM-name "CustomVideoMode1" "1400x1050x16"
```

The VESA mode IDs for custom video modes start at 0x160. In order to use the above defined custom video mode, the following command line has to be supplied to Linux:

```
vga = 0x200 | 0x160
vga = 864
```

For guest operating systems with Oracle VirtualBox Guest Additions, a custom video mode can be set using the video mode hint feature.

11.4.2 Configuring the Maximum Resolution of Guests When Using the Graphical Frontend

When guest systems with the Guest Additions installed are started using the graphical frontend, the normal Oracle VirtualBox application, they will not be allowed to use screen resolutions greater than the host's screen size unless the user manually resizes them by dragging the window, switching to full screen or seamless mode or sending a video mode hint using VBoxManage. This behavior is what most users will want, but if you have different needs, you can change it by issuing one of the following commands from the command line:

- Remove all limits on guest resolutions.

  ```
  VBoxManage setextradata global GUI/MaxGuestResolution any
  ```

- Manually specify a maximum resolution.

  ```
  VBoxManage setextradata global GUI/MaxGuestResolution widthxheight
  ```

- Restore the default settings to all guest VMs.

  ```
  VBoxManage setextradata global GUI/MaxGuestResolution auto
  ```

11.5 Advanced Storage Configuration

11.5.1 Using a Raw Host Hard Disk From a Guest

As an alternative to using virtual disk images as described in *Virtual Storage*, Oracle VirtualBox can also present either entire physical hard disks or selected partitions as virtual disks to virtual machines.

With Oracle VirtualBox, this type of access is called *raw hard disk access*. It enables a guest operating system to access its virtual hard disk without going through the host OS file system. The actual performance difference for image files compared to raw disk varies greatly depending on the overhead of the host file system, whether dynamically growing images are used, and on host OS caching strategies. The caching indirectly also affects other aspects such as failure behavior. For example, whether the virtual disk contains all data written before a host OS crash. Consult your host OS documentation for details on this.

CAUTION:

Raw hard disk access is for expert users only. Incorrect use or use of an outdated configuration can lead to **total loss of data** on the physical disk. Most importantly, *do not* attempt to boot the partition with the currently running host operating system in a guest. This will lead to severe data corruption.

Raw hard disk access, both for entire disks and individual partitions, is implemented as part of the VMDK image format support. As a result, you will need to create a special VMDK image file which defines where the data will be stored. After creating such a special VMDK image, you can use it like a regular virtual disk image. For example, you can use the Virtual Media Manager, see *The Virtual Media Manager*, or VBoxManage to assign the image to a virtual machine.

11.5.1.1 Access to Entire Physical Hard Disk

While this variant is the simplest to set up, you must be aware that this will give a guest operating system direct and full access to an *entire physical disk*. If your *host* operating system is also booted from this disk, please take special care to not access the partition from the guest at all. On the positive side, the physical disk can be repartitioned in arbitrary ways without having to recreate the image file that gives access to the raw disk.

On a Linux host, to create an image that represents an entire physical hard disk which will not contain any actual data, as this will all be stored on the physical disk, use the following command:

```
$ VBoxManage createmedium disk --filename path-to-file.vmdk --format=VMDK
 --variant RawDisk --property RawDrive=/dev/sda
```

This creates the *path-to-file*.vmdk file image that must be an absolute path. All data is read and written from /dev/sda.

On a Windows host, instead of the above device specification, for example use \\.\PhysicalDrive0. On a macOS host, instead of the above device specification use for example /dev/rdisk1. Note that on Mac OS X you can only get access to an entire disk if no volume is mounted from it.

Creating the image requires read/write access for the given device. Read/write access is also later needed when using the image from a virtual machine. On some host platforms, such as Windows, raw disk access may be restricted and not permitted by the host OS in some situations.

Just like with regular disk images, this does not automatically attach the newly created image to a virtual machine. This can be done as follows:

```
$ VBoxManage storageattach WindowsXP --storagectl "IDE Controller" \
 --port 0 --device 0 --type hdd --medium path-to-file.vmdk
```

When this is done the selected virtual machine will boot from the specified physical disk.

11.5.1.2 Access to Individual Physical Hard Disk Partitions

This *raw partition support* is quite similar to the full hard disk access described above. However, in this case, any partitioning information will be stored inside the VMDK image. This means that you can install a different boot loader in the virtual hard disk without affecting the host's partitioning information. While the guest will be able to *see* all partitions that exist on the physical disk, access will be filtered in that reading from partitions for which no access is allowed the partitions will only yield zeroes, and all writes to them are ignored.

To create a special image for raw partition support, which will contain a small amount of data, on a Linux host, use the command:

```
$ VBoxManage createmedium disk --filename path-to-file.vmdk --format=VMDK
--variant RawDisk --property RawDrive=/dev/sda --property Partitions=1,5
```

The command is identical to the one for full hard disk access, except for the additional `--property Partitions=1,5` parameter. This example would create the image *path-to-file*.vmdk, which must be absolute, and partitions 1 and 5 of /dev/sda would be made accessible to the guest.

Oracle VirtualBox uses the same partition numbering as your Linux host. As a result, the numbers given in the above example would refer to the first primary partition and the first logical drive in the extended partition, respectively.

On a Windows host, instead of the above device specification, use for example \\.\PhysicalDrive0. On a macOS host, instead of the above device specification use /dev/rdisk1, for example. Note that on OS X you can only use partitions which are not mounted. Unmount the respective disk first using *diskutil unmountDisk /dev/diskX* . Partition numbers are the same on Linux, Windows, and macOS hosts.

The numbers for the list of partitions can be taken from the output of the following command:

```
$ VBoxManage list hostdrives
```

The output lists available drives and their partitions with the partition types and sizes to give the user enough information to identify the partitions necessary for the guest.

Images which give access to individual partitions are specific to a particular host disk setup. You cannot transfer these images to another host. Also, whenever the host partitioning changes, the image *must be recreated*.

Creating the image requires read/write access for the given device. Read/write access is also later needed when using the image from a virtual machine. If this is not feasible, there is a special variant for raw partition access, currently only available on Linux hosts, that avoids having to give the current user access to the entire disk. To set up such an image, use:

```
$ VBoxManage createmedium disk --filename path-to-file.vmdk --format=VMDK
--variant RawDisk --property RawDrive=/dev/sda --property Partitions=1,5
--property Relative=1
```

When used from a virtual machine, the image will then refer not to the entire disk, but only to the individual partitions. In this example, /dev/sda1 and /dev/sda5. As a consequence, read/write access is only required for the affected partitions, not for the entire disk. During creation however, read-only access to the entire disk is required to obtain the partitioning information.

In some configurations it may be necessary to change the MBR code of the created image. For example, to replace the Linux boot loader that is used on the host by another boot loader. This enables for example the guest to boot directly to Windows, while the host boots Linux from the "same" disk. For this purpose the --property-file BootSector=*path-to-file-with-boot-sector* parameter is provided. It specifies a file name from which to take the MBR code. The partition table is not modified at all, so a MBR file from a system with totally different partitioning can be used. An example of this is:

```
$ VBoxManage createmedium disk --filename path-to-file.vmdk --format=VMDK
--variant RawDisk --property RawDrive=/dev/sda --property Partitions=1,5
--property-file BootSector=winxp.mbr
```

The modified MBR will be stored inside the image, not on the host disk.

The created image can be attached to a storage controller in a VM configuration as usual.

11.5.2 Configuring the Hard Disk Vendor Product Data (VPD)

Oracle VirtualBox reports vendor product data for its virtual hard disks which consist of hard disk serial number, firmware revision and model number. These can be changed using the following commands:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/SerialNumber" "serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/FirmwareRevision" "firmware"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/ModelNumber" "model"
```

The serial number is a 20 byte alphanumeric string, the firmware revision an 8 byte alphanumeric string and the model number a 40 byte alphanumeric string. Instead of Port0, referring to the first port, specify the required SATA hard disk port.

The above commands apply to virtual machines with an AHCI (SATA) controller. The commands for virtual machines with an IDE controller are:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/piix3ide/0/Config/PrimaryMaster/SerialNumber" "serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/piix3ide/0/Config/PrimaryMaster/FirmwareRevision" "firmware"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/piix3ide/0/Config/PrimaryMaster/ModelNumber" "model"
```

For hard disks, you can mark the drive as having a nonrotational medium by using the following command:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/NonRotational" "1"
```

Additional three parameters are needed for CD/DVD drives to report the vendor product data:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/ATAPIVendorId" "vendor"
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/ATAPIProductId" "product"
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/ATAPIRevision" "revision"
```

The vendor id is an 8 byte alphanumeric string, the product id an 16 byte alphanumeric string and the revision a 4 byte alphanumeric string. Instead of Port0, referring to the first port, specify the required SATA hard disk port.

11.6 Fine Tuning the Oracle VirtualBox NAT Engine

11.6.1 Configuring the Address of a NAT Network Interface

In NAT mode, the guest network interface is assigned to the IPv4 range 10.0.*x*.0/24 by default where *x* corresponds to the instance of the NAT interface +2. So *x* is 2 when there is only one NAT instance active. In that case the guest is assigned to the address 10.0.2.15, the gateway is set to 10.0.2.2 and the name server can be found at 10.0.2.3.

If the NAT network needs to be changed, use the following command:

```
$ VBoxManage modifyvm VM-name \
--natnet1 "192.168/16"
```

This command would reserve the network addresses from 192.168.0.0 to 192.168.254.254 for the first NAT network instance of *VM-name* The guest IP would be assigned to 192.168.0.15 and the default gateway could be found at 192.168.0.2.

11.6.2 Configuring the Boot Server (Next Server) of a NAT Network Interface

For network booting in NAT mode, by default Oracle VirtualBox uses a built-in TFTP server at the IP address 10.0.2.4. This default behavior should work fine for typical remote-booting scenarios. However, it is possible to change the boot server IP and the location of the boot image with the following commands:

```
$ VBoxManage modifyvm VM-name \
--nattftpserver1 10.0.2.2
$ VBoxManage modifyvm VM-name \
--nattftpfile1 /srv/tftp/boot/MyPXEBoot.pxe
```

11.6.3 Enabling DNS Proxy in NAT Mode

The NAT engine by default offers the same DNS servers to the guest that are configured on the host. In some scenarios, it can be appropriate to hide the DNS server IPs from the guest, for example when this information can change on the host due to expiring DHCP leases. In this case, you can tell the NAT engine to act as DNS proxy using the following command:

```
$ VBoxManage modifyvm VM-name --natdnsproxy1 on
```

11.6.4 Using the Host's Resolver as a DNS Proxy in NAT Mode

For resolving network names, the DHCP server of the NAT engine offers a list of registered DNS servers of the host. If for some reason you need to hide this DNS server list and use the host's resolver settings, thereby forcing the Oracle VirtualBox NAT engine to intercept DNS requests and forward them to host's resolver, use the following command:

```
$ VBoxManage modifyvm VM-name --natdnshostresolver1 on
```

Note that this setting is similar to the DNS proxy mode, however whereas the proxy mode just forwards DNS requests to the appropriate servers, the resolver mode will interpret the DNS requests and use the host's DNS API to query the information and return it to the guest.

11.6.4.1 User-Defined Host Name Resolving

In some cases it might be useful to intercept the name resolving mechanism, providing a user-defined IP address on a particular DNS request. The intercepting mechanism enables the user to map not only a single host but domains and even more complex naming conventions if required.

The following command sets a rule for mapping a name to a specified IP:

```
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name-of-interception-rule/HostIP" IPv4

VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostName" hostname
```

The following command sets a rule for mapping a pattern name to a specified IP:

```
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostIP" IPv4

VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostNamePattern" hostpattern
```

The host name pattern can include the following wildcard characters: pipe (|), question mark (?), and asterisk (*).

This example demonstrates how to instruct the host-resolver mechanism to resolve all domain and probably some mirrors of www.blocked-site.info site with IP 127.0.0.1:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/e1000/0/LUN#0/AttachedDriver/Config/HostResolverMappings/all_blocked_site/HostIP"
 127.0.0.1
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/e1000/0/LUN#0/AttachedDriver/Config/HostResolverMappings/all_blocked_site/
HostNamePattern" "*.blocked-site.*|*.fb.org"
```

The host resolver mechanism should be enabled to use user-defined mapping rules, otherwise they do not have any effect.

11.6.5 Configuring Aliasing of the NAT Engine

By default, the NAT core uses aliasing and uses random ports when generating an alias for a connection. This works well for the most protocols like SSH, FTP and so on. Though some protocols might need a more transparent behavior or may depend on the real port number the packet was sent from. You can change the NAT mode by using the following commands:

```
$ VBoxManage modifyvm VM-name \
--nataliasmode1 proxyonly

$ VBoxManage modifyvm "Linux Guest" --nataliasmode1 sameports
```

The first example disables aliasing and switches NAT into transparent mode, the second example enforces preserving of port values. These modes can be combined if necessary.

11.7 Configuring the BIOS DMI Information

The DMI data that Oracle VirtualBox provides to guests can be changed for a specific VM. Use the following commands to configure the DMI BIOS information. In case your VM is configured to use EFI firmware you need to replace pcbios by efi in the keys.

- DMI BIOS information (type 0)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSVendor"       "BIOS Vendor"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSVersion"      "BIOS Version"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSReleaseDate"   "BIOS Release Date"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSReleaseMajor"  1
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSReleaseMinor"  2
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSFirmwareMajor" 3
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSFirmwareMinor" 4
```

- DMI system information (type 1)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemVendor"     "System Vendor"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemProduct"    "System Product"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemVersion"    "System Version"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemSerial"     "System Serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemSKU"        "System SKU"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemFamily"     "System Family"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemUuid" \
"9852bf98-b83c-49db-a8de-182c42c7226b"
```

- DMI board information (type 2)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardVendor"      "Board Vendor"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardProduct"     "Board Product"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardVersion"     "Board Version"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardSerial"      "Board Serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardAssetTag"    "Board Tag"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardLocInChass"  "Board Location"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardBoardType"   10
```

- DMI system enclosure or chassis (type 3)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisVendor"    "Chassis Vendor"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisType"      3
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisVersion"   "Chassis Version"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisSerial"    "Chassis Serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisAssetTag"  "Chassis Tag"
```

- DMI processor information (type 4)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiProcManufacturer"  "GenuineIntel"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiProcVersion"       "Pentium(R) III"
```

- DMI OEM strings (type 11)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiOEMVBoxVer"        "vboxVer_1.2.3"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiOEMVBoxRev"        "vboxRev_12345"
```

If a DMI string is not set, the default value of Oracle VirtualBox is used. To set an empty string use "<EMPTY>".

Note that in the above list, all quoted parameters (DmiBIOSVendor, DmiBIOSVersion but not DmiBIOSReleaseMajor) are expected to be strings. If such a string is a valid number, the parameter is treated as number and the VM will most probably refuse to start with an VERR_CFGM_NOT_STRING error. In that case, use "string:*value*". For example:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemSerial"      "string:1234"
```

Changing this information can be necessary to provide the DMI information of the host to the guest to prevent Windows from asking for a new product key. On Linux hosts, the DMI BIOS information can be obtained with the following command:

```
$ dmidecode -t0
```

The DMI system information can be obtained as follows:

```
$ dmidecode -t1
```

11.8 Configuring Custom ACPI Tables

You can configure Oracle VirtualBox to present up to four custom ACPI tables to the guest. Use a command such as the following to configure custom ACPI tables. Note that CustomTable1, CustomTable2, and CustomTable3 are available in addition to CustomTable0.

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/acpi/0/Config/CustomTable0" "/path-to-table.bin"
```

Configuring custom ACPI tables can for example avoid the need for asking for a new product key on Windows Vista, Windows 7, Windows 8 and later guests. On Linux hosts, one of the system's ACPI tables can be read from /sys/firmware/acpi/tables/.

11.9 Fine Tuning Timers and Time Synchronization

11.9.1 Configuring the Guest Time Stamp Counter (TSC) to Reflect Guest Execution

By default, Oracle VirtualBox keeps all sources of time visible to the guest synchronized to a single time source, the monotonic host time. This reflects the assumptions of many guest operating systems, which expect all time sources to reflect "wall clock" time. In special circumstances it may be useful however to make the time stamp counter (TSC) in the guest reflect the time actually spent executing the guest.

This special TSC handling mode can be enabled on a per-VM basis, and for best results must be used only in combination with hardware virtualization. To enable this mode use the following command:

$ VBoxManage setextradata *VM-name* "VBoxInternal/TM/TSCTiedToExecution" 1

To revert to the default TSC handling mode use:

$ VBoxManage setextradata *VM-name* "VBoxInternal/TM/TSCTiedToExecution"

Note that if you use the special TSC handling mode with a guest operating system which is very strict about the consistency of time sources you may get a warning or error message about the timing inconsistency. It may also cause clocks to become unreliable with some guest operating systems depending on how they use the TSC.

11.9.2 Accelerate or Slow Down the Guest Clock

For certain purposes it can be useful to accelerate or to slow down the virtual guest clock. This can be achieved as follows:

$ VBoxManage setextradata *VM-name* "VBoxInternal/TM/WarpDrivePercentage" 200

The above example will double the speed of the guest clock while

$ VBoxManage setextradata *VM-name* "VBoxInternal/TM/WarpDrivePercentage" 50

will halve the speed of the guest clock. Note that changing the rate of the virtual clock can confuse the guest and can even lead to abnormal guest behavior. For instance, a higher clock rate means shorter timeouts for virtual devices with the result that a slightly increased response time of a virtual device due to an increased host load can cause guest failures. Note further that any time synchronization mechanism will frequently try to resynchronize the guest clock with the reference clock, which is the host clock if the Oracle VirtualBox Guest Additions are active. Therefore any time synchronization should be disabled if the rate of the guest clock is changed as described above. See *11.9.3 Tuning the Guest Additions Time Synchronization Parameters on page 190*.

11.9.3 Tuning the Guest Additions Time Synchronization Parameters

The Oracle VirtualBox Guest Additions ensure that the guest's system time is synchronized with the host time. There are several parameters which can be tuned. The parameters can be set for a specific VM using the following command:

$ VBoxManage guestproperty set *VM-name* "/VirtualBox/GuestAdd/VBoxService/*property*" *value*

property is one of the following:

--timesync-interval	Specifies the interval at which to synchronize the time with the host. The default is 10000 ms (10 seconds).
--timesync-min-adjust	The minimum absolute drift value measured in milliseconds to make adjustments for. The default is 1000 ms on OS/2 and 100 ms elsewhere.
--timesync-latency-factor	The factor to multiply the time query latency with to calculate the dynamic minimum adjust

	time. The default is 8 times, which means as follows: Measure the time it takes to determine the host time, the guest has to contact the VM host service which may take some time. Multiply this value by 8 and do an adjustment only if the time difference between host and guest is bigger than this value. Do not do any time adjustment otherwise.
--timesync-max-latency	The max host timer query latency to accept. The default is 250 ms.
--timesync-set-threshold	The absolute drift threshold, given as milliseconds where to start setting the time instead of trying to smoothly adjust it. The default is 20 minutes.
--timesync-set-start	Set the time when starting the time sync service.
--timesync-set-on-restore 0|1	Set the time after the VM was restored from a saved state when passing 1 as parameter. This is the default. Disable by passing 0. In the latter case, the time will be adjusted smoothly, which can take a long time.

All these parameters can be specified as command line parameters to VBoxService as well.

11.9.4 Disabling the Guest Additions Time Synchronization

Once installed and started, the Oracle VirtualBox Guest Additions will try to synchronize the guest time with the host time. This can be prevented by forbidding the guest service from reading the host clock:

```
$ VBoxManage setextradata VM-name "VBoxInternal/Devices/VMMDev/0/Config/GetHostTimeDisabled" 1
```

11.10 Installing the Alternate Bridged Networking Driver on Oracle Solaris 11 Hosts

Oracle VirtualBox includes a network filter driver that utilizes Oracle Solaris 11's Crossbow functionality. By default, this new driver is installed for Oracle Solaris 11 hosts that have support for it.

To force installation of the older STREAMS based network filter driver, execute as root the following command before installing the Oracle VirtualBox package:

```
$ touch /etc/vboxinst_vboxflt
```

To force installation of the Crossbow based network filter driver, execute as root the following command before installing the Oracle VirtualBox package:

```
$ touch /etc/vboxinst_vboxbow
```

To check which driver is currently being used by Oracle VirtualBox, execute:

```
$ modinfo | grep vbox
```

If the output contains *vboxbow*, it indicates Oracle VirtualBox is using the Crossbow network filter driver, while the name *vboxflt* indicates usage of the older STREAMS network filter.

11.11 Oracle VirtualBox VNIC Templates for VLANs on Oracle Solaris 11 Hosts

Oracle VirtualBox supports Virtual Network Interface (VNIC) templates for configuring VMs over VLANs. An Oracle VirtualBox VNIC template is a VNIC whose name starts with vboxvnic_template. The string is case-sensitive.

On Oracle Solaris 11 hosts, when Crossbow-based bridged networking is used, a VNIC template may be used to specify the VLAN ID to use while bridging over a network link.

The following is an example of how to use a VNIC template to configure a VM over a VLAN. Create an Oracle VirtualBox VNIC template, by executing as root:

```
# dladm create-vnic -t -l nge0 -v 23 vboxvnic_template0
```

This will create a temporary VNIC template over interface nge0 with the VLAN ID 23. To create VNIC templates that are persistent across host reboots, skip the -t parameter in the above command. You may check the current state of links using the following command:

```
$ dladm show-link
LINK        CLASS     MTU    STATE    BRIDGE     OVER
nge0        phys      1500   up       --         --
nge1        phys      1500   down     --         --
vboxvnic_template0 vnic 1500 up       --         nge0

$ dladm show-vnic
LINK         OVER         SPEED  MACADDRESS        MACADDRTYPE       VID
vboxvnic_template0 nge0   1000   2:8:20:25:12:75   random            23
```

Once the VNIC template is created, any VMs that need to be on VLAN 23 over the interface nge0 can be configured to bridge using this VNIC template.

VNIC templates makes managing VMs on VLANs simpler and efficient. The VLAN details are not stored as part of every VM's configuration but rather inherited from the VNIC template while starting the VM. The VNIC template itself can be modified anytime using the dladm command.

VNIC templates can be created with additional properties such as bandwidth limits and CPU fanout. Refer to your Oracle Solaris network documentation for details. The additional properties are also applied to VMs which bridge using the VNIC template.

11.12 Configuring Multiple Host-Only Network Interfaces on Oracle Solaris Hosts

By default Oracle VirtualBox provides you with one host-only network interface. Adding more host-only network interfaces on Oracle Solaris hosts requires manual configuration. Here is how to add another host-only network interface.

Begin by stopping all running VMs. Then, unplumb the existing "vboxnet0" interface by execute the following command as root:

```
# ifconfig vboxnet0 unplumb
```

If you have several vboxnet interfaces, you will need to unplumb all of them. Once all vboxnet interfaces are unplumbed, remove the driver by executing the following command as root:

```
# rem_drv vboxnet
```

Edit the file /platform/i86pc/kernel/drv/vboxnet.conf and add a line for the new interface we want to add as shown below:

```
name="vboxnet" parent="pseudo" instance=1;
name="vboxnet" parent="pseudo" instance=2;
```

Add as many of these lines as required with each line having a unique instance number.

Next, reload the vboxnet driver by executing the following command as root:

```
# add_drv vboxnet
```

On Oracle Solaris 11.1 and newer hosts you may want to rename the default vanity interface name. To check what name has been assigned, execute:

```
$ dladm show-phys
LINK            MEDIA           STATE     SPEED  DUPLEX    DEVICE
net0            Ethernet        up        100    full      e1000g0
net2            Ethernet        up        1000   full      vboxnet1
net1            Ethernet        up        1000   full      vboxnet0
```

In the above example, we can rename "net2" to "vboxnet1" before proceeding to plumb the interface. This can be done by executing as root:

```
# dladm rename-link net2 vboxnet1
```

Now plumb all the interfaces using ifconfig vboxnet*X* plumb, where *X* would be 1 in this case. Once the interface is plumbed, it may be configured like any other network interface. Refer to the ifconfig documentation for further details.

To make the settings for the newly added interfaces persistent across reboots, you will need to edit the files /etc/inet/netmasks, and if you are using NWAM /etc/nwam/llp and add the appropriate entries to set the netmask and static IP for each of those interfaces. The Oracle VirtualBox installer only updates these configuration files for the one "vboxnet0" interface it creates by default.

11.13 Configuring the Oracle VirtualBox CoreDumper on Oracle Solaris Hosts

Oracle VirtualBox is capable of producing its own core files for extensive debugging when things go wrong. Currently this is only available on Oracle Solaris hosts.

The Oracle VirtualBox CoreDumper can be enabled using the following command:

```
$ VBoxManage setextradata VM-name VBoxInternal2/CoreDumpEnabled 1
```

You can specify which directory to use for core dumps with this command, as follows:

```
$ VBoxManage setextradata VM-name VBoxInternal2/CoreDumpDir path-to-directory
```

Ensure the directory you specify is on a volume with sufficient free space and that the Oracle VirtualBox process has sufficient permissions to write files to this directory. If you skip this

command and do not specify any core dump directory, the current directory of the Oracle VirtualBox executable will be used. This would most likely fail when writing cores as they are protected with root permissions. It is recommended you explicitly set a core dump directory.

You must specify when the Oracle VirtualBox CoreDumper should be triggered. This is done using the following commands:

```
$ VBoxManage setextradata VM-name VBoxInternal2/CoreDumpReplaceSystemDump 1
$ VBoxManage setextradata VM-name VBoxInternal2/CoreDumpLive 1
```

At least one of the above two commands will have to be provided if you have enabled the Oracle VirtualBox CoreDumper.

Setting CoreDumpReplaceSystemDump sets up the VM to override the host's core dumping mechanism and in the event of any crash only the Oracle VirtualBox CoreDumper would produce the core file.

Setting CoreDumpLive sets up the VM to produce cores whenever the VM process receives a SIGUSR2 signal. After producing the core file, the VM will not be terminated and will continue to run. You can thus take cores of the VM process using the following command:

```
$ kill -s SIGUSR2 VM-process-id
```

The Oracle VirtualBox CoreDumper creates core files of the form core.vb.*process-name*.*process-ID* such as core.vb.VBoxHeadless.11321.

11.14 Oracle VirtualBox and Oracle Solaris Kernel Zones

Oracle Solaris kernel zones on x86-based systems make use of hardware-assisted virtualization features like Oracle VirtualBox does. However, for kernel zones and Oracle VirtualBox to share this hardware resource, they need to cooperate.

By default, due to performance reasons, Oracle VirtualBox acquires the hardware-assisted virtualization resource (VT-x/AMD-V) globally on the host machine and uses it until the last Oracle VirtualBox VM that requires it is powered off. This prevents other software from using VT-x/AMD-V during the time Oracle VirtualBox has taken control of it.

Oracle VirtualBox can be instructed to relinquish use of hardware-assisted virtualization features when not executing guest code, thereby allowing kernel zones to make use of them. To do this, shutdown all Oracle VirtualBox VMs and execute the following command:

```
$ VBoxManage setproperty hwvirtexclusive off
```

This command needs to be executed only once as the setting is stored as part of the global Oracle VirtualBox settings which will continue to persist across host-reboots and Oracle VirtualBox upgrades.

11.15 Locking Down VirtualBox Manager

11.15.1 Customizing VirtualBox Manager

There are several advanced customization settings for locking down VirtualBox Manager. Locking down means removing some features that the user should not see.

VBoxManage setextradata global GUI/Customizations *property*[,*property* ...]

property is one of the following properties:

noSelector	Do not allow users to start VirtualBox Manager. Trying to do so will show a window containing a proper error message.
noMenuBar	VM windows will not contain a menu bar.
noStatusBar	VM windows will not contain a status bar.

To disable any of these VirtualBox Manager customizations use the following command:

$ VBoxManage setextradata global GUI/Customizations

11.15.2 VM Selector Customization

The following per-machine VM extradata settings can be used to change the behavior of the VM selector window in respect of certain VMs:

$ VBoxManage setextradata *VM-name*
property true

property can be any of the following:

GUI/HideDetails	Do not show the VM configuration of a certain VM. The details window will remain just empty if this VM is selected.
GUI/PreventReconfiguration	Do not allow the user to open the **Settings** dialog for a certain VM.
GUI/PreventSnapshotOperations	Prevent snapshot operations for a VM from the GUI, either at runtime or when the VM is powered off.
GUI/HideFromManager	Hide a certain VM in the VM selector window.
GUI/PreventApplicationUpdate	Disable the automatic update check and hide the corresponding menu item.

Note that these settings do not prevent the user from reconfiguring the VM by using the VBoxManage modifyvm command.

11.15.3 Configure VM Selector Menu Entries

You can disable certain entries in the global settings page of the VM selector:

$ VBoxManage setextradata global GUI/RestrictedGlobalSettingsPages *property*[,*property*...]

property is one of the following:

General	Do not show the **General** settings pane.

Input	Do not show the **Input** settings pane.
Update	Do not show the **Update** settings pane.
Language	Do not show the **Language** settings pane.
Display	Do not show the **Display** settings pane.
Network	Do not show the **Network** settings pane.
Extensions	Do not show the **Extensions** settings pane.
Proxy	Do not show the **Proxy** settings pane.

This is a global setting. You can specify any combination of properties. To restore the default behavior, use the following command:

```
$ VBoxManage setextradata global GUI/RestrictedGlobalSettingsPages
```

11.15.4 Configure VM Window Menu Entries

You can disable certain menu actions in the VM window:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMenus OPTION[,OPTION...]
```

where OPTION is one of the following keywords:

All	Do not show any menu in the VM window.
Application	Do not show **Application/File** menu in the VM window.
Machine	Do not show the **Machine** menu in the VM window.
View	Do not show the **View** menu in the VM window.
Input	Do not show **Input** menu in the VM window.
Devices	Do not show the **Devices** menu in the VM window.
Help	Do not show the **Help** menu in the VM window.
Debug	Do not show the **Debug** menu in the VM window. The Debug menu is only visible if the GUI was started with special command line parameters or environment variable settings.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use the following command:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMenus
```

You can also disable certain menu actions of certain menus. Use the following command to disable certain actions of the **Application** menu. This is only available on macOS hosts.

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeApplicationMenuActions OPTION[,OPTION...]
```

where OPTION is one of the following keywords:

All	Do not show any menu item in this menu.
About	Do not show the **About** menu item in this menu.
Preferences	Do not show the **Preferences** menu item in this menu.
NetworkAccessManager	Do not show the **Network Operations Manager** menu item in this menu.
ResetWarnings	Do not show the **Reset All Warnings** menu item in this menu.
Close	Do not show the **Close** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use the following command:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMenus
```

Use the following command to disable certain actions of the **Machine** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMachineMenuActions OPTION[,OPTION...]
```

where OPTION is one of the following keywords:

All	Do not show any menu item in this menu.
SettingsDialog	Do not show the **Settings** menu item in this menu.
TakeSnapshot	Do not show the **Take Snapshot...** menu item in this menu.
InformationDialog	Do not show the **Session Information...** menu item in this menu.
FileManagerDialog	Do not show the **File Manager...** menu item in this menu.
Pause	Do not show the **Pause** menu item in this menu.

Reset	Do not show the **Reset** menu item in this menu.
Shutdown	Do not show the **ACPI Shutdown** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMachineMenuActions
```

Use the following command to disable certain actions of the **View** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeViewMenuActions OPTION[,OPTION...]
```

where OPTION is one of the following keywords:

All	Do not show any menu item in this menu.
Fullscreen	Do not show the **Full-screen Mode** menu item in this menu.
Seamless	Do not show the **Seamless Mode** menu item in this menu.
Scale	Do not show the **Scaled Mode** menu item in this menu.
GuestAutoresize	Do not show the **Auto-resize Guest Display** menu item in this menu.
AdjustWindow	Do not show the **Adjust Window Size** menu item in this menu.
TakeScreenshot	Do not show the **Take Screenshot...** menu item in this menu.
Recording	Do not show the **Recording** menu item in this menu.
VRDEServer	Do not show the **Remote Display** menu item in this menu.
MenuBar	Do not show the **Menu Bar** menu item in this menu.
MenuBarSettings	Do not show the **Menu Bar Settings...** menu item in this menu.
StatusBar	Do not show the **Status Bar** menu item in this menu.
StatusbarSettings	Do not show the **Statusbar Settings...** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeViewMenuActions
```

Use the following command to disable certain actions of the **Input** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeInputMenuActions OPTION[,OPTION...]
```

where OPTION is one of the following keywords:

All	Do not show any menu item in this menu.
Keyboard	Do not show the **Keyboard** menu item in this menu.
KeyboardSettings	Do not show the **Keyboard Settings...** menu item in this menu.
SoftKeyboard	Do not show the **Soft Keyboard...** menu item in this menu.
TypeCAD	Do not show the **Insert Ctrl-Alt-Del** menu item in this menu.
TypeCABS	Do not show the **Insert Ctrl-Alt-Backspace** menu item in this menu.
TypeCtrlBreak	Do not show the **Insert Ctrl-Break** menu item in this menu.
TypeInsert	Do not show the **Insert Insert** menu item in this menu.
TypePrintScreen	Do not show the **Insert Print Screen** menu item in this menu.
TypeAltPrintScreen	Do not show the **Insert Alt Print Screen** menu item in this menu.
TypeHostKeyCombo	Do not show the **Insert Host Key Combo** menu item in this menu.
MouseIntegration	Do not show the **MouseIntegration** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeInputMenuActions
```

Use the following command to disable certain actions of the **Devices** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeDevicesMenuActions OPTION[,OPTION...]
```

where OPTION is one of the following keywords to disable actions in the **Devices** menu:

All	Do not show any menu item in this menu.
HardDrives	Do not show the **Hard Disks** menu item in this menu.
OpticalDevices	Do not show the **Optical Devices** menu item in this menu.
FloppyDevices	Do not show the **Floppy Drives** menu item in this menu.
Audio	Do not show the **Audio** menu item in this menu.
Network	Do not show the **Network** menu item in this menu.
NetworkSettings	Do not show the **Network Settings** menu item in this menu.
USBDevices	Do not show the **USB** menu item in this menu.
WebCams	Do not show the **WebCams** menu item in this menu.
SharedFolders	Do not show the **Shared Folders** menu item in this menu.
SharedFoldersSettings	Do not show the **Shared Folders Settings...** menu item in this menu.
SharedClipboard	Do not show the **Shared Clipboard** menu item in this menu.
DragAndDrop	Do not show the **Drag and Drop** menu item in this menu.
InstallGuestTools	Do not show the **Insert Guest Additions CD image...** menu item in this menu.

This is a per-VM or global or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeDevicesMenuActions
```

Use the following command to disable certain actions of the **Debug** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeDebuggerMenuActions OPTION[,OPTION...]
```

where OPTION is one of the following keywords to disable actions in the *Debug* menu, which is normally completely disabled:

All	Do not show any menu item in this menu.

Statistics	Do not show the **Statistics...** menu item in this menu.
CommandLine	Do not show the **Command Line...** menu item in this menu.
Logging	Do not show the **Logging...** menu item in this menu.
LogDialog	Do not show the **Show Log...** menu item in this menu.
GuestControlConsole	Do not show the **Guest Control Terminal...** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeDebuggerMenuActions
```

Use the following command to disable certain actions of the **View** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeHelpMenuActions OPTION[,OPTION...]
```

where OPTION is one of the following keywords to disable actions in the **Help** menu, which is normally completely disabled:

All	Do not show any menu item in this menu.
Contents	Do not show the **Contents...** menu item in this menu.
WebSite	Do not show the **VirtualBox Web Site...** menu item in this menu.
BugTracker	Do not show the **VirtualBox Bug Tracker...** menu item in this menu.
Forums	Do not show the **VirtualBox Forums...** menu item in this menu.
Oracle	Do not show the **Oracle Web Site...** menu item in this menu.
About	Do not show the **About VirtualBox...** menu item in this menu. Only for non-macOS hosts.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeHelpMenuActions
```

11.15.5 Configure VM Window Status Bar Entries

You can disable certain status bar items:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedStatusBarIndicators OPTION[,OPTION...]
```

where OPTION is one of the following keywords:

HardDisks	Do not show the hard disk icon in the VM window status bar. By default the hard disk icon is only shown if the VM configuration contains one or more hard disks.
OpticalDisks	Do not show the CD icon in the VM window status bar. By default the CD icon is only shown if the VM configuration contains one or more CD drives.
FloppyDisks	Do not show the floppy icon in the VM window status bar. By default the floppy icon is only shown if the VM configuration contains one or more floppy drives.
Network	Do not show the network icon in the VM window status bar. By default the network icon is only shown if the VM configuration contains one or more active network adapters.
USB	Do not show the USB icon in the status bar.
SharedFolders	Do not show the shared folders icon in the status bar.
Capture	Do not show the capture icon in the status bar.
Features	Do not show the CPU features icon in the status bar.
Mouse	Do not show the mouse icon in the status bar.
Keyboard	Do not show the keyboard icon in the status bar.

This is a per-VM or global setting. Any combination of the above is allowed. If all options are specified, no icons are displayed in the status bar of the VM window. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedStatusBarIndicators
```

11.15.6 Configure VM Window Visual Modes

You can disable certain VM visual modes:

```
$ VBoxManage setextradata VM-name GUI/RestrictedVisualStates property[,property...]
```

property is one of the following:

Fullscreen	Do not allow to switch the VM into full screen mode.
Seamless	Do not allow to switch the VM into seamless mode.
Scale	Do not allow to switch the VM into scale mode.

This is a per-VM setting. You can specify any combination of properties. To restore the default behavior, use the following command:

```
$ VBoxManage setextradata VM-name GUI/RestrictedVisualStates
```

11.15.7 Host Key Customization

To disable all Host key combinations, open the preferences and change the Host key to None. This might be useful when using Oracle VirtualBox in a kiosk mode.

To redefine or disable certain Host key actions, use the following command:

```
$ VBoxManage setextradata global GUI/Input/MachineShortcuts "FullscreenMode=F,...."
```

The following table shows the possible Host key actions, together with their default Host key shortcut. Setting an action to None will disable that Host key action.

Table 7: Host Key Customization

Host Key Customization

Action	Default Key	Action
TakeSnapshot	T	Take a snapshot
TakeScreenshot	E	Take a screenshot
MouseIntegration	I	Toggle mouse integration
TypeCAD	Del	Inject Ctrl+Alt+Del
TypeCABS	Backspace	Inject Ctrl+Alt+Backspace
Pause	P	Pause the VM
Reset	R	Hard reset the guest
SaveState		Save the VM state and terminate the VM
Shutdown	H	Press the virtual ACPI power button
PowerOff		Power off the VM without saving the state
Close	Q	Show the Close VM dialog

Action	Default Key	Action
FullscreenMode	F	Switch the VM into full screen mode
SeamlessMode	L	Switch the VM into seamless mode
ScaleMode	C	Switch the VM into scaled mode
GuestAutoResize	G	Automatically resize the guest window
WindowAdjust	A	Immediately resize the guest window
PopupMenu	Home	Show the popup menu in full screen mode and seamless mode
SettingsDialog	S	Open the VM Settings dialog
InformationDialog	N	Show the VM Session Information window
NetworkAdaptersDialog		Show the VM Network Adapters dialog
SharedFoldersDialog		Show the VM Shared Folders dialog
InstallGuestAdditions	D	Mount the ISO containing the Guest Additions

To disable full screen mode and seamless mode, use the following command:

```
$ VBoxManage setextradata global GUI/Input/MachineShortcuts "FullscreenMode=None,SeamlessMode=None"
```

11.15.8 Action when Terminating the VM

You can disallow certain actions when terminating a VM. To disallow specific actions, use the following command:

```
$ VBoxManage setextradata VM-name GUI/RestrictedCloseActions property[,property...]
```

property is one of the following:

SaveState — Do not allow the user to save the VM state when terminating the VM.

Shutdown — Do not allow the user to shutdown the VM by sending the ACPI power-off event to the guest.

PowerOff — Do not allow the user to power off the VM.

PowerOffRestoringSnapshot — Do not allow the user to return to the last snapshot when powering off the VM.

Detach — Do not allow the user to detach from the VM process if the VM was started in separate mode.

This is a per-VM setting. You can specify any combination of properties. If all properties are specified, the VM cannot be shut down.

11.15.9 Default Action when Terminating the VM

You can define a specific action for terminating a VM. In contrast to the setting decribed in the previous section, this setting allows only one action when the user terminates the VM. No exit menu is shown. Use the following command:

$ VBoxManage setextradata *VM-name* GUI/DefaultCloseAction *action*

action is one of the following:

SaveState	Save the VM state before terminating the VM process.
Shutdown	The VM is shut down by sending the ACPI power-off event to the guest.
PowerOff	The VM is powered off.
PowerOffRestoringSnapshot	The VM is powered off and the saved state returns to the last snapshot.
Detach	Terminate the frontend but leave the VM process running.

This is a per-VM setting. You can specify any combination of properties. If all properties are specified, the VM cannot be shut down.

11.15.10 Action for Handling a Guru Meditation

A VM runs into a Guru Meditation if there is a problem which cannot be fixed by other means than terminating the process. The default is to show a message window which instructs the user to open a bug report.

This behavior can be configured as follows:

$ VBoxManage setextradata *VM-name* GUI/GuruMeditationHandler *mode*

mode is one of the following:

Default	A message window is shown. After the user confirmed, the VM is terminated.
PowerOff	The VM is immediately powered-off without showing any message window. The VM logfile will show information about what happened.

Ignore	The VM is left in stuck mode. Execution is stopped but no message window is shown. The VM has to be powered off manually.

This is a per-VM setting.

11.15.11 Configuring Automatic Mouse Capturing

By default, the mouse is captured if the user clicks on the guest window and the guest expects relative mouse coordinates at this time. This happens if the pointing device is configured as PS/2 mouse and the guest has not yet started the Oracle VirtualBox Guest Additions. For instance, the guest is booting or the Guest Additions are not installed, or if the pointing device is configured as a USB tablet but the guest has no USB driver loaded yet. Once the Guest Additions become active or the USB guest driver is started, the mouse capture is automatically released.

The default behavior is sometimes not appropriate. Therefore it can be configured as follows:

VBoxManage setextradata *VM-name* GUI/MouseCapturePolicy *mode*

mode is one of the following:

Default	The default behavior as described above.
HostComboOnly	The mouse is only captured if the Host Key is toggled.
Disabled	The mouse is never captured, also not by toggling the Host Key

This is a per-VM setting.

11.15.12 Requesting Legacy Full-Screen Mode

Oracle VirtualBox uses special window manager facilities to switch a multiscreen machine to full-screen on a multimonitor host system. However, not all window managers provide these facilities correctly. Oracle VirtualBox can be configured to use a legacy method of switching to full-screen mode instead, by using the command:

VBoxManage setextradata global GUI/Fullscreen/LegacyMode true

You can go back to the default method by using the following command:

VBoxManage setextradata global GUI/Fullscreen/LegacyMode

This is a global setting.

11.15.13 Removing Certain Modes of Networking From the GUI

It is possible to remove networking modes from Oracle VirtualBox GUI. To do this, use the following command:

VBoxManage setextradata global GUI/RestrictedNetworkAttachmentTypes *property*[,*property*...]

property is one of the following:

NAT	Remove the **NAT** option from the GUI.
NATNetwork	Remove the **NAT network** option from the GUI.
BridgedAdapter	Remove the **Bridged networking** option from the GUI.
InternalNetwork	Remove the **Internal networking** option from the GUI.
HostOnlyAdapter	Remove the **Host Only networking** option from the GUI.
GenericDriver	Remove the **Generic networking** option from the GUI.

This is a global setting. You can specify any combination of properties. To restore the default behavior, use the following command:

```
VBoxManage setextradata global GUI/RestrictedNetworkAttachmentTypes
```

11.16 Starting the Oracle VirtualBox Web Service Automatically

The Oracle VirtualBox web service, vboxwebsrv, is used for controlling Oracle VirtualBox remotely. It is documented in detail in the Oracle VirtualBox Software Development Kit (SDK). See *12.1 Oracle VirtualBox Programming Interfaces on page 235*. Web service start scripts are available for supported host operating systems. The following sections describe how to use the scripts. The Oracle VirtualBox web service is never started automatically as a result of a standard installation.

11.16.1 Linux: Starting the Web Service With init

On Linux, the web service can be automatically started during host boot by adding appropriate parameters to the file /etc/default/virtualbox. There is one mandatory parameter, VBOXWEB_USER, which must be set to the user which will later start the VMs. The parameters in the following table all start with the VBOXWEB_ prefix string. For example: VBOXWEB_HOST and VBOXWEB_PORT.

Table 8: Web Service Configuration Parameters

Web Service Configuration Parameters

Parameter	Description	Default
USER	The user which the web service runs as	
HOST	The host to bind the web service to	localhost
PORT	The port to bind the web service to	18083

Parameter	Description	Default
SSL_KEYFILE	Server key and certificate file, in PEM format	
SSL_PASSWORDFILE	File name for password to server key	
SSL_CACERT	CA certificate file, in PEM format	
SSL_CAPATH	CA certificate path	
SSL_DHFILE	DH file name or DH key length in bits	
SSL_RANDFILE	File containing seed for random number generator	
TIMEOUT	Session timeout in seconds, 0 disables timeouts	300
CHECK_INTERVAL	Frequency of timeout checks in seconds	5
THREADS	Maximum number of worker threads to run in parallel	100
KEEPALIVE	Maximum number of requests before a socket will be closed	100
ROTATE	Number of log files, 0 disables log rotation	10
LOGSIZE	Maximum log file size to trigger rotation, in bytes	1MB
LOGINTERVAL	Maximum time interval to trigger log rotation, in seconds	1 day

Setting the parameter SSL_KEYFILE enables the SSL/TLS support. Using encryption is strongly encouraged, as otherwise everything, including passwords, is transferred in clear text.

11.16.2 Oracle Solaris: Starting the Web Service With SMF

On Oracle Solaris hosts, the Oracle VirtualBox web service daemon is integrated into the SMF framework. You can change the parameters, but do not have to if the defaults below already match your needs:

```
svccfg -s svc:/application/virtualbox/webservice:default setprop config/host=localhost
svccfg -s svc:/application/virtualbox/webservice:default setprop config/port=18083
svccfg -s svc:/application/virtualbox/webservice:default setprop config/user=root
```

The table in *11.16.1 Linux: Starting the Web Service With init on page 207* showing the parameter names and defaults also applies for Oracle Solaris. The parameter names must be changed to lowercase and a prefix of config/ has to be added. For example: config/user or config/ssl_keyfile. If you make any change, do not forget to run the following command to put the changes into effect immediately:

```
svcadm refresh svc:/application/virtualbox/webservice:default
```

If you forget the above command then the previous settings are used when enabling the service. Check the current property settings as follows:

```
svcprop -p config svc:/application/virtualbox/webservice:default
```

When everything is configured correctly you can start the Oracle VirtualBox web service with the following command:

```
svcadm enable svc:/application/virtualbox/webservice:default
```

For more information about SMF, please refer to the Oracle Solaris documentation.

11.16.3 macOS: Starting the Web Service With launchd

On macOS, launchd is used to start the Oracle VirtualBox webservice. An example configuration file can be found in $HOME/Library/LaunchAgents/org.virtualbox.vboxwebsrv.plist. It can be enabled by changing the Disabled key from true to false. To manually start the service use the following command:

```
launchctl load ~/Library/LaunchAgents/org.virtualbox.vboxwebsrv.plist
```

For additional information on how launchd services could be configured see:

https://developer.apple.com/library/mac/documentation/MacOSX/Conceptual/BPSystemStartup/Chapters/CreatingLaunchdJobs.html.

11.17 Oracle VirtualBox Watchdog

The memory ballooning service, formerly known as VBoxBalloonCtrl, was renamed to VBoxWatchdog. This service now incorporates the following host services that are meant to be run in a server environment:

- **Memory ballooning control.** This service automatically takes care of a VM's configured memory balloon. See *Memory Ballooning*. This service is useful for server environments where VMs may dynamically require more or less memory during runtime.

  The service periodically checks a VM's current memory balloon and its free guest RAM and automatically adjusts the current memory balloon by inflating or deflating it accordingly. This handling only applies to running VMs having recent Guest Additions installed.
- **Host isolation detection.** This service provides a way to detect whether the host cannot reach the specific Oracle VirtualBox server instance anymore and take appropriate actions, such as shutting down, saving the current state or even powering down certain VMs.

All configuration values can be either specified using the command line or global extradata, whereas command line values always have a higher priority when set. Some of the configuration values also be specified on a per-VM basis. So the overall lookup order is: command line, per-VM basis extradata if available, global extradata.

11.17.1 Memory Ballooning Control

The memory ballooning control inflates and deflates the memory balloon of VMs based on the VMs free memory and the requested maximum balloon size.

To set up the memory ballooning control the maximum ballooning size a VM can reach needs to be set. This can be specified using the command line, as follows:

```
--balloon-max <Size in MB>
```

Using a per-VM basis extradata value, as follows:

VBoxManage setextradata <VM-Name> VBoxInternal2/Watchdog/BalloonCtrl/BalloonSizeMax <Size in MB>

Using a global extradata value, as follows:

VBoxManage setextradata global VBoxInternal2/Watchdog/BalloonCtrl/BalloonSizeMax <Size in MB>

Note:

If no maximum ballooning size is specified by at least one of the parameters above, no ballooning will be performed at all.

Setting the ballooning increment in MB can be either done using command line, as follows:

--balloon-inc <Size in MB>

Using a global extradata value, as follows:

VBoxManage setextradata global VBoxInternal2/Watchdog/BalloonCtrl/BalloonIncrementMB <Size in MB>

The default ballooning increment is 256 MB if not specified.

The same options apply for a ballooning decrement. Using the command line, as follows:

--balloon-dec <Size in MB>

Using a global extradata value, as follows:

VBoxManage setextradata global VBoxInternal2/Watchdog/BalloonCtrl/BalloonDecrementMB <Size in MB>

The default ballooning decrement is 128 MB if not specified.

The lower limit in MB for a balloon can be defined using the command line, as follows:

--balloon-lower-limit <Size in MB>

Using a global extradata value, as follows:

VBoxManage setextradata global VBoxInternal2/Watchdog/BalloonCtrl/BalloonLowerLimitMB <Size in MB>

The default lower limit is 128 MB if not specified.

11.17.2 Host Isolation Detection

To detect whether a host is being isolated, that is, the host cannot reach the Oracle VirtualBox server instance anymore, the host needs to set an alternating value to a global extradata value within a time period. If this value is not set within that time period a timeout occurred and the so-called host isolation response will be performed to the VMs handled. Which VMs are handled can be controlled by defining VM groups and assigning VMs to those groups. By default no groups are set, meaning that all VMs on the server will be handled when no host response is received within 30 seconds.

Set the groups handled by the host isolation detection using the following command line:

--apimon-groups=<string[,stringN]>

Using a global extradata value, as follows:

VBoxManage setextradata global VBoxInternal2/Watchdog/APIMonitor/Groups <string[,stringN]>

Set the host isolation timeout using the following command line:

--apimon-isln-timeout=<ms>

Using a global extradata value, as follows:

VBoxManage setextradata global VBoxInternal2/Watchdog/APIMonitor/IsolationTimeoutMS <ms>

Set the actual host isolation response using the following command line:

--apimon-isln-response=<cmd>

Using a global extradata value, as follows:

VBoxManage setextradata global VBoxInternal2/Watchdog/APIMonitor/IsolationResponse <cmd>

The following response commands are available:

- none. This has no effect.
- pause. Pauses the execution of a VM.
- poweroff. Shuts down the VM by pressing the virtual power button. The VM will not have the chance of saving any data or veto the shutdown process.
- save. Saves the current machine state and then powers off the VM. If saving the machine state fails the VM will be paused.
- shutdown. Shuts down the VM in a gentle way by sending an ACPI shutdown event to the VM's operating system. The OS then has the chance of doing a clean shutdown.

11.17.3 More Information

For more advanced options and parameters like verbose logging check the built-in command line help accessible with --help.

11.17.4 Linux: Starting the Watchdog Service With init

On Linux, the watchdog service can be automatically started during host boot by adding appropriate parameters to the file /etc/default/virtualbox. There is one mandatory parameter, VBOXWATCHDOG_USER, which must be set to the user which will later start the VMs. For backward compatibility you can also specify VBOXBALLOONCTRL_USER.

The parameters in the following table all start with the VBOXWATCHDOG_ prefix string. For example: VBOXWATCHDOG_BALLOON_INTERVAL and VBOXWATCHDOG_LOGSIZE. Legacy parameters such as VBOXBALLOONCTRL_INTERVAL can still be used.

Table 9: Oracle VirtualBox Watchdog Configuration Parameters

Oracle VirtualBox Watchdog Configuration Parameters

Parameter	Description	Default
USER	The user which the watchdog service runs as	
ROTATE	Number of log files, 0 disables log rotation	10
LOGSIZE	Maximum log file size to trigger rotation, in bytes	1MB
LOGINTERVAL	Maximum time interval to trigger log rotation, in seconds	1 day
BALLOON_INTERVAL	Interval for checking the balloon size, in milliseconds	30000
BALLOON_INCREMENT	Balloon size increment, in megabytes	256

Parameter	Description	Default
BALLOON_DECREMENT	Balloon size decrement, in megabytes	128
BALLOON_LOWERLIMIT	Balloon size lower limit, in megabytes	64
BALLOON_SAFETYMARGIN	Free memory required for decreasing the balloon size, in megabytes	1024

11.17.5 Oracle Solaris: Starting the Watchdog Service With SMF

On Oracle Solaris hosts, the Oracle VirtualBox watchdog service daemon is integrated into the SMF framework. You can change the parameters, but do not have to if the defaults already match your needs:

```
svccfg -s svc:/application/virtualbox/balloonctrl:default setprop \
  config/balloon_interval=10000
svccfg -s svc:/application/virtualbox/balloonctrl:default setprop \
config/balloon_safetymargin=134217728
```

Table 9: Oracle VirtualBox Watchdog Configuration Parameters on page 211 also applies for Oracle Solaris. The parameter names must be changed to lowercase and a prefix of config/ has to be added. For example: config/user or config/balloon_safetymargin. If you made any change, do not forget to run the following command to put the changes into effect immediately:

```
svcadm refresh svc:/application/virtualbox/balloonctrl:default
```

If you forget the above command then the previous settings will be used when enabling the service. Check the current property settings with the following command:

```
svcprop -p config svc:/application/virtualbox/balloonctrl:default
```

When everything is configured correctly you can start the Oracle VirtualBox watchdog service with the following command:

```
svcadm enable svc:/application/virtualbox/balloonctrl:default
```

For more information about SMF, please refer to the Oracle Solaris documentation.

11.18 Other Extension Packs

Another extension pack called VNC is available. This extension pack is open source and replaces the previous integration of the VNC remote access protocol. This is available in the Oracle VirtualBox source code package but it is code contributed by users, and is not supported in any way by Oracle.

The keyboard handling is severely limited, and only the US keyboard layout works. Other keyboard layouts will have at least some keys which produce the wrong results, often with quite surprising effects, and for layouts which have significant differences to the US keyboard layout it is most likely unusable.

It is possible to install both the Oracle VirtualBox Extension Pack and VNC, but only one VRDE module can be active at any time. The following command switches to the VNC VRDE module in VNC:

```
VBoxManage setproperty vrdeextpack VNC
```

Configuring the remote access works very similarly to VRDP, see *10.1 Remote Display (VRDP Support) on page 161*, with some limitations. VNC does not support specifying several port numbers, and the authentication is done differently. VNC can only deal with password authentication, and there is no option to use password hashes. This leaves no other choice than having a clear-text password in the VM configuration, which can be set with the following command:

```
VBoxManage modifyvm VM-name --vrde-property VNCPassword=secret
```

The user is responsible for keeping this password secret, and it should be removed when a VM configuration is passed to another person, for whatever purpose. Some VNC servers claim to have encrypted passwords in the configuration. This is not true encryption, it is only concealing the passwords, which is only as secure as using clear-text passwords.

The following command switches back to VRDP, if installed:

```
VBoxManage setproperty vrdeextpack "Oracle VirtualBox Extension Pack"
```

11.19 Starting Virtual Machines During System Boot

You can start VMs automatically during system boot on Linux, Oracle Solaris, and macOS platforms for all users.

11.19.1 Linux: Starting the Autostart Service With init

On Linux, the autostart service is activated by setting two variables in /etc/default/virtualbox. The first one is VBOXAUTOSTART_DB which contains an absolute path to the autostart database directory. The directory should have write access for every user who should be able to start virtual machines automatically. Furthermore the directory should have the sticky bit set. The second variable is VBOXAUTOSTART_CONFIG which points the service to the autostart configuration file which is used during boot to determine whether to allow individual users to start a VM automatically and configure startup delays. The configuration file can be placed in /etc/vbox and contains several options. One is default_policy which controls whether the autostart service allows or denies to start a VM for users which are not in the exception list. The exception list starts with exception_list and contains a comma separated list with usernames. Furthermore a separate startup delay can be configured for every user to avoid overloading the host. A sample configuration is given below:

```
# Default policy is to deny starting a VM, the other option is "allow".
default_policy = deny

# Bob is allowed to start virtual machines but starting them
# will be delayed for 10 seconds
bob = {
   allow = true
   startup_delay = 10
}

# Alice is not allowed to start virtual machines, useful to exclude certain users
# if the default policy is set to allow.
alice = {
   allow = false
}
```

Any user who wants to enable autostart for individual machines must set the path to the autostart database directory with the following command:

```
VBoxManage setproperty autostartdbpath autostart-directory
```

11.19.2 Oracle Solaris: Starting the Autostart Service With SMF

On Oracle Solaris hosts, the Oracle VirtualBox autostart daemon is integrated into the SMF framework. To enable it you must point the service to an existing configuration file which has the same format as on Linux, see *11.19.1 Linux: Starting the Autostart Service With init on page 213*. For example:

```
# svccfg -s svc:/application/virtualbox/autostart:default setprop \
  config/config=/etc/vbox/autostart.cfg
```

When everything is configured correctly you can start the Oracle VirtualBox autostart service with the following command:

```
# svcadm enable svc:/application/virtualbox/autostart:default
```

For more information about SMF, see the Oracle Solaris documentation.

11.19.3 macOS: Starting the Autostart Service With launchd

On macOS, launchd is used to start the Oracle VirtualBox autostart service. An example configuration file can be found in /Applications/VirtualBox.app/Contents/MacOS/org.virtualbox.vboxautostart.plist. To enable the service copy the file to /Library/LaunchDaemons and change the Disabled key from true to false. Furthermore replace the second parameter to an existing configuration file which has the same format as on Linux, see *11.19.1 Linux: Starting the Autostart Service With init on page 213*.

To manually start the service use the following command:

```
# launchctl load /Library/LaunchDaemons/org.virtualbox.vboxautostart.plist
```

For additional information on how launchd services can be configured see:

http://developer.apple.com/mac/library/documentation/MacOSX/Conceptual/BPSystemStartup/BPSystemStartup.html.

11.19.4 Windows: Starting the Autostart Service

On Windows, autostart functionality consist of two components. The first component is a configuration file where the administrator can both set a delayed start for the VMs and temporarily disable autostarting for a particular user. The configuration file should be located in a folder accessible by all required users but it should have permissions allowing only reading by everyone but administrators. The configuration file contains several options. The default_policy controls whether the autostart service allows or denies starting of a VM for users that are not in the exception list. The exception list starts with exception_list and contains a comma separated list with usernames. Furthermore, a separate startup delay can be configured for every user to avoid overloading the host. A sample configuration is given below:

```
# Default policy is to deny starting a VM, the other option is "allow".
default_policy = deny

# Bob is allowed to start virtual machines but starting them
# will be delayed for 10 seconds
bob = {
   allow = true
   startup_delay = 10
}
```

```
# Alice is not allowed to start virtual machines, useful to exclude certain users
# if the default policy is set to allow.
alice = {
    allow = false
}
```

The user name can be specified using the following forms: "user", "domain\user", ".\user" and "user@domain". An administrator must add the VBOXAUTOSTART_CONFIG environment variable into system variables containing the path to the configuration file described above. The environment variable tells the autostart services which configuration file is used.

The second component of autostart functionality is a Windows service. Every instance of this works on behalf of a particular user using their credentials.

To enable autostarting for a particular user, a member of the administrators group must run the following command:

VBoxAutostartSvc install --user=*user* [--password-file=*password_file*]

The password file should contain the password followed by a line break. The rest of the file is ignored. The user will be asked for a password if the password file is not specified.

To disable autostarting for particular user, a member of the administrators group must run the following command:

VBoxAutostartSvc delete --user=*user*

If a user has changed their password then a member of the administrators group must either reinstall the service or change the service credentials using Windows Service Manager. Due to Windows security policies, the autostart service cannot be installed for users with empty passwords.

Finally, the user should define which VMs should be started at boot. The user should run the following command for every VM they want to start at boot:

VBoxManage modifyvm *VM name or UUID* --autostart-enabled on

The user can remove a particular VM from the VMs starting at boot by running the following command:

VBoxManage modifyvm *VM name or UUID* --autostart-enabled off

Note:

On Windows hosts, starting VMs by using the autostart service might cause some issues, as the virtual machines are starting within the same session as VBoxSVC. For more information see *11.32 VBoxSVC running in Windows Session 0 on page 226*.

11.20 Encryption of VMs

Oracle VirtualBox enables you to transparently encrypt the VM data stored in the configuration file, saved state, and EFI boot data for the guest.

Oracle VirtualBox uses the AES algorithm in various modes. The selected mode depends on the encrypting component of the VM. Oracle VirtualBox supports 128-bit or 256-bit data encryption keys (DEK). The DEK is stored encrypted in the VM configuration file and is decrypted during VM startup.

Since the DEK is stored as part of the VM configuration file, it is important that the file is kept safe. Losing the DEK means that the data stored in the VM is lost irrecoverably. Having complete and up-to-date backups of all data related to the VM is the responsibility of the user.

The VM, even if it is encrypted, may contain media encrypted with different passwords. To deal with this, the password for the VM has a password identifier, in the same way as passwords for media. The password ID is an arbitrary string which uniquely identifies the password in the VM and its media. You can use the same password and ID for both the VM and its media.

11.20.1 Limitations of VM Encryption

There are some limitations the user needs to be aware of when using this feature:

- Exporting appliances containing an encrypted VM is not possible, because the OVF specification does not support this. The VM is therefore decrypted during export.
- The DEK is kept in memory while the VM is running to be able to encrypt and decrypt VM data. While this should be obvious the user needs to be aware of this because an attacker might be able to extract the key on a compromised host and decrypt the data.
- When encrypting or decrypting the VM, the password is passed in clear text using the Oracle VirtualBox API. This needs to be kept in mind, especially when using third party API clients which make use of the web service where the password might be transmitted over the network. The use of HTTPS is mandatory in such a case.

11.20.2 Encrypting a VM

To encrypt an unencrypted VM with VBoxManage, use:

```
VBoxManage encryptvm uuid|vmname setencryption --new-password filename|- \
--cipher cipher-ID --new-password-id ID
```

To supply the encryption password, point VBoxManage to the file where the password is stored or specify - to let VBoxManage prompt for the password on the command line.

The cipher parameter specifies the cipher to use for encryption and can be either AES-128 or AES-256. The appropriate mode of operation, such as GCM, CTR, or XTS will be selected by the VM depending on the encrypting component. The specified password identifier can be freely chosen by the user and is used for correct identification when supplying multiple passwords for the VM.

11.20.3 Opening the Encrypted VM

When Oracle VirtualBox has just started up the encrypted VM cannot be opened and it stays inaccessible. Also, the encrypted VM stays inaccessible if it was just registered without a password or the password is incorrect. The user needs to provide the password using VirtualBox Manager or with the following VBoxManage command:

```
VBoxManage encryptvm uuid|vmname addpassword --password filename|- --password-id ID
```

To supply the encryption password point VBoxManage to the file where the password is stored or specify - to let VBoxManage prompt for the password on the command line.

If *ID* is the same as the password identifier supplied when encrypting the VM it updates the accessibility state.

To remove the entered password from the VM memory, use VBoxManage as follows:

VBoxManage encryptvm *uuid|vmname* removepassword *ID*

If *ID* is the same as the password identifier supplied when encrypting the VM it updates the accessibility state.

Note:

If a machine becomes inaccessible all passwords are purged. You have to add required passwords again, using the VBoxManage encryptvm *vmname* addpassword command.

11.20.4 Decrypting Encrypted VMs

In some circumstances it might be required to decrypt previously encrypted VMs. This can be done using VBoxManage with the following command:

VBoxManage encryptvm *uuid|vmname* setencryption --old-password *file|-*

The only required parameter is the password the VM was encrypted with. The options are the same as for encrypting VMs.

11.21 Oracle VirtualBox Expert Storage Management

In case the snapshot model of Oracle VirtualBox is not sufficient it is possible to enable a special mode which makes it possible to reconfigure storage attachments while the VM is paused. The user has to make sure that the disk data stays consistent to the guest because unlike with hotplugging the guest is not informed about detached or newly attached media.

The expert storage management mode can be enabled per VM executing:

$ VBoxManage setextradata *VM-name* "VBoxInternal2/SilentReconfigureWhilePaused" 1

You can reconfigure storage attachments later while the VM is paused by using the VBoxManage storageattach command.

11.22 Handling of Host Power Management Events

Some host power management events are handled by Oracle VirtualBox. The actual behavior depends on the platform:

- **Host Suspends.** This event is generated when the host is about to suspend, that is, the host saves the state to some nonvolatile storage and powers off.

  This event is currently only handled on Windows hosts and Mac OS X hosts. When this event is generated, Oracle VirtualBox will pause all running VMs.
- **Host Resumes.** This event is generated when the host woke up from the suspended state.

  This event is currently only handled on Windows hosts and Mac OS X hosts. When this event is generated, Oracle VirtualBox will resume all VMs which are where paused before.
- **Battery Low.** The battery level reached a critical level, usually less than 5 percent charged.

This event is currently only handled on Windows hosts and Mac OS X hosts. When this event is generated, Oracle VirtualBox will save the state and terminate all VMs in preparation of a potential host powerdown.

The behavior can be configured. By executing the following command, no VM is saved:

```
$ VBoxManage setextradata global "VBoxInternal2/SavestateOnBatteryLow" 0
```

This is a global setting as well as a per-VM setting. The per-VM value has higher precedence than the global value. The following command will save the state of all VMs but will not save the state of VM "foo":

```
$ VBoxManage setextradata global "VBoxInternal2/SavestateOnBatteryLow" 1
$ VBoxManage setextradata "foo" "VBoxInternal2/SavestateOnBatteryLow" 0
```

The first line is actually not required as by default the savestate action is performed.

11.23 Passing Through SSE4.1/SSE4.2 Instructions

To provide SSE 4.1/SSE 4.2 support to guests, the host CPU has to implement these instruction sets. The instruction sets are exposed to guests by default, but it is possible to disable the instructions for certain guests by using the following commands:

```
$ VBoxManage setextradata VM-name \
VBoxInternal/CPUM/IsaExts/SSE4.1 0
$ VBoxManage setextradata VM-name \
VBoxInternal/CPUM/IsaExts/SSE4.2 0
```

These are per-VM settings which are enabled by default.

11.24 Support for Keyboard Indicator Synchronization

This feature makes the host keyboard indicators (LEDs) match those of the VM's emulated keyboard when the machine window is active. It is currently implemented for macOS and Windows hosts. This feature is enabled by default on supported host OSs. You can disable this feature by running the following command:

```
$ VBoxManage setextradata VM-name GUI/HidLedsSync 0
```

This is a per-VM setting that is enabled by default.

11.25 Capturing USB Traffic for Selected Devices

You can capture USB traffic for single USB devices or on the root hub level, which captures the traffic of all USB devices attached to the root hub. Oracle VirtualBox stores the traffic in a format which is compatible with Wireshark. To capture the traffic of a specific USB device it must be attached to the VM with VBoxManage using the following command:

```
VBoxManage controlvm VM-name usbattach device uuid|address --capturefile filename
```

In order to enable capturing on the root hub use the following command while the VM is not running:

```
VBoxManage setextradata VM-name \
VBoxInternal/Devices/usb-ehci/0/LUN#0/Config/CaptureFilename filename
```

The command above enables capturing on the root hub attached to the EHCI controller. To enable it for the OHCI or XHCI controller replace usb-ehci with usb-ohci or usb-xhci, respectively.

11.26 Configuring the Heartbeat Service

Oracle VirtualBox ships a simple heartbeat service. Once the Guest Additions are active, the guest sends frequent heartbeat pings to the host. If the guest stops sending the heartbeat pings without properly terminating the service, the VM process will log this event in the VBox.log file. In the future it might be possible to configure dedicated actions but for now there is only a warning in the log file.

There are two parameters to configure. The *heartbeat interval* defines the time between two heartbeat pings. The default value is 2 seconds, that is, the heartbeat service of the Oracle VirtualBox Guest Additions will send a heartbeat ping every two seconds. The value in nanoseconds can be configured like this:

```
VBoxManage setextradata VM-name \
VBoxInternal/Devices/VMMDev/0/Config/HeartbeatInterval 2000000000
```

The *heartbeat timeout* defines the time the host waits starting from the last heartbeat ping before it defines the guest as unresponsive. The default value is 2 times the heartbeat interval (4 seconds) and can be configured as following, in nanoseconds:

```
VBoxManage setextradata VM-name \
VBoxInternal/Devices/VMMDev/0/Config/HeartbeatTimeout 4000000000
```

If the heartbeat timeout expires, there will be a log message like *VMMDev: HeartBeatCheckTimer: Guest seems to be unresponsive. Last heartbeat received 5 seconds ago.* If another heartbeat ping arrives after this warning, there will be a log message like *VMMDev: GuestHeartBeat: Guest is alive.*

11.27 Encryption of Disk Images

Oracle VirtualBox enables you to transparently encrypt the data stored in hard disk images for the guest. It does not depend on a specific image format to be used. Images which have the data encrypted are not portable between Oracle VirtualBox and other virtualization software.

Oracle VirtualBox uses the AES algorithm in XTS mode and supports 128-bit or 256-bit data encryption keys (DEK). The DEK is stored encrypted in the medium properties and is decrypted during VM startup by entering a password which was chosen when the image was encrypted.

Since the DEK is stored as part of the VM configuration file, it is important that it is kept safe. Losing the DEK means that the data stored in the disk images is lost irrecoverably. Having complete and up-to-date backups of all data related to the VM is the responsibility of the user.

11.27.1 Limitations of Disk Encryption

There are some limitations the user needs to be aware of when using this feature:

- This feature is part of the Oracle VirtualBox Extension Pack, which needs to be installed. Otherwise disk encryption is unavailable.

- Since encryption works only on the stored user data, it is currently not possible to check for metadata integrity of the disk image. Attackers might destroy data by removing or changing blocks of data in the image or change metadata items such as the disk size.
- Exporting appliances which contain encrypted disk images is not possible because the OVF specification does not support this. All images are therefore decrypted during export.
- The DEK is kept in memory while the VM is running to be able to decrypt data read and encrypt data written by the guest. While this should be obvious the user needs to be aware of this because an attacker might be able to extract the key on a compromised host and decrypt the data.
- When encrypting or decrypting the images, the password is passed in clear text using the Oracle VirtualBox API. This needs to be kept in mind, especially when using third party API clients which make use of the webservice where the password might be transmitted over the network. The use of HTTPS is mandatory in such a case.
- Encrypting images with differencing images is only possible if there are no snapshots or a linear chain of snapshots. This limitation may be addressed in a future Oracle VirtualBox version.
- The disk encryption feature can protect the content of the disks configured for a VM only. It does not cover any other data related to a VM, including saved state or the configuration file itself.

11.27.2 Encrypting Disk Images

Encrypting disk images can be done either using VirtualBox Manager or the VBoxManage. While VirtualBox Manager is easier to use, it works on a per VM basis and encrypts all disk images attached to the specific VM. With VBoxManage one can encrypt individual images, including all differencing images. To encrypt an unencrypted medium with VBoxManage, use:

```
VBoxManage encryptmedium uuid|filename \
--newpassword filename|- --cipher cipher-ID --newpasswordid "ID
```

To supply the encryption password point VBoxManage to the file where the password is stored or specify - to let VBoxManage ask you for the password on the command line.

The cipher parameter specifies the cipher to use for encryption and can be either AES-XTS128-PLAIN64 or AES-XTS256-PLAIN64. The specified password identifier can be freely chosen by the user and is used for correct identification when supplying multiple passwords during VM startup.

If the user uses the same password when encrypting multiple images and also the same password identifier, the user needs to supply the password only once during VM startup.

11.27.3 Starting a VM with Encrypted Images

When a VM is started using VirtualBox Manager, a dialog will open where the user needs to enter all passwords for all encrypted images attached to the VM. If another frontend like VBoxHeadless is used, the VM will be paused as soon as the guest tries to access an encrypted disk. The user needs to provide the passwords through VBoxManage using the following command:

```
VBoxManage controlvm uuid|vmname addencpassword ID
              password [--removeonsuspend yes|no]
```

ID must be the same as the password identifier supplied when encrypting the images. *password* is the password used when encrypting the images. Optionally, you can specify --removeonsuspend yes|no to specify whether to remove the password from VM memory when the VM is suspended.

Before the VM can be resumed, the user needs to supply the passwords again. This is useful when a VM is suspended by a host suspend event and the user does not want the password to remain in memory.

11.27.4 Decrypting Encrypted Images

In some circumstances it might be required to decrypt previously encrypted images. This can be done in VirtualBox Manager for a complete VM or using VBoxManage with the following command:

VBoxManage encryptmedium *uuid|filename* --oldpassword *file*|-

The only required parameter is the password the image was encrypted with. The options are the same as for encrypting images.

11.28 Paravirtualized Debugging

This section covers debugging of guest operating systems using interfaces supported by paravirtualization providers.

> **Note:**
>
> Paravirtualized debugging significantly alter guest operating system behaviour and should only be used by expert users for debugging and diagnostics.

These debug options are specified as a string of key-value pairs separated by commas. An empty string disables paravirtualized debugging.

11.28.1 Hyper-V Debug Options

All of the options listed below are optional, and thus the default value specified will be used when the corresponding key-value pair is not specified.

- Key: **enabled**

  Value: 0 or 1

  Default: 0

  Specify 1 to enable the Hyper-V debug interface. If this key-value pair is not specified or the value is not 1, the Hyper-V debug interface is disabled regardless of other key-value pairs being present.
- Key: **address**

  Value: IPv4 address

  Default: 127.0.0.1

  Specify the IPv4 address where the remote debugger is connected.
- Key: **port**

  Value: UDP port number

  Default: 50000

Specify the UDP port number where the remote debugger is connected.

- Key: **vendor**

  Value: Hyper-V vendor signature reported by CPUID to the guest

  Default: When debugging is enabled: Microsoft Hv, otherwise: VBoxVBoxVBox

  Specify the Hyper-V vendor signature which is exposed to the guest by CPUID. For debugging Microsoft Windows guests, it is required the hypervisor reports the Microsoft vendor.
- Key: **hypercallinterface**

  Value: 0 or 1

  Default: 0

  Specify whether hypercalls should be suggested for initiating debug data transfers between host and guest rather than MSRs when requested by the guest.
- Key: **vsinterface**

  Value: 0 or 1

  Default: When debugging is enabled, 1, otherwise 0

  Specify whether to expose the VS#1 virtualization service interface to the guest. This interface is required for debugging Microsoft Windows 10 32-bit guests, but is optional for other Windows versions.

11.28.1.1 Setting up Windows Guests for Debugging with the Hyper-V Paravirtualization Provider

Windows supports debugging over a serial cable, USB, IEEE 1394 Firewire, and Ethernet. USB and IEEE 1394 are not applicable for virtual machines, and Ethernet requires Windows 8 or later. While a serial connection is universally usable, it is slow.

Debugging using the Hyper-V debug transport, supported on Windows Vista and later, offers significant benefits. It provides excellent performance due to direct host-to-guest transfers, it is easy to set up and requires minimal support from the hypervisor. It can be used with the debugger running on the same host as the VM or with the debugger and VM on separate machines connected over a network.

Prerequisites

- A VM configured for Hyper-V paravirtualization running a Windows Vista or newer Windows guest. You can check the effective paravirtualization provider for your VM with the output of the following VBoxManage command:

  ```
  $ VBoxManage showvminfo VM-name
  ```

- A sufficiently up-to-date version of the Microsoft WinDbg debugger required to debug the version of Windows in your VM.
- While Windows 8 and newer Windows guests ship with Hyper-V debug support, Windows 7 and Vista do not. To use Hyper-V debugging with a Windows 7 or Vista guest, copy the file kdvm.dll from a Windows 8.0 installation. This file is typically located in C:\Windows\System32. Copy it to the same location in your Windows 7/Vista guest. Make sure you copy the 32-bit or 64-bit version of the DLL which matches your guest OS.

> **Note:**
>
> Only Windows 8.0 ships kdvm.dll. Windows 8.1 and newer Windows versions do not.

VM and Guest Configuration

1. Power off the VM.
2. Enable the debug options with the following VBoxManage command:

   ```
   $ VBoxManage modifyvm VM-name --paravirt-debug "enabled=1"
   ```

   The above command assumes your debugger will connect to your host machine on UDP port 50000. However, if you need to run the debugger on a remote machine you may specify the remote address and port here. For example:

   ```
   $ VBoxManage modifyvm VM-name \
   --paravirt-debug "enabled=1,address=192.168.32.1,port=55000"
   ```

   See *11.28.1 Hyper-V Debug Options on page 221* for the complete set of options.
3. Start the VM.
4. In the guest, start an elevated command prompt and execute the following commands:

   - For a Windows 8 or newer Windows guest:

     ```
     bcdedit /dbgsettings net hostip:5.5.5.5 port:50000 key:1.2.3.4
     ```
   - For a Windows 7 or Vista guest:

     ```
     bcdedit /set loadoptions host_ip=5.5.5.5,host_port=50000,encryption_key=1.2.3.4
     bcdedit /set dbgtransport kdvm.dll
     ```

     The IP address and port in the bcdedit command are ignored when using the Hyper-V debug transport. Any valid IP and a port number greater than 49151 and lower than 65536 can be entered.

     The encryption key in the bcdedit command is relevant and must be valid. The key "1.2.3.4" used in the above example is valid and may be used if security is not a concern. If you do not specify any encryption key, bcdedit will generate one for you and you will need to copy this key to later enter in Microsoft WinDbg on the remote end. This encryption key is used to encrypt the debug data exchanged between Windows and the debugger.
   - Run one or more of the following commands to enable debugging for the appropriate phase or component of your Windows guest:

     ```
     bcdedit /set debug on
     bcdedit /set bootdebug on
     bcdedit /set {bootmgr} bootdebug on
     ```

     Please note that the bootdebug options are only effective on Windows 8 or newer when using the Hyper-V debug transport. Refer to Microsoft Windows documentation for detailed explanation of bcdedit options.
5. Start Microsoft WinDbg on your host machine or remote host.

   From the **File** menu, select **Kernel Debug**. On the **NET** tab, specify the UDP port number you used in the paravirtdebug options. If you did not specify any, leave it as 50000. Ensure that the UDP port is not blocked by a firewall or other security software.

   In the **Key** field, enter 1.2.3.4 or the encryption key from the bcdedit command in your Windows guest.

Click **OK** to start listening for connections. Microsoft WinDbg typically shows a Waiting to Reconnect message during this phase.

Alternatively, to directly start a debug session, run WinDbg from the command line as follows :

```
windbg.exe -k net:port=50000,key=1.2.3.4
```

See the WinDbg documentation for the complete command line syntax.

6. Reboot your Windows guest and it should then connect as a debuggee with Microsoft WinDbg.

11.29 Accessing USB devices Exposed Over the Network with USB/IP

Oracle VirtualBox supports passing through USB devices which are exposed over the network using the USB over IP protocol without the need to configure the client side provided by the kernel and usbip tools. Furthermore, this feature works with Oracle VirtualBox running on any supported host, rather than just Linux alone, as is the case with the official client.

To enable support for passing through USB/IP devices, use the following command to add the device server that exports the devices:

VBoxManage usbdevsource add *unique-name* --backend *USBIP* --address *device-server*[:*port*]

USB devices exported on the device server are then accessible through VirtualBox Manager or VBoxManage, like any USB devices attached locally. This can be used multiple times to access different device servers.

To remove a device server, the following command can be used:

$ VBoxManage usbdevsource remove *unique-name*

11.29.1 Setting up USB/IP Support on a Linux System

This section gives a brief overview on how to set up a Linux based system to act as a USB device server. The system on the server requires that the usbip-core.ko and usbip-host.ko kernel drivers are available, and that the USB/IP tools package is installed. The particular installation method for the necessary tools depends on which distribution is used. For example, for Debian based systems, use the following command to install the required tools:

```
$ apt-get install usbip-utils
```

To check whether the necessary tools are already installed use the following command:

```
$ usbip list -l
```

This should produce output similar to that shown in the example below:

```
 - busid 4-2 (0bda:0301)
   Realtek Semiconductor Corp. : multicard reader (0bda:0301)

 - busid 5-1 (046d:c52b)
   Logitech, Inc. : Unifying Receiver (046d:c52b)
```

If everything is installed, the USB/IP server needs to be started as root using the following command:

```
# usbipd -D
```

See the documentation for the installed distribution to determine how to start the service when the system boots.

By default, no device on the server is exported. This must be done manually for each device. To export a device use the following command:

```
# usbip bind -b "bus identifier"
```

To export the multicard reader in the previous example:

```
# usbip bind -b 4-2
```

11.29.2 Security Considerations

The communication between the server and client is unencrypted and there is no authorization required to access exported devices. An attacker might sniff sensitive data or gain control over a device. To mitigate this risk, the device should be exposed over a local network to which only trusted clients have access. To access the device remotely over a public network, a VPN solution should be used to provide the required level of security protection.

11.30 Using Hyper-V with Oracle VirtualBox

Oracle VirtualBox can be used on a Windows host where Hyper-V is running but host systems might experience significant Oracle VirtualBox performance degradation.

Assuming Windows Hypervisor Platform is running, Oracle VirtualBox detects Hyper-V automatically and uses Hyper-V as the virtualization engine for the host system. The CPU icon in the VM window status bar indicates that Hyper-V is being used.

Note: In Windows, **Windows Hypervisor Platform** must be enabled in addition to **Hyper-V**.

11.31 Nested Virtualization

Oracle VirtualBox supports *nested virtualization*. This feature enables the passthrough of hardware virtualization functions to the guest VM. That means that you can install a hypervisor, such as Oracle VirtualBox, Oracle VM Server or KVM, on an Oracle VirtualBox guest. You can then create and run VMs within the guest VM.

Hardware virtualization features not present on the host CPU will not be exposed to the guest. In addition, some features such as nested paging are not yet supported for passthrough to the guest.

You can enable the nested virtualization feature in one of the following ways:

- From VirtualBox Manager, select the **Enable Nested VT-x/AMD-V** check box on the **Processor** tab. To disable the feature, deselect the check box.
- Use the `--nested-hw-virt` option of the `VBoxManage modifyvm` command to enable or disable nested virtualization. See *15.35 VBoxManage modifyvm on page 402*.

11.32 VBoxSVC running in Windows Session 0

Oracle VirtualBox supports executing the VBoxSVC in Windows session 0. This allows VBoxSVC to run like a regular Windows service, which in turn enables headless VMs to continue running even if the user logs out.

The feature is disabled by default and can be enabled by creating a REG_DWORD value `ServerSession0` in the key `HKEY_LOCAL_MACHINE\Software\Oracle\VirtualBox\VBoxSDS` of the Windows registry. Specify `1` as the value's data to enable the feature, or `0` to disable the feature. A host reboot is needed in order to make the change effective.

11.33 VISO file format / RTIsoMaker

ISO image maker

11.33.1 Synopsis

RTIsoMaker [*options*] [*@commands.rsp*] <*filespec...*>

11.33.2 Description

Construct a virtual ISO 9660 / Joliet / UDF / HFS hybrid image and either write it to a file (RTIsoMaker) or serve it as a virtual image (VISO).

11.33.2.1 VISO file format

A VISO file is a virtual ISO image, i.e. constructed in memory from a bunch of files on the host. A VISO is just the recipe describing how to go about this using a syntax vaguely similar to mkisofs and genisoimage.

One requirement is that the VISO file must start with one of the --iprt-iso-maker-file-marker options. Which of the options you use will dictate the quoting and escaping rules used when reading the file. The option takes the image UUID as an argument.

The VISO files are treated as UTF-8 and must not contain any byte order marker (BOM). There is currently no way to comment out lines in a VISO file.

11.33.2.2 File specifications and --name-setup

All non-options that does not start with '@' are taken to indicate a file, directory, or similar that is should be added to the ISO image. Directories are added recursively and content is subject to filtering options.

Since there can be up to six different namespaces on an ISO, it is handy to be able to control the names used in each and be able to exclude an object from one or more namespaces. The --name-setup option specifies the file specification format to use forthwith.

The default setup is:

--name-setup iso+joliet+udf+hfs

Which means you specify one on-ISO name for all namespaces followed by '=' and the source file system name. Only specifying the source file system will add the file/dir/whatever to the root of the ISO image.

Lets look at the following two examples:

/docs/readme.txt=/home/user/Documents/product-x-readme.txt

/home/user/Documents/product-x-readme.txt

In the first case the file '/home/user/Documents/product-x-readme.txt' is added to the ISO image as '/docs/readme.txt' in all enabled namespaces. In the primary ISO 9660 namespace, the filename will by default be converted to upper case because it's required by the spec.

In the second case the file is added to the root under the name 'product-x-readme.txt' in all namespaces. Though, in the primary ISO 9660 namespace the name will be transformed to apply with the current ISO level, probably uppercased, possibly truncated too.

Given --name-setup iso,joliet,udf you can specify the name individually for each of the three namespace, if you like. If you omit any, they will use last name given. Any names left blank (==) will be considered omitted.

A different name in each namespace:

/ISO.TXT=/Joliet.TxT=/UDF.txt=/tmp/iso/real.txt

Specific name in the ISO 9660 namespace, same in the rest:

/ISO.TXT=/OtherNamespaces.TxT=/tmp/iso/real.txt

Omit the file from the ISO 9660 namespace:

=/OtherNamespaces.TxT=/tmp/iso/real.txt

Omit the file from the joliet namespace:

/ISO.TXT==/UDF.TxT=/tmp/iso/real.txt

Use the same filename as the source everywhere:

/tmp/iso/real.txt

Using for instance --name-setup udf you can add a files/dirs/whatever to select namespace(s) without the more complicated empty name syntax above.

When adding directories, you can only control the naming and omitting of the directory itself, not any recursively added files and directories below it.

11.33.3 Options

11.33.3.1 General

-o *output-file*
--output=*output-file*

The output filename. This option is not supported in VISO mode.

--dry-run

Do not write anything, just test the argument and image setup. This option is not supported in VISO mode.

--name-setup=*spec*

Configures active namespaces and how file specifications are to be interpreted. The specification is a comma separated list. Each element in the list is a sub-list separated by space, '+' or '|' giving the namespaces that elements controls. Namespaces are divied into two major and minor ones, you cannot specifying a minor before the major it belongs to.

Major namespaces and aliases in parentheses:

- iso (primary, iso9660, iso-9660, primary-iso, iso-primary)
- joliet
- udf
- hfs (hfs-plus)

Minor namespaces:

- rock: rock ridge on previous major namespace (iso / joliet)
- iso-rock: rock ridge extensions on primary ISO 9660 namespace
- joliet-rock: rock ridge on joliet namespace (just for fun)
- trans-tbl: translation table file on previous major namespace
- iso-trans-tbl
- joliet-trans-tbl
- udf-trans-tbl
- hfs-trans-tbl

--name-setup-from-import

This is for use following one or more --import-iso operations and will pick a configuration matching the imported content as best we can. If the imported ISOs only had a iso9660 namespace, the joliet, udf and hfs namespaces will be removed. This is useful when adding additional files to the ISO and will prevent guest from picking a namespace without the imported ISO content when mounting it.

--push-iso=*iso-file*
--push-iso-no-joliet=*iso-file*
--push-iso-no-rock-*iso-file*
--push-iso-no-rock-no-joliet=*iso-file*

Open the specified ISO file and use it as source file system until the corresponding --pop options is encountered. The variations are for selecting which namespace on the ISO to (not) access. These options are handy for copying files/directories/stuff from an ISO without having to extract them first or using the :iprtvfs: syntax.

--pop

Pops a --push-iso of the source file system stack.

--import-iso=*iso-file*

Imports everything on the given ISO file, including boot configuration and system area (first 16 sectors) content. You can use --name-setup to omit namespaces.

--import-iso-skip-eltorito=*iso-file*

Same as --import-iso, but skips the El Torito boot info.

11.33.3.2 Namespaces

--iso-level=*0*|*1*|*2*|*3*

Sets the ISO level:

- 0: Disable primary ISO namespace.
- 1: ISO level 1: Filenames 8.3 format and limited to 4GB - 1.
- 2: ISO level 2: 31 char long names and limited to 4GB - 1.
- 3: ISO level 3: 31 char long names and support for >=4GB files. (default)
- 4: Fictive level used by other tools. Not yet implemented.

--rock-ridge
--limited-rock-ridge
--no-rock-ridge

Enables or disables rock ridge support for the primary ISO 9660 namespace. The --limited-rock-ridge option omits a couple of bits in the root directory that would make Linux pick rock ridge over joliet.

Default: --limited-rock-ridge

-J
--joliet
--no-joliet

Enables or disable the joliet namespace. This option must precede any file specifications.

Default: --joliet

--joliet-ucs-level=*1*|*2*|*3*
--ucs-level=*1*|*2*|*3*

Set the Joliet UCS support level. This is currently only flagged in the image but not enforced on the actual path names.

Default level: 3

11.33.3.3 Filtering

--ignore-symlinks,--no-ignore-symlinks

Whether to ignore symbolic links or not (default). This is a hack for missing symblic links support.

11.33.3.4 File Attributes

--rational-attribs

Enables rational file attribute handling (default):

- Owner ID is set to zero
- Group ID is set to zero
- Mode is set to 0444 for non-executable files.
- Mode is set to 0555 for executable files.
- Mode is set to 0555 for directories, preserving stick bits.

--strict-attribs

Counters --rational-attribs and causes attributes to be recorded exactly as they appear in the source.

--file-mode=*mode*
--no-file-mode

Controls the forced file mode mask for rock ridge, UDF and HFS.

--dir-mode=*mode*
--no-dir-mode

Controls the forced directory mode mask for rock ridge, UDF and HFS.

--new-dir-mode=*mode*

Controls the default mode mask (rock ridge, UDF, HFS) for directories that are created implicitly. The --dir-mode option overrides this.

--chmod=*mode*:*on-iso-file*

Explictily sets the rock ridge, UDF and HFS file mode for a file/dir/whatever that has already been added to the ISO. The mode can be octal, ra+x, a+r, or a+rx. (Support for more complicated mode specifications may be implemented at a later point.)

Note that only namespaces in the current --name-setup are affected.

--chown=*owner-id*:*on-iso-file*

Explictily sets the rock ridge, UDF and HFS file owner ID (numeric) for a file/dir/whatever that has already been added to the ISO.

Note that only namespaces in the current --name-setup are affected.

--chgrp=*group-id*:*on-iso-file*

Explictily sets the rock ridge, UDF and HFS file group ID (numeric) for a file/dir/whatever that has already been added to the ISO.

Note that only namespaces in the current --name-setup are affected.

11.33.3.5 Booting

--eltorito-new-entry
--eltorito-alt-boot

Starts a new El Torito boot entry.

--eltorito-add-image=*filespec*

File specification of a file that should be added to the image and used as the El Torito boot image of the current boot entry.

-b *on-iso-file*
--eltorito-boot=*on-iso-file*

Specifies a file on the ISO as the El Torito boot image for the current boot entry.

--eltorito-floppy-12
--eltorito-floppy-144
--eltorito-floppy-288
--no-emulation-boot
--hard-disk-boot

Sets the boot image emulation type of the current El Torito boot entry.

--boot-load-seg=*seg*

Specify the image load segment for the current El Torito boot entry.

Default: 0x7c0

--boot-load-size=*sectors*

Specify the image load size in emulated sectors for the current El Torito boot entry.

Default: 4 (sectors of 512 bytes)

--no-boot

Indicates that the current El Torito boot entry isn't bootable. (The BIOS will allegedly configure the emulation, but not attempt booting.)

--boot-info-table

Write a isolinux/syslinux boot info table into the boot image for the current El Torito boot entry.

--eltorito-platform-id=*id*

Set the El Torito platform ID of the current entry, a new entry of the verification entry depending on when it's used. The ID must be one of: x86, PPC, Mac, efi

-c *namespec*
--boot-catalog=*namespec*

Enters the El Torito boot catalog into the namespaces as a file. The *namespec* uses the same format as a 'filespec', but omits the final source file system name component.

-G *file*
--generic-boot=*file*

Specifies a file that should be loaded at offset 0 in the ISO image. The file must not be larger than 32KB. When creating a hybrid image, parts of this may be regenerated by partition tables and such.

11.33.3.6 String properties (applied to active namespaces only)

--abstract=*file-id*

The name of the abstract file in the root dir.

-A *text*|*_file-id*
--application-id=*text*|*_file-id*

Application ID string or root file name. The latter must be prefixed with an underscore.

--biblio=*file-id*

The name of the bibliographic file in the root dir.

--copyright=*file-id*

The name of the copyright file in the root dir.

-P *text*|*_file-id*
--publisher=*text*|*_file-id*

Publisher ID string or root file name. The latter must be prefixed with an underscore.

-p *text*|*_file-id*
--preparer=*text*|*_file-id*

Data preparer ID string or root file name. The latter must be prefixed with an underscore.

--sysid=*text*

System ID string.

--volid=*text*
--volume-id=*text*

Volume ID string (label). (It is possible to set different labels for primary ISO 9660, joliet, UDF and HFS by changing the active namespaces using the --name-setup option between --volume-id occurences.)

--volset=*text*

Volume set ID string.

11.33.3.7 Compatibility:

--graft-points

Alias for --name-setup iso+joliet+udf+hfs.

-l
--long-names

Allow 31 charater filenames. Just ensure ISO level >= 2 here.

-R
--rock

Same as --rock-ridge and --strict-attribs.

-r
--rational-rock

Same as --rock-ridge and --rational-attribs.

11.33.3.8 VISO Specific:

--iprt-iso-maker-file-marker=*UUID*
--iprt-iso-maker-file-marker-bourne=*UUID*
--iprt-iso-maker-file-marker-bourne-sh=*UUID*

Used as first option in a VISO file to specify the file UUID and that it is formatted using bourne-shell argument quoting & escaping style.

--iprt-iso-maker-file-marker-ms=*UUID*
--iprt-iso-maker-file-marker-ms-sh=*UUID*

Used as first option in a VISO file to specify the file UUID and that it is formatted using microsoft CRT argument quoting & escaping style.

11.33.3.9 Testing (not applicable to VISO):

--output-buffer-size=*bytes*

Selects a specific output buffer size for testing virtual image reads.

--random-output-buffer-size

Enables randomized buffer size for each virtual image read, using the current output buffer size (--output-buffer-size) as maximum.

--random-order-verification=*size*

Enables verification pass of the image that compares blocks of the given size in random order from the virtual and output images.

12 Customizing Oracle VirtualBox

12.1 Oracle VirtualBox Programming Interfaces

Oracle VirtualBox comes with comprehensive support for third-party developers. The so-called *Main API* of Oracle VirtualBox exposes the entire feature set of the virtualization engine. It is completely documented and available to anyone who wants to control Oracle VirtualBox programmatically.

The Main API is made available to C++ clients through COM on Windows hosts or XPCOM on other hosts. Bridges also exist for SOAP, Java and Python.

All programming information such as documentation, reference information, header and other interface files, as well as samples have been split out to a separate **Software Development Kit (SDK)**. The SDK is available for download from http://www.virtualbox.org. In particular, the SDK comes with a Programming Guide and Reference manual in PDF format.

13 Troubleshooting

Understand how to find VirtualBox files and processes, how to collect debugging information, and identify and address common issues that can occur while working with Oracle VirtualBox.

13.1 Where Oracle VirtualBox Stores its Files

In Oracle VirtualBox, a virtual machine and its settings are described in a virtual machine settings file in XML format. In addition, most virtual machines have one or more virtual hard disks. These are typically represented by disk images, such as those in VDI format. The location of these files may vary, depending on the host operating system. See *13.1.1 The VM Folder on page 237*.

Global configuration data for Oracle VirtualBox is maintained in another location on the host. See *13.1.2 Global Settings on page 238*.

13.1.1 The VM Folder

By default, each virtual machine has a directory on your host computer where all the files of that machine are stored: the XML settings file, with a .vbox file extension, and its disk images. This is called the **VM Folder**.

By default, this machine folder is located in a common folder called VirtualBox VMs, which Oracle VirtualBox creates in the current system user's home directory. The location of this home directory depends on the conventions of the host operating system, as follows:

- On Windows, this is the location returned by the SHGetFolderPath function of the Windows system library Shell32.dll, asking for the user profile. A typical location is C:\Users*username*.
- On Linux, macOS, and Oracle Solaris, this is generally taken from the environment variable $HOME, except for the user root where it is taken from the account database. This is a workaround for the frequent trouble caused by users using Oracle VirtualBox in combination with the tool sudo, which by default does not reset the environment variable $HOME.

  A typical location on Linux and Oracle Solaris is /home/*username* and on macOS is /Users/*username*.

For simplicity, we abbreviate the location of the home directory as $HOME. Using that convention, the common folder for all virtual machines is $HOME/VirtualBox VMs.

As an example, when you create a virtual machine called *Example VM*, Oracle VirtualBox creates the following:

- A VM folder: $HOME/VirtualBox VMs/Example VM/
- In the VM folder, a settings file: Example VM.vbox
- In the VM folder, a virtual disk image: Example VM.vdi.

This is the default layout if you use the **Create New Virtual Machine** workflow described in *4 Creating a New Virtual Machine on page 47*. Once you start working with the VM, additional files are added. Log files are in a subfolder called Logs, and if you have taken snapshots, they are in a Snapshots subfolder. For each VM, you can change the location of its snapshots folder in the VM settings.

To change the default VM folder:

1. In VirtualBox Manager, click **File**, **Preferences**.
2. In **Preferences**, click **General** and change the **Default Machine Folder**.

Alternatively, use the VBoxManage setproperty machinefolder command. See *15.41 VBoxManage setproperty on page 433*.

13.1.2 Global Settings

In addition to the files for the virtual machines, Oracle VirtualBox maintains global configuration data in the following directory:

- **Linux and Oracle Solaris:**$HOME/.config/VirtualBox.
- **Windows:**$HOME/.VirtualBox.
- **macOS:**$HOME/Library/VirtualBox.

Oracle VirtualBox creates this configuration directory automatically, if necessary. You can specify an alternate configuration directory by either setting the VBOX_USER_HOME environment variable, or on Linux or Oracle Solaris by using the standard XDG_CONFIG_HOME variable. Since the global VirtualBox.xml settings file points to all other configuration files, this enables switching between several Oracle VirtualBox configurations.

In this configuration directory, Oracle VirtualBox stores its global settings file, an XML file called VirtualBox.xml. This file includes global configuration options and a list of registered virtual machines with pointers to their XML settings files.

13.1.3 Summary of Configuration Data Locations

The following table gives a brief overview of the configuration data locations on an Oracle VirtualBox host.

Table 10: Configuration File Locations

Configuration File Locations

Setting	Location
Default machines folder	$HOME/VirtualBox VMs
Default disk image location	In each machine's folder
Machine settings file extension	.vbox
Media registry	Each machine settings file Media registration is done automatically when a storage medium is attached to a VM

13.1.4 Oracle VirtualBox XML Files

Oracle VirtualBox uses XML for both the machine settings files and the global configuration file, VirtualBox.xml.

All Oracle VirtualBox XML files are versioned. When a new settings file is created, for example because a new virtual machine is created, Oracle VirtualBox automatically uses the settings format of the current Oracle VirtualBox version. These files may not be readable if

you downgrade to an earlier version of Oracle VirtualBox. However, when Oracle VirtualBox encounters a settings file from an earlier version, such as after upgrading Oracle VirtualBox, it attempts to preserve the settings format as much as possible. It will only silently upgrade the settings format if the current settings cannot be expressed in the old format, for example because you enabled a feature that was not present in an earlier version of Oracle VirtualBox.

In such cases, Oracle VirtualBox backs up the old settings file in the virtual machine's configuration directory. If you need to go back to the earlier version of Oracle VirtualBox, then you will need to manually copy these backup files back.

We intentionally do not document the specifications of the Oracle VirtualBox XML files, as we must reserve the right to modify them in the future. We therefore strongly suggest that you do not edit these files manually. Oracle VirtualBox provides complete access to its configuration data through its the VBoxManage command line tool, see *VBoxManage* and its API, see *12.1 Oracle VirtualBox Programming Interfaces on page 235*.

13.2 Oracle VirtualBox Host Processes

Oracle VirtualBox was designed to be modular and flexible. When the Oracle VirtualBox graphical user interface (GUI) is opened and a VM is started, at least the following three processes are running:

- VBoxSVC, the Oracle VirtualBox service process which always runs in the background. This process is started automatically by the first Oracle VirtualBox client process and exits a short time after the last client exits.

  Note:

  When we refer to *clients* here, we mean the local clients of a particular VBoxSVC server process, not clients in a network. Oracle VirtualBox employs its own client/server design to allow its processes to cooperate, but all these processes run under the same user account on the host operating system, and this is totally transparent to the user.

  The first Oracle VirtualBox service can be VirtualBox Manager, VBoxManage, VBoxHeadless, the web service amongst others. The service is responsible for bookkeeping, maintaining the state of all VMs, and for providing communication between Oracle VirtualBox components. This communication is implemented using COM/XPCOM. Whenever an Oracle VirtualBox process is started, it requests access to the COM server and Windows automatically starts the process. You should never start the process directly.

  When the last process disconnects from the COM server, it will stop itself after a few seconds. The Oracle VirtualBox configuration XML files are maintained and owned by the COM server and the files are locked whenever the server runs.

  In some cases, such as when a virtual machine is closed unexpectedly, the COM server will not notice that the client is disconnected and stay active for a longer period of 10 minutes or so, keeping the configuration files locked. In other rare cases the COM server might experience an internal error and subsequently other processes fail to initialize it. In these situations, use the Windows task manager to stop the process VBoxSVC.exe.
- The GUI process, VirtualBoxVM, a client application based on the cross-platform Qt library. When started without the --startvm option, this application acts as VirtualBox Manager, displaying the VMs and their settings. It then communicates settings and state changes to

VBoxSVC and also reflects changes effected through other means, such as the VBoxManage command.

- If the VirtualBoxVM client application is started with the --startvm argument, it loads the VMM library which includes the actual hypervisor and then runs a virtual machine and provides the input and output for the guest.

Any Oracle VirtualBox front end, or client, will communicate with the service process and can both control and reflect the current state. For example, either the VM selector or the VM window or VBoxManage can be used to pause the running VM, and other components will always reflect the changed state.

The Oracle VirtualBox GUI application, called VirtualBox Manager, is only one of several available front ends, or clients. The complete list shipped with Oracle VirtualBox is as follows:

- VirtualBoxVM: The Qt front end implementing VirtualBox Manager and running VMs.
- VBoxManage: A less user-friendly but more powerful alternative. See *VBoxManage*.
- VBoxHeadless: A VM front end which does not directly provide any video output and keyboard or mouse input, but enables redirection through the VirtualBox Remote Desktop Extension. See *10.1.2 VBoxHeadless, the Remote Desktop Server on page 162*.
- vboxwebsrv: The Oracle VirtualBox web service process which enables control of an Oracle VirtualBox host remotely. This is described in detail in the Oracle VirtualBox Software Development Kit (SDK) reference. See *12.1 Oracle VirtualBox Programming Interfaces on page 235*.
- The Oracle VirtualBox Python shell: A Python alternative to VBoxManage. This is also described in the SDK reference.

Internally, Oracle VirtualBox consists of many components. You may encounter these when analyzing Oracle VirtualBox internal error messages or log files. These include the following:

- IPRT: A portable runtime library which abstracts file access, threading, and string manipulation. Whenever Oracle VirtualBox accesses host operating features, it does so through this library for cross-platform portability.
- VMM (Virtual Machine Monitor): The heart of the hypervisor.
- EM (Execution Manager): Controls execution of guest code.
- TRPM (Trap Manager): Intercepts and processes guest traps and exceptions.
- HM (Hardware Acceleration Manager): Provides support for VT-x and AMD-V.
- GIM (Guest Interface Manager): Provides support for various paravirtualization interfaces to the guest.
- PDM (Pluggable Device Manager): An abstract interface between the VMM and emulated devices which separates device implementations from VMM internals and makes it easy to add new emulated devices. Through PDM, third-party developers can add new virtual devices to Oracle VirtualBox without having to change Oracle VirtualBox itself.
- PGM (Page Manager): A component that controls guest paging.
- TM (Time Manager): Handles timers and all aspects of time inside guests.
- CFGM (Configuration Manager): Provides a tree structure which holds configuration settings for the VM and all emulated devices.
- SSM (Saved State Manager): Saves and loads VM state.
- VUSB (Virtual USB): A USB layer which separates emulated USB controllers from the controllers on the host and from USB devices. This component also enables remote USB.
- DBGF (Debug Facility): A built-in VM debugger.

- Oracle VirtualBox emulates a number of devices to provide the hardware environment that various guests need. Most of these are standard devices found in many PC compatible machines and widely supported by guest operating systems. For network and storage devices in particular, there are several options for the emulated devices to access the underlying hardware. These devices are managed by PDM.
- Guest Additions for various guest operating systems. This is code that is installed from within a virtual machine. See *Guest Additions*.
- The "Main" component is special. It ties all the above bits together and is the only public API that Oracle VirtualBox provides. All the client processes listed above use only this API and never access the hypervisor components directly. As a result, third-party applications that use the Oracle VirtualBox Main API can rely on the fact that it is always well-tested and that all capabilities of Oracle VirtualBox are fully exposed. It is this API that is described in the Oracle VirtualBox SDK. See *12.1 Oracle VirtualBox Programming Interfaces on page 235*.

13.3 Oracle VirtualBox Guest Processes

Oracle VirtualBox VMs also run VirtualBox processes.

If a particular desktop service is not working correctly, it is worth checking that the process that should provide it is running.

- VBoxClient provides desktop services in guests running the X11 window system such as Oracle Solaris and Linux. This process runs under the ID of the user who started the desktop session and is automatically started using the following command lines when your X11 user session is started if you are using a common desktop environment such as Gnome or KDE.

  ```
  $ VBoxClient --clipboard
  $ VBoxClient --display
  $ VBoxClient --seamless
  ```

  The VBoxClient processes create files in the user's home directory with names of the form .vboxclient-*.pid when they are running in order to prevent a given service from being started twice. It can happen due to misconfiguration that these files are created owned by root and not deleted when the services are stopped, which will prevent them from being started in future sessions. If the services cannot be started, you may want to check whether these files still exist.

13.4 Categorizing and Isolating Problems

Usually a virtual machine behaves like a physical machine. Any problems that a physical machine would encounter, a virtual machine will encounter as well. If, for example, Internet connectivity is lost due to external issues, virtual machines will be affected just as much as physical ones.

If a true Oracle VirtualBox problem is encountered, it helps to categorize and isolate the problem first. Here are some of the questions that should be answered when reporting a problem:

- Is the problem specific to a certain guest OS? Or a specific release of a guest OS? Especially with Linux guest related problems, the issue may be specific to a certain distribution and version of Linux.
- Is the problem specific to a certain host OS? Problems are usually not host OS specific, because most of the Oracle VirtualBox code base is shared across all supported platforms. However in the areas of networking and USB support, there are significant differences between host platforms. Some GUI related issues are also host specific.

- Is the problem specific to certain host hardware? This category of issues is typically related to the host CPU. Because of significant differences between VT-x and AMD-V, problems may be specific to one or the other technology. The exact CPU model may also make a difference because different CPUs support different features, which may affect certain aspects of guest CPU operation.
- Is the problem specific to guest SMP? That is, is it related to the number of virtual CPUs (VCPUs) in the guest? Using more than one CPU usually significantly affects the internal operation of a guest OS.
- Is the problem specific to the Guest Additions? In some cases, this is obvious, such as a shared folders problem. In other cases, such as display problems, it may be less obvious. If the problem is Guest Additions specific, is it also specific to a certain version of the Guest Additions?
- Is the problem specific to a certain environment? Some problems are related to a particular environment external to the VM. This usually involves network setup. Certain configurations of external servers such as DHCP or PXE may expose problems which do not occur with other, similar servers.
- Is the problem a regression? Knowing that an issue is a regression usually makes it significantly easier to find the solution. In this case, it is crucial to know which version is affected and which is not.
- Are the processes running that should be? See *13.2 Oracle VirtualBox Host Processes on page 239*.

13.5 Collecting Debugging Information

For problem determination, it is often important to collect debugging information which can be analyzed by Oracle VirtualBox support. This section contains information about what kind of information can be obtained.

Every time Oracle VirtualBox starts up a VM, a so-called *release log file* is created, containing lots of information about the VM configuration and runtime events. The log file is called VBox.log and resides in the VM log file folder, which is $HOME/VirtualBox VMs/*VM-name*/Logs by default.

When starting a VM, the configuration file of the last run will be renamed to .1, up to .3. Sometimes when there is a problem, it is useful to have a look at the logs. You are also required to supply the corresponding log file when requesting support for Oracle VirtualBox.

For convenience, for each virtual machine, VirtualBox Manager can show these logs in a window. Select a virtual machine from the machine list on the left and click **Logs** in the machine tools menu.

The release log file, VBox.log, contains a wealth of diagnostic information, such as Host OS type and version, Oracle VirtualBox version and build. It also includes a complete dump of the guest's configuration (CFGM), detailed information about the host CPU type and supported features, whether hardware virtualization is enabled, information about VT-x/AMD-V setup, state transitions (such as creating, running, paused, stopping), guest BIOS messages, Guest Additions messages, device-specific log entries and, at the end of execution, final guest state and condensed statistics.

In case of crashes, it is very important to collect *crash dumps*. This is true for both host and guest crashes. For information about enabling core dumps on Linux, Oracle Solaris, and macOS systems, refer to the following core dump article on the Oracle VirtualBox website:

http://www.virtualbox.org/wiki/Core_dump.

You can also use VBoxManage debugvm to create a dump of a complete virtual machine. See *15.16 VBoxManage debugvm on page 332*.

For network related problems, it is often helpful to capture a trace of network traffic. If the traffic is routed through an adapter on the host, it is possible to use Wireshark or a similar tool to capture the traffic there. However, this often also includes a lot of traffic unrelated to the VM.

Oracle VirtualBox provides an ability to capture network traffic only on a specific VM's network adapter. Refer to the following network tracing article on the Oracle VirtualBox website for information on enabling this capture:

http://www.virtualbox.org/wiki/Network_tips.

The trace files created by Oracle VirtualBox are in .pcap format and can be easily analyzed with Wireshark.

13.5.1 Using the VBoxBugReport Command to Collect Debug Information Automatically

The VBoxBugReport command is used to collect debug information automatically for an Oracle VirtualBox installation. This command can be useful when you need to gather information to send to Oracle Support.

The following examples show how to use VBoxBugReport.

By default, the command collects VBoxSVC process logs, device settings, and global configuration data for an Oracle VirtualBox host.

```
$ VBoxBugReport
  ...
  0% - collecting VBoxSVC.log.10...
  7% - collecting VBoxSVC.log.9...
  ...
 64% - collecting VBoxSVC.log.1...
 71% - collecting VBoxSVC.log...
 78% - collecting VirtualBox.xml...
 85% - collecting HostUsbDevices...
 92% - collecting HostUsbFilters...
100% - compressing...

Report was written to '2019-03-26-13-32-02-bugreport.tgz'
```

The results are saved as a compressed tar file archive in the same directory where the command is run.

To specify a different output file location:

```
$ VBoxBugReport --output ~/debug/bug004.tgz
```

To output all debug information to a single text file, rather than a tgz file:

```
$ VBoxBugReport --text
```

To collect information for a specific VM, called Windows_10:

```
$ VBoxBugReport Windows_10
```

This command collects machine settings, guest properties, and log files for the specified VM. Global configuration information for the host is also included.

To collect information for several VMs, called Windows_7, Windows_8, and Windows_10:

```
$ VBoxBugReport Windows_7 Windows_8 Windows_10
```

To collect information for all VMs:

```
$ VBoxBugReport --all
```

To show a full list of the available command options, run VBoxBugReport --help.

13.5.2 The Built-In VM Debugger

Oracle VirtualBox includes a built-in VM debugger, which advanced users may find useful. This debugger enables you to examine and, to some extent, control the VM state.

> **CAUTION:**
>
> Use the VM debugger at your own risk. There is no support for it, and the following documentation is only made available for advanced users with a very high level of familiarity with the x86/AMD64 machine instruction set, as well as detailed knowledge of the PC architecture. A degree of familiarity with the internals of the guest OS in question may also be very helpful.

The VM debugger is available in all regular production versions of Oracle VirtualBox, but it is disabled by default because the average user will have little use for it. There are two ways to access the debugger:

- Using a debugger console window displayed alongside the VM
- Using the telnet protocol on port 5000

The debugger can be enabled in the following ways:

- Start the VM directly using VirtualBoxVM --startvm, with an additional --dbg, --debug, or --debug-command-line argument. See the VirtualBoxVM --help command usage help for details.
- Set the VBOX_GUI_DBG_ENABLED or VBOX_GUI_DBG_AUTO_SHOW environment variable to true before launching the Oracle VirtualBox process. Setting these variables, only their presence is checked, is effective even when the first Oracle VirtualBox process is the VM selector window. VMs subsequently launched from the selector will have the debugger enabled.
- Set the GUI/Dbg/Enabled extra data item to true before launching the VM. This can be set globally or on a per VM basis.

A new **Debug** menu entry is added to the Oracle VirtualBox application. This menu enables the user to open the debugger console.

The VM debugger command syntax is loosely modeled on Microsoft and IBM debuggers used on DOS, OS/2, and Windows. Users familiar with symdeb, CodeView, or the OS/2 kernel debugger will find the Oracle VirtualBox VM debugger familiar.

The most important command is help. This will print brief usage help for all debugger commands. The set of commands supported by the VM debugger changes frequently and the help command is always up-to-date.

A brief summary of frequently used commands is as follows:

- stop: Stops the VM execution and enables single stepping
- g: Continue VM execution
- t: Single step an instruction

- rg, rh, and r: Print the guest, hypervisor, and current registers
- kg, kh, and k: Print the guest, hypervisor, and current call stack
- da, db, dw, dd, dq: Print memory contents as ASCII, bytes, words, dwords, and qwords
- u: Unassemble memory
- dg: Print the guest's GDT
- di: Print the guest's IDT
- dl: Print the guest's LDT
- dt: Print the guest's TSS
- dp*: Print the guest's page table structures
- bp and br: Set a normal and recompiler breakpoint
- bl: List breakpoints
- bc: Clear a breakpoint
- writecore: Write a VM core file to disk. See *13.5.3 VM Core Format on page 246*

See the built-in help for other available commands.

The VM debugger supports symbolic debugging, although symbols for guest code are often not available. For Oracle Solaris guests, the detect command automatically determines the guest OS version and locates kernel symbols in guest's memory. Symbolic debugging is then available. For Linux guests, the detect commands also determines the guest OS version, but there are no symbols in the guest's memory. Kernel symbols are available in the file /proc/kallsyms on Linux guests. This file must be copied to the host, for example using scp. The loadmap debugger command can be used to make the symbol information available to the VM debugger. Note that the kallsyms file contains the symbols for the currently loaded modules. If the guest's configuration changes, the symbols will change as well and must be updated.

For all guests, a simple way to verify that the correct symbols are loaded is the k command. The guest is normally idling and it should be clear from the symbolic information that the guest operating system's idle loop is being executed.

Another group of debugger commands is the set of info commands. Running info help provides complete usage information. The information commands provide ad-hoc data pertinent to various emulated devices and aspects of the VMM. There is no general guideline for using the info commands, the right command to use depends entirely on the problem being investigated. Some of the info commands are as follows:

- cfgm: Print a branch of the configuration tree
- cpuid: Display the guest CPUID leaves
- ioport: Print registered I/O port ranges
- mmio: Print registered MMIO ranges
- mode: Print the current paging mode
- pit: Print the i8254 PIT state
- pic: Print the i8259A PIC state
- ohci, ehci, xhci: Print a subset of the OHCI, EHCI, and xHCI USB controller state
- pcnet0: Print the PCnet state
- vgatext: Print the contents of the VGA framebuffer formatted as standard text mode
- timers: Print all VM timers

The output of the info commands generally requires in-depth knowledge of the emulated device or Oracle VirtualBox VMM internals. However, when used properly, the information provided can be very valuable.

13.5.3 VM Core Format

Oracle VirtualBox uses the 64-bit ELF format for its VM core files created by VBoxManage debugvm, see *15.16 VBoxManage debugvm on page 332*. The VM core file contain the memory and CPU dumps of the VM and can be useful for debugging your guest OS. The 64-bit ELF object format specification can be obtained at:

http://downloads.openwatcom.org/ftp/devel/docs/elf-64-gen.pdf.

The overall layout of the VM core format is as follows:

```
[ ELF 64 Header]
[ Program Header, type PT_NOTE ]
  # offset to COREDESCRIPTOR
[ Program Header, type PT_LOAD ] - one for each contiguous physical memory range
  # Memory offset of range
  # File offset
[ Note Header, type NT_VBOXCORE ]
[ COREDESCRIPTOR ]
  # Magic
  # VM core file version
  # VBox version
  # Number of vCPUs etc.
[ Note Header, type NT_VBOXCPU ] - one for each vCPU
[ vCPU 1 Note Header ]
  [ DBGFCORECPU - vCPU 1 dump ]
[ Additional Notes + Data ] - currently unused
[ Memory dump ]
```

The memory descriptors contain physical addresses relative to the guest and not virtual addresses. Regions of memory such as MMIO regions are not included in the core file.

The relevant data structures and definitions can be found in the Oracle VirtualBox sources under the following header files: include/VBox/dbgfcorefmt.h, include/iprt/x86.h and src/VBox/Runtime/include/internal/ldrELFCommon.h.

The VM core file can be inspected using elfdump and GNU readelf or other similar utilities.

13.6 Running Legacy Guest OSs

Older Operating Systems that no longer qualify for Oracle support may work in Oracle VirtualBox, but may need some additional setup and will have limitations. Here are some suggestions and workarounds for common problems.

13.6.1 Graphics and Mouse Integration

In older Linux and Oracle Solaris guests, Oracle VirtualBox graphics and mouse integration goes through the X Window System. Oracle VirtualBox can use the X.Org variant of the system, or XFree86 version 4.3 which is identical to the first X.Org release. During the installation process, the X.Org display server will be set up to use the graphics and mouse drivers that come with the Guest Additions.

After installing the Guest Additions into a fresh installation of most Linux distributions or Oracle Solaris systems, the guest's graphics mode will change to fit the size of the Oracle VirtualBox window on the host when it is resized. You can also ask the guest system to switch to a particular resolution by sending a video mode hint using the VBoxManage tool.

Multiple guest monitors are supported in guests using the X.Org server version 1.3, which is part of release 7.3 of the X Window System version 11, or a later version. The layout of the guest screens can be adjusted as needed using the tools which come with the guest operating system.

The Oracle VirtualBox Guest Additions includes drivers for X.Org. You should not need to change these. By default these drivers are in the following directory:

/opt/VBoxGuestAdditions-*version*/other/

The correct versions for the X server are symbolically linked into the X.Org driver directories.

For graphics integration to work correctly, the X server must load the vboxvideo driver. Many recent X server versions look for it automatically if they see that they are running in Oracle VirtualBox. For an optimal user experience, the guest kernel drivers must be loaded and the Guest Additions tool VBoxClient must be running as a client in the X session.

For mouse integration to work correctly, the guest kernel drivers must be loaded. In addition, for legacy X servers the correct vboxmouse driver must be loaded and associated with /dev/mouse or /dev/psaux. For most guests, a driver for a PS/2 mouse must be loaded and the correct vboxmouse driver must be associated with /dev/vboxguest.

The Oracle VirtualBox guest graphics driver can use any graphics configuration for which the virtual resolution fits into the virtual video memory allocated to the virtual machine, minus a small amount used by the guest driver, as described in *Display Settings*. The driver will offer a range of standard modes at least up to the default guest resolution for all active guest monitors. The default mode can be changed by setting the output property VBOX_MODE to "<width>x<height>" for any guest monitor. When VBoxClient and the kernel drivers are active this is done automatically when the host requests a mode change. The driver for older versions can only receive new modes by querying the host for requests at regular intervals.

With legacy X Servers before version 1.3, you can also add your own modes to the X server configuration file. Add them to the "Modes" list in the "Display" subsection of the "Screen" section. For example, the following section has a custom 2048x800 resolution mode added:

```
Section "Screen"
    Identifier    "Default Screen"
    Device        "VirtualBox graphics card"
    Monitor       "Generic Monitor"
    DefaultDepth  24
    SubSection "Display"
        Depth         24
        Modes         "2048x800" "800x600" "640x480"
    EndSubSection
EndSection
```

13.6.2 Guest OSs With no ATAPI CD-ROM Support May Fail to Boot

Some guest operating systems predating ATAPI CD-ROMs may exhibit long delays or entirely fail to boot in certain configurations. This is most likely to happen when an IDE/ATAPI CD-ROM exists alone on a primary or secondary IDE channel. For example, OS/2 1.21 fails to boot with an error message referencing COUNTRY.SYS, and OS/2 1.3 experiences long boot delays.

Disable the emulated IDE/ATAPI CD-ROM. The guest OS can't use this device anyway.

13.6.3 Windows 2000 Installation Failures

When installing Windows 2000 guests, you might run into one of the following issues:

- Installation reboots, usually during component registration.
- Installation fills the whole hard disk with empty log files.
- Installation complains about a failure installing msgina.dll.

These problems are all caused by a bug in the hard disk driver of Windows 2000. After issuing a hard disk request, there is a race condition in the Windows driver code which leads to corruption if the operation completes too fast. For example, the hardware interrupt from the IDE controller arrives too soon. With physical hardware, there is a guaranteed delay in most systems so the problem is usually hidden there. However, it should be possible to also reproduce it on physical hardware. In a virtual environment, it is possible for the operation to be done immediately, especially on very fast systems with multiple CPUs, and the interrupt is signaled sooner than on a physical system. The solution is to introduce an artificial delay before delivering such interrupts. This delay can be configured for a VM using the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/Devices/piix3ide/0/Config/IRQDelay" 1
```

This sets the delay to one millisecond. In case this does not help, increase it to a value between 1 and 5 milliseconds. Please note that this slows down disk performance. After installation, you should be able to remove the key, or set it to 0.

13.6.4 Windows 3.x Limited to 64 MB RAM

Windows 3.x guests are typically limited to 64 MB RAM, even if a VM is assigned much more memory. While Windows 3.1 is theoretically capable of using up to 512 MB RAM, it only uses memory available through the XMS interface. Versions of HIMEM.SYS, the Microsoft XMS manager, shipped with MS-DOS and Microsoft Windows 3.x can only use up to 64 MB on standard PCs.

This is a known HIMEM.SYS limitation. Windows 3.1 memory limits are described in detail in Microsoft Knowledge base article KB 84388.

It is possible for Windows 3.x guests to utilize more than 64 MB RAM if a different XMS provider is used. That could be a newer HIMEM.SYS version, such as that shipped with Windows 98, or a more capable third-party memory manager, such as QEMM.

13.6.5 No Networking in Windows Vista Guests

With Windows Vista, Microsoft dropped support for the AMD PCNet card that legacy versions of Oracle VirtualBox used to provide as the default virtual network card. For Windows Vista guests, Oracle VirtualBox now uses an Intel E1000 card by default.

If, for some reason, you still want to use the AMD card, you need to download the PCNet driver from the AMD website. This driver is available for 32-bit Windows only. You can transfer it into the virtual machine using a shared folder. See *Shared Folders*.

13.6.6 No USB 3.0 Support in Windows 7 Guests

If a Windows 7 or Windows Server 2008 R2 guest is configured for USB 3.0 (xHCI) support, the guest OS will not have any USB support at all. This happens because Windows 7 predates USB 3.0 and therefore does not ship with any xHCI drivers. Microsoft also does not offer any vendor-provided xHCI drivers through Windows Update.

To solve this problem, download and install the Intel xHCI driver in the guest. Intel offers the driver as the USB 3.0 eXtensible Host Controller (xHCI) driver for Intel 7 Series/C216 chipsets.

Note that the driver only supports Windows 7 and Windows Server 2008 R2. The driver package includes support for both 32-bit and 64-bit OS variants.

13.6.7 Windows Fails After Changing VM Configuration

Changing certain virtual machine settings can cause Windows guests to fail during start up with a bluescreen. This may happen if you change VM settings after installing Windows, or if you copy a disk image with an already installed Windows to a newly created VM which has settings that differ from the original machine.

This applies in particular to the following settings:

- The ACPI and I/O APIC settings should never be changed after installing Windows. Depending on the presence of these hardware features, the Windows installation program chooses special kernel and device driver versions and will fail to startup should these hardware features be removed. Enabling them for a Windows VM which was installed without them does not cause any harm. However, Windows will not use these features in this case.
- Changing the storage controller hardware will cause bootup failures. This might also apply to you if you copy a disk image from an older version of Oracle VirtualBox to a new virtual machine. The default subtype of IDE controller hardware used by Oracle VirtualBox is PIIX4. Make sure that the storage controller settings are identical.

13.6.8 IDE/SATA Errors on Guest OSs

Occasionally, some host file systems provide very poor writing performance and as a consequence cause the guest to time out IDE/SATA commands. This is normal behavior and should normally cause no real problems, as the guest should repeat commands that have timed out. However, guests such as some Linux versions have severe problems if a write to an image file takes longer than about 15 seconds. Some file systems however require more than a minute to complete a single write, if the host cache contains a large amount of data that needs to be written.

The result of this problem is that the guest can no longer access its files during large write or copying operations, usually leading to an immediate hang of the guest.

To work around this problem, it is possible to flush the image file after a certain amount of data has been written. This interval is normally infinite, but can be configured individually for each disk of a VM.

For IDE disks use the following command:

```
VBoxManage setextradata VM-name
"VBoxInternal/Devices/piix3ide/0/LUN#[x]/Config/FlushInterval" [b]
```

For SATA disks use the following command:

```
VBoxManage setextradata VM-name
"VBoxInternal/Devices/ahci/0/LUN#[x]/Config/FlushInterval" [b]
```

[x] specifies the disk. For IDE, 0 represents device 0 on the primary channel, 1 represents device 1 on the primary channel, 2 represents device 0 on the secondary channel, and 3 represents device 1 on the secondary channel. For SATA, use values between 0 and 29. This configuration option applies to disks only. Do not use this option for CD or DVD drives.

The unit of the interval ([*b*]) is the number of bytes written since the last flush. The value for it must be selected so that the occasional long write delays do not occur. Since the proper flush interval depends on the performance of the host and the host filesystem, finding the optimal value that makes the problem disappear requires some experimentation. Values between 1000000 and 10000000 (1 to 10 megabytes) are a good starting point. Decreasing the interval both decreases the probability of the problem and the write performance of the guest. Setting the value unnecessarily low will cost performance without providing any benefits. An interval of 1 will cause a flush for each write operation and should solve the problem, but with a severe write performance penalty.

A value of 0 for [*b*] is treated as an infinite flush interval, effectively disabling this workaround. Removing the extra data key by specifying no value for [*b*] has the same effect.

13.6.9 Buggy Linux 2.6 Kernel Versions

The following bugs in Linux kernels prevent them from executing correctly in Oracle VirtualBox, causing VM boot crashes:

- The Linux kernel version 2.6.18, and some 2.6.17 versions, introduced a race condition that can cause boot failures in Oracle VirtualBox. Use kernel version 2.6.19 or later.
- With hardware virtualization and the I/O APIC enabled, kernels before 2.6.24-rc6 may panic on boot with the following message:

  ```
  Kernel panic - not syncing: IO-APIC + timer doesn't work!  Boot with
  apic=debug and send a report.  Then try booting with the 'noapic' option
  ```

  If you see this message, either disable hardware virtualization or the I/O APIC as described in *System Settings*, or upgrade the guest to a newer kernel.

  See *this message* for details about the kernel fix.

13.6.10 Crash on Start Caused by Kernel Bugs

The version of the Linux kernel supplied by default in SUSE and openSUSE 10.2, Ubuntu 6.10 (all versions) and Ubuntu 6.06 (server edition) contains a bug that can cause it to crash during startup when it is run in a virtual machine.

13.6.11 Linux Guests May Cause a High CPU load

Some legacy Linux guests may cause a high CPU load even if the guest system appears to be idle. This can be caused by a high timer frequency of the guest kernel. Some older Linux distributions ship a Linux kernel configured for a timer frequency of 1000Hz. We recommend recompiling the guest kernel and selecting a timer frequency of 100Hz.

Linux kernels shipped with Red Hat Enterprise Linux, as well as kernels of related Linux distributions, such as CentOS and Oracle Linux, support a kernel parameter *divider=N*. Hence, such kernels support a lower timer frequency without recompilation. Add the kernel parameter *divider=10* to select a guest kernel timer frequency of 100Hz.

13.6.12 Certain Oracle Solaris 10 Releases May Take a Long Time to Boot with SMP

When using more than one CPU, Oracle Solaris 10 10/08, and Oracle Solaris 10 5/09 may take a long time to boot and may print warnings on the system console regarding failures to read from disk. This is a bug in Oracle Solaris 10 that affects specific physical and virtual configurations. It is caused by trying to read microcode updates from the boot disk when the disk interrupt is reassigned to a not yet fully initialized secondary CPU. Disk reads will time out and fail, triggering delays of about 45 seconds, and warnings.

The recommended solution is upgrading to at least Oracle Solaris 10 10/09, which includes a fix for this problem. Alternative solutions include restricting the number of virtual CPUs to one or possibly using a different storage controller.

13.6.13 Older Solaris Releases Do Not Work with E1000 Ethernet

Solaris releases before Solaris 10 1/06, including Solaris 9, Solaris 10 1/05 (GA), and Solaris 10 3/05 (HW2), are unable to communicate through the Intel E1000 card. The Solaris e1000g driver does not enable PCI bus mastering for the network adapter and is therefore unable to send and receive data. This problem appears to be specific to the e1000g driver and does not reflect general Solaris driver behavior.

The AMD PCnet emulation (using the Solaris pcn driver) can be used instead of Intel E1000. Solaris 10 1/06 (U1) and later releases do not have this problem and work with the emulated E1000 ethernet controller.

13.7 Known Issues

The following section describes known problems with this release of Oracle VirtualBox. Unless marked otherwise, these issues are planned to be fixed in later releases.

13.7.1 General Issues

13.7.1.1 Responding to Guest IDE/SATA Flush Requests

If required, the virtual disk images can be flushed when the guest issues the IDE FLUSH CACHE command. Normally these requests are ignored for improved performance. The parameters below are only accepted for disk drives. They must not be set for DVD drives.

To enable flushing for IDE disks, issue the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/Devices/piix3ide/0/LUN#[x]/Config/IgnoreFlush" 0
```

[*x*] specifies the disk. Enter 0 for device 0 on the primary channel, 1 for device 1 on the primary channel, 2 for device 0 on the secondary channel, or 3 for device 1 on the secondary channel.

To enable flushing for SATA disks, issue the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/Devices/ahci/0/LUN#[x]/Config/IgnoreFlush" 0
```

The value [x] that selects the disk can be a value between 0 and 29.

Note that this does not affect the flushes performed according to the configuration described in *13.6.8 IDE/SATA Errors on Guest OSs on page 249*. Restoring the default of ignoring flush commands is possible by setting the value to 1 or by removing the key.

13.7.1.2 Performance Variation with Frequency Boosting

Many multicore processors support some form of frequency boosting, which means that if only one core is utilized, it can run possibly 50% faster or even more than the rated CPU frequency. This causes measured performance to vary somewhat as a function of the momentary overall system load. The exact behavior depends strongly on the specific processor model.

As a consequence, benchmarking on systems which utilize frequency boosting may produce unstable and nonrepeatable results. This is especially true if benchmark runs are short, of the order of seconds. To obtain stable results, benchmarks must be run over longer periods of time and with a constant system load apart from the VM being tested.

13.7.1.3 Frequency Scaling Effect on CPU Usage

On some hardware platforms and operating systems, CPU frequency scaling may cause CPU usage reporting to be highly misleading. This happens in situations when the host CPU load is significant but not heavy, such as between 15% to 30% of the maximum.

Most operating systems determine CPU usage in terms of time spent, measuring for example how many nanoseconds the systems or a process was active within one second. However, in order to save energy, systems can significantly scale down CPU speed when the system is not fully loaded. When the CPU is running at for example one half of its maximum speed, the same number of instructions will take roughly twice as long to execute compared to running at full speed.

Depending on the specific hardware and host OS, this effect can very significantly skew the CPU usage reported by the OS. The reported CPU usage can be several times higher than what it would have been had the CPU been running at full speed. The effect can be observed both on the host OS and in a guest OS.

13.7.1.4 Inaccurate Windows CPU Usage Reporting

CPU usage reporting tools which come with Windows, such as Task Manager or Resource Monitor, do not take the time spent processing hardware interrupts into account. If the interrupt load is heavy, with thousands of interrupts per second, CPU usage may be significantly underreported.

This problem affects Windows as both host and guest OS. Sysinternals tools, such as Process Explorer, do not suffer from this problem.

13.7.1.5 Poor Performance Caused by Host Power Management

On some hardware platforms and operating systems, virtualization performance is negatively affected by host CPU power management. The symptoms may be choppy audio in the guest or erratic guest clock behavior.

Some of the problems may be caused by firmware or host operating system bugs. Therefore, updating the firmware and applying operating system fixes is recommended.

For optimal virtualization performance, the C1E power state support in the system's BIOS should be disabled, if such a setting is available. Not all systems support the C1E power state. On Intel systems, the Intel C State setting should be disabled. Disabling other power management

settings may also improve performance. However, a balance between performance and power consumption must always be considered.

13.7.1.6 Guest SMP (Multiprocessor) Limitations

Details

- **Poor performance** with 32-bit guests on AMD CPUs. This affects Windows and Oracle Solaris guests, and possibly also some Linux kernel revisions. Partially solved for 32-bit Windows NT, 2000, XP, and 2003 guests.
- **Poor performance** with 32-bit guests on certain Intel CPU models that do not include virtual APIC hardware optimization support. This affects Windows and Oracle Solaris guests, and possibly also some Linux kernel revisions. Partially solved for 32-bit Windows NT, 2000, XP, and 2003 guests.

Workaround

We're working on a resolution.

Ensure you have Guest Additions installed.

13.7.1.7 Can't Compact VMDK Virtual Disk Images

Details

The VBoxManage modifymedium --compact command is currently only implemented for VDI and VHD files. You can't use this command for VMDK files.

Workaround

At the moment the only way to optimize the size of a virtual disk image in VMDK is to clone the image and then use the cloned image in the VM configuration.

13.7.1.8 Preserving the Aspect Ratio in Scale Mode Not Available on All Hosts

Details

Preserving the aspect ratio in scale mode works only on Windows hosts and on macOS hosts.

Workaround

No workaround exists.

13.7.1.9 Drag Limitations

Details

On Linux hosts and guests, programs can query for dragged data while the drag operation is still in progress. For example, on LXDE using

the PCManFM file manager. This feature does not work with Oracle VirtualBox.

Workaround

A different file manager, such as Nautilus, can be used to force programs to wait until a drag operation is complete before querying the data.

13.7.1.10 Guest OS Won't Run Using ICH9

Details

VMs using the ICH9 chipset will not run if they are running very old OSs that have no IO-APIC support, or any VM with IO-APIC disabled in the config. This is because interrupts coming from PCI devices can't be delivered.

The interrupt delivery to the legacy PIC interrupt controller is not implemented for ICH9, just the delivery to IO-APIC.

Workaround

Use the PIIX3 chipset for the VM.

13.7.2 Windows Guests

13.7.2.1 How to Record Bluescreen Information from Windows Guests

When Windows guests run into a kernel crash, they display a bluescreen error. Depending on how Windows is configured, the information will remain on the screen until the machine is restarted or it will reboot automatically. During installation, Windows is usually configured to reboot automatically. With automatic reboots, there is no chance to record the bluescreen information which might be important for problem determination.

Oracle VirtualBox provides a method of halting a guest when it wants to perform a reset. In order to enable this feature, use the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/PDM/HaltOnReset" 1
```

13.7.2.2 Windows Guests Cause a High CPU Load

Several background applications in Windows guests, especially virus scanners, are known to increase the CPU load notably even if the guest appears to be idle. Deactivating virus scanners in VMs, where possible, can reduce this problem.

Windows Updates, especially on Windows 10 and Windows 11 guests, can also cause a temporary increase in guest CPU usage and storage activity. Modern Windows versions do a lot of updating in the background to deploy new features and security fixes.

13.7.2.3 Long Delays When Accessing Shared Folders

The performance for accesses to shared folders from a Windows guest might be decreased due to delays during the resolution of the Oracle VirtualBox shared folders name service. To fix

these delays, add the following entries to the file \windows\system32\drivers\etc\lmhosts of the Windows guest:

```
255.255.255.255     VBOXSVR #PRE
255.255.255.255     VBOXSRV #PRE
```

After doing this change, a reboot of the guest is required.

13.7.2.4 USB Tablet Coordinates Wrong in Windows 98 Guests

If a Windows 98 VM is configured to use the emulated USB tablet (absolute pointing device), the coordinate translation may be incorrect and the pointer is restricted to the upper left quarter of the guest's screen.

The USB HID (Human Interface Device) drivers in Windows 98 are very old and do not handle tablets in the same way as modern operating systems do. To work around the problem, use the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/USB/HidMouse/0/Config/CoordShift" 0
```

To restore the default behavior, remove the key or set its value to 1.

13.7.2.5 Windows Guests are Removed From an Active Directory Domain After Restoring a Snapshot

If a Windows guest is a member of an Active Directory domain and the snapshot feature of Oracle VirtualBox is used, it could be removed from the Active Directory domain after you restore an older snapshot.

This is caused by automatic machine password changes performed by Windows at regular intervals for security purposes. You can disable this feature as shown in this *article from Microsoft*.

13.7.2.6 Windows XP Guests Have Slower Transmission Rates

Details	Neither virtio nor Intel PRO/1000 drivers for Windows XP guests support segmentation offloading. Therefore Windows XP guests have slower transmission rates comparing to other guest types. Refer to Microsoft Knowledge base article 842264 for additional information.
Workaround	No workaround exists.

13.7.3 Linux Guests

13.7.3.1 Repeated Rebuild of Kernel Modules on Reboot of Guest

Details	Some Linux distributions, for example Debian, do not provide tools that VirtualBox Guest Additions uses to verify kernel module signatures. If VirtualBox Guest Additions can't verify a module's signature, they will attempt to rebuild the kernel module on system boot. This

can cause boot delays and the need to re-sign modules every time the VM is rebooted.

Workaround

On the VM, create a file /etc/virtualbox-guest-additions.conf, with the content

```
VBOX_BYPASS_MODULES_SIGNATURE_CHECK=1
```

This tells VirtualBox Guest Additions not to check signatures on boot, but to load the modules and leave it to the kernel to check module signatures.

If you set the variable to any value other than 1, it has no effect.

13.7.3.2 Error When Removing a Monitor

Details

VBoxDRMClient can't handle arbitrary guest monitor topologies. Disabling a guest monitor other than the last one invalidates the monitor topology because of limitations in the vmwgfx.ko Linux kernel module.

Workaround

Always remove the last monitor in a the topology. For example, when the guest is configured to have four monitors, avoid disabling the second or third monitor.

13.7.4 Guest Control Not Working

Details

7.9 Guest Control File Manager on page 120, or other processes to control guest applications from the host using *15.24 VBoxManage guestcontrol on page 360*, may be prevented from running by Security-Enhanced Linux (SELinux).

Workaround

In SELinux, if your security policies permit, allow the execve() call for the VBoxService binary only.

13.7.5 Arm Guests

13.7.5.1 7.1 Saved States and Snapshots Not Usable in 7.2

Details	Saved states and online snapshots created on Arm VMs in Oracle VirtualBox 7.1 are not usable in later releases.
Workaround	Take a snapshot while the VM is powered off. It will then not have a saved state and therefore won't have compatibility issues.

13.7.6 Windows Hosts

13.7.6.1 CD and DVD Changes Not Recognized

In case you have assigned a physical CD or DVD drive to a guest and the guest does not notice when the medium changes, make sure that the Windows media change notification (MCN) feature is not turned off. This is represented by the following key in the Windows registry:

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Cdrom\Autorun

Certain applications may disable this key against Microsoft's advice. If it is set to 0, change it to 1 and reboot your system. Oracle VirtualBox relies on Windows notifying it of media changes.

13.7.6.2 Issues Accessing Network Shares When VBoxSVC running in Windows Session 0

- Due to different Windows sessions having their own set of resources, there might be some issues with accessing network shares created in the interactive user session when at least one of the Oracle VirtualBox processes are running in session 0.

  For accessing network shares within session 0, a possible workaround is to establish permanent access to the share and then restart the host.

13.7.6.3 Sluggish Response When Using Microsoft RDP Client

If connecting to a Virtual Machine using the Microsoft RDP client, called a Remote Desktop Connection, there can be large delays between input such as moving the mouse over a menu and output. This is because this RDP client collects input for a certain time before sending it to the RDP server.

The interval can be decreased by setting a Windows registry key to smaller values than the default of 100. The key does not exist initially and must be of type DWORD. The unit for its values is milliseconds. Values around 20 are suitable for low-bandwidth connections between the RDP client and server. Values around 4 can be used for a gigabit Ethernet connection. Generally values below 10 achieve a performance that is very close to that of the local input devices and screen of the host on which the Virtual Machine is running.

Depending whether the setting should be changed for an individual user or for the system, set either of the following.

HKEY_CURRENT_USER\Software\Microsoft\Terminal Server Client\Min Send Interval

HKEY_LOCAL_MACHINE\Software\Microsoft\Terminal Server Client\Min Send Interval

13.7.6.4 Running an iSCSI Initiator and Target on a Single System

Deadlocks can occur on a Windows host when attempting to access an iSCSI target running in a guest virtual machine with an iSCSI initiator, such as a Microsoft iSCSI Initiator, that is running on the host. This is caused by a flaw in the Windows cache manager component, and causes sluggish host system response for several minutes, followed by a "Delayed Write Failed" error message in the system tray or in a separate message window. The guest is blocked during that period and may show error messages or become unstable.

Setting the VBOX_DISABLE_HOST_DISK_CACHE environment variable to 1 enables a workaround for this problem until Microsoft addresses the issue. For example, open a command prompt window and start Oracle VirtualBox like this:

```
set VBOX_DISABLE_HOST_DISK_CACHE=1
VirtualBox
```

While this will decrease guest disk performance, especially writes, it does not affect the performance of other applications running on the host.

13.7.6.5 Bridged Networking Adapters Missing

If no bridged adapters show up in the **Networking** section of the VM settings, this typically means that the bridged networking driver was not installed properly on your host. This could be due to the following reasons:

- The maximum allowed filter count was reached on the host. In this case, the MSI log would mention the 0x8004a029 error code returned on NetFlt network component install, as follows:

  ```
  VBoxNetCfgWinInstallComponent: Install failed, hr (0x8004a029)
  ```

  You can try to increase the maximum filter count in the Windows registry using the following key:

  ```
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Network\MaxNumFilters
  ```

  The maximum number allowed is 14. After a reboot, try to reinstall Oracle VirtualBox.
- The INF cache is corrupt. In this case, the install log at %windir%\inf\setupapi.dev.log would typically mention the failure to find a suitable driver package for either the sun_VBoxNetFlt or sun_VBoxNetFltmp components. The solution then is to uninstall Oracle VirtualBox, remove the INF cache (%windir%\inf\INFCACHE.1), reboot and try to reinstall Oracle VirtualBox.

13.7.6.6 Host-Only Networking Adapters Cannot be Created

If a host-only adapter cannot be created, either with the VirtualBox Manager or the VBoxManage command, then the INF cache is probably corrupt. In this case, the install log at %windir%\inf\setupapi.dev.log would typically mention the failure to find a suitable driver package for the sun_VBoxNetAdp component. Again, as with the bridged networking problem described above, the solution is to uninstall Oracle VirtualBox, remove the INF cache (%windir%\inf\INFCACHE.1), reboot and try to reinstall Oracle VirtualBox.

13.7.6.7 Poor performance when using Oracle VirtualBox and Hyper-V on the same host

Details	Oracle VirtualBox and **Hyper-V** can conflict with each other when run on the same host. Always disable Hyper-V when running VirtualBox.

Workaround

Turn off the Windows features Hyper-V Platform, Virtual Machine Platform and Windows Hypervisor Platform, and then reboot the host.

On newer Windows versions, the device security features Core Isolation and Memory Integrity use Hyper-V, even if you have turned it off.

Use the Microsoft Device Guard and Credential Guard hardware readiness tools to turn off more features that use Hyper-V. For example, to disable AutoReboot, use the following command:

```
.\DG_Readiness_Tool_vX.X.ps1 -Disable -AutoReboot
```

> **Note:**
>
> Disabling Device Guard and Credential Guard features impacts on the overall security of the host. Take this into account before deciding to disable them.

13.7.7 Linux Hosts

13.7.7.1 Repeated Rebuild of Kernel Modules on Reboot of Host

Details

Some Linux distributions, for example Debian, do not provide tools that VirtualBox uses to verify kernel module signatures. If VirtualBox can't verify a module's signature, it will attempt to rebuild the kernel module on system boot. This can cause boot delays and the need to re-sign modules every time the machine is rebooted.

Workaround

On the host machine, edit the file /etc/vbox/vbox.cfg, and add the line

```
VBOX_BYPASS_MODULES_SIGNATURE_CHECK=1
```

This tells VirtualBox not to check signatures on boot, but to load the modules and leave it to the kernel to check module signatures.

If you set the variable to any value other than 1, it has no effect.

13.7.7.2 Linux Kernel Module Refuses to Load

If the Oracle VirtualBox kernel module, vboxdrv, refuses to load you may see an Error inserting vboxdrv: Invalid argument message. As root, check the output of the dmesg command to find out why the load failed. Most probably the kernel disagrees with the version of gcc used to compile the module. Make sure that you use the same compiler that was used to build the kernel.

13.7.7.3 Linux Host CD/DVD or Floppy Disk Drive Not Found

If you have configured a virtual machine to use the host's CD or DVD drive or floppy disk drive, but this does not appear to work, make sure that the current user has permission to access the corresponding Linux device file. For example, for a CD or DVD drive this may be /dev/hdc, /dev/scd0, /dev/cdrom or similar. On most distributions, the user must be added to a corresponding group, usually called cdrom or cdrw or floppy.

On supported Linux distributions, Oracle VirtualBox uses udev to locate hardware such as CD/DVD drives and floppy disk drives.

13.7.7.4 Strange Guest IDE Error Messages When Writing to CD or DVD

If the experimental CD or DVD writer support is enabled with an incorrect host or guest configuration, it is possible that any attempt to access the CD or DVD writer fails and simply results in guest kernel error messages for Linux guests or application error messages for Windows guests. Oracle VirtualBox performs the usual consistency checks when a VM is powered up. In particular, it aborts with an error message if the device for the CD or DVD writer is not writable by the user starting the VM. But Oracle VirtualBox cannot detect all misconfigurations. The necessary host and guest OS configuration is not specific for Oracle VirtualBox, but a few frequent problems are listed here which occurred in connection with Oracle VirtualBox.

Special care must be taken to use the correct device. The configured host CD or DVD device file name, in most cases /dev/cdrom, must point to the device that allows writing to the CD or DVD unit. For CD or DVD writer units connected to a SCSI controller or to a IDE controller that interfaces to the Linux SCSI subsystem, common for some SATA controllers, this must refer to the SCSI device node, such as /dev/scd0. Even for IDE CD or DVD writer units this must refer to the appropriate SCSI CD-ROM device node, such as /dev/scd0, if the ide-scsi kernel module is loaded. This module is required for CD or DVD writer support with some early 2.6 kernels. Many Linux distributions load this module whenever a CD or DVD writer is detected in the system, even if the kernel would support CD or DVD writers without the module. Oracle VirtualBox supports the use of IDE device files, such as /dev/hdc, provided the kernel supports this and the ide-scsi module is not loaded.

Similar rules, except that within the guest the CD or DVD writer is always an IDE device, apply to the guest configuration. Since this setup is very common, it is likely that the default configuration of the guest works as expected.

13.7.7.5 VBoxSVC IPC Issues

On Linux, Oracle VirtualBox makes use of a custom version of Mozilla XPCOM (cross platform component object model) for interprocess and intraprocess communication (IPC). The process VBoxSVC serves as a communication hub between different Oracle VirtualBox processes and maintains the global configuration, such as the XML database. When starting an Oracle VirtualBox component, the processes VBoxSVC and VBoxXPCOMIPCD are started automatically. They are only accessible from the user account they are running under. VBoxSVC owns the Oracle VirtualBox configuration database which normally resides in ~/.config/

VirtualBox, or the appropriate configuration directory for your operating system. While it is running, the configuration files are locked. Communication between the various Oracle VirtualBox components and VBoxSVC is performed through a local domain socket residing in /tmp/.vbox-*username*-ipc. In case there are communication problems, such as an Oracle VirtualBox application cannot communicate with VBoxSVC, terminate the daemons and remove the local domain socket directory.

13.7.7.6 USB Not Working

If USB is not working on your Linux host, make sure that the current user is a member of the vboxusers group. Please remember that group membership does not take effect immediately but rather at the next login. If available, the newgrp command may avoid the need for a logout and login.

13.7.7.7 PAX/grsec Kernels

Linux kernels including the grsec patch, see http://www.grsecurity.net/, and derivates have to disable PAX_MPROTECT for the VBox binaries to be able to start a VM. The reason is that Oracle VirtualBox has to create executable code on anonymous memory.

13.7.7.8 Linux Kernel vmalloc Pool Exhausted

When running a large number of VMs with a lot of RAM on a Linux system, say 20 VMs with 1 GB of RAM each, additional VMs might fail to start with a kernel error saying that the vmalloc pool is exhausted and should be extended. The error message also tells you to specify vmalloc=256MB in your kernel parameter list. If adding this parameter to your GRUB or LILO configuration makes the kernel fail to boot, with an error message such as failed to mount the root partition, then you have probably run into a memory conflict of your kernel and initial RAM disk. This can be solved by adding the following parameter to your GRUB configuration:

```
uppermem 524288
```

13.7.8 Oracle Solaris Hosts

13.7.8.1 Cannot Start VM, Not Enough Contiguous Memory

Details	The ZFS file system's Adaptive Replacement Cache (ARC) uses a portion of the system's RAM to store frequently accessed data to significantly speed up accessing and reading file system data. The memory used by the ZFS ARC can become fragmented (for example, when cached file system data is deleted and the kernel has yet to recover the memory buffers). This can prevent applications such as VirtualBox from starting.
Workaround	Solaris 11.1 SRU 20.5 and later includes a kernel tunable parameter,user_reserve_hint_pct, which can be set to allow system administrators to specify a reserve of free memory for applications by

restricting growth of the ZFS ARC cache. See the Oracle Solaris 11.4 TunableParameters Reference Manual(*https://docs.oracle.com/en/operating-systems/solaris/oracle-solaris/11.4/tuning/user_reserve_hint_pct-zfs-parameter.html*) and Document 1663862.1, Memory Management Between ZFS and Applications in Oracle Solaris 11.x, in My Oracle Support (MOS) for further information and guidance on tuning this parameter.

13.7.9 macOS Hosts

13.7.9.1 Internal Network Not Working

Details

Internal networking on macOS hosts doesn't work between VMs run by different users.

Workaround

We're working on a resolution.

13.7.9.2 macOS Host Limitations

Details

On macOS hosts, the following features are not yet implemented:

- Numlock emulation
- CPU frequency metric
- Memory ballooning

macOS/Arm 64 (Apple silicon) hosts have the following limitations:

- x86-based guest operating systems will not run.
- Arm(AArch64) guests only. Arm 32 is not supported at present.
- Arm hosts have limitations with sound, storage, graphics, guest additions and unattended installation.

Workaround

We're working on a resolution.

14 Security Guide

14.1 General Security Principles

The following principles are fundamental to using any application securely.

- **Keep software up-to-date**. One of the principles of good security practise is to keep all software versions and patches up-to-date. Activate the Oracle VirtualBox update notification to get notified when a new Oracle VirtualBox release is available. When updating Oracle VirtualBox, do not forget to update the Guest Additions. Keep the host operating system as well as the guest operating system up-to-date.
- **Restrict network access to critical services.** Use proper means, for instance a firewall, to protect your computer and your guests from accesses from the outside. Choosing the proper networking mode for VMs helps to separate host networking from the guest and vice versa.
- **Follow the principle of least privilege.** The principle of least privilege states that users should be given the least amount of privilege necessary to perform their jobs. Always execute Oracle VirtualBox as a regular user. We strongly discourage anyone from executing Oracle VirtualBox with system privileges.

  Choose restrictive permissions when creating configuration files, for instance when creating /etc/default/virtualbox, see *Automatic Installation Options*. Mode 0600 is preferred.
- **Monitor system activity.** System security builds on three pillars: good security protocols, proper system configuration and system monitoring. Auditing and reviewing audit records address the third requirement. Each component within a system has some degree of monitoring capability. Follow audit advice in this document and regularly monitor audit records.

14.2 Secure Installation and Configuration

14.2.1 Installation Overview

The Oracle VirtualBox base package should be downloaded only from a trusted source, for instance the official website http://www.virtualbox.org. The integrity of the package should be verified with the provided SHA256 checksum which can be found on the official website.

General Oracle VirtualBox installation instructions for the supported hosts can be found in *2 Installing VirtualBox on page 29*.

On Windows hosts, the installer can be used to disable USB support, support for bridged networking, support for host-only networking and the Python language binding. See *Installing on Windows Hosts*. All these features are enabled by default but disabling some of them could be appropriate if the corresponding functionality is not required by any virtual machine. The Python language bindings are only required if the Oracle VirtualBox API is to be used by external Python applications. In particular USB support and support for the two networking modes require the installation of Windows kernel drivers on the host. Therefore disabling those selected features can not only be used to restrict the user to certain functionality but also to minimize the surface provided to a potential attacker.

The general case is to install the complete Oracle VirtualBox package. The installation must be done with system privileges. All Oracle VirtualBox binaries should be executed as a regular user and never as a privileged user.

The Oracle VirtualBox Extension Pack provides additional features and must be downloaded and installed separately, see *3.1.1 Install the Oracle VirtualBox Extension Pack on page 43*. As for the base package, the SHA256 checksum of the extension pack should be verified. As the installation requires system privileges, Oracle VirtualBox will ask for the system password during the installation of the extension pack.

14.2.2 Post Installation Configuration

Normally there is no post installation configuration of Oracle VirtualBox components required. However, on Oracle Solaris and Linux hosts it is necessary to configure the proper permissions for users executing VMs and who should be able to access certain host resources. For instance, Linux users must be member of the *vboxusers* group to be able to pass USB devices to a guest. If a serial host interface should be accessed from a VM, the proper permissions must be granted to the user to be able to access that device. The same applies to other resources like raw partitions, DVD/CD drives, and sound devices.

14.3 Security Features

This section outlines the specific security mechanisms offered by Oracle VirtualBox.

14.3.1 The Security Model

One property of virtual machine monitors (VMMs) like Oracle VirtualBox is to encapsulate a guest by executing it in a protected environment, a virtual machine, running as a user process on the host operating system. The guest cannot communicate directly with the hardware or other computers but only through the VMM. The VMM provides emulated physical resources and devices to the guest which are accessed by the guest operating system to perform the required tasks. The VM settings control the resources provided to the guest, for example the amount of guest memory or the number of guest processors and the enabled features for that guest. For example remote control, certain screen settings and others. See *5.11 Virtual Machine Settings on page 70*.

14.3.2 Secure Configuration of Virtual Machines

Several aspects of a virtual machine configuration are subject to security considerations.

14.3.2.1 Networking

The default networking mode for VMs is NAT which means that the VM acts like a computer behind a router, see *Network Address Translation (NAT)*. The guest is part of a private subnet belonging to this VM and the guest IP is not visible from the outside. This networking mode works without any additional setup and is sufficient for many purposes. Remember that NAT allows access to the host operating system's loopback interface.

If bridged networking is used, the VM acts like a computer inside the same network as the host, see *Bridged Networking*. In this case, the guest has the same network access as the host and a

firewall might be necessary to protect other computers on the subnet from a potential malicious guest as well as to protect the guest from a direct access from other computers. In some cases it is worth considering using a forwarding rule for a specific port in NAT mode instead of using bridged networking.

Some setups do not require a VM to be connected to the public network at all. Internal networking, see *Internal Networking*, or host-only networking, see *Host-Only Networking*, are often sufficient to connect VMs among each other or to connect VMs only with the host but not with the public network.

14.3.2.2 Security of Remote VMs

Remote VMs require security protocols in place to control access to the VM from the VRDP server providing access to it. You can change the security method using VBoxManage or the VM Settings in VirtualBox Manager, as described in *10.1.7 RDP Encryption on page 167*.

The default security method is TLS, which requires certificates to operate. You can set up custom certificates, or accept the default self-signed certificate. For more information, see *10.1.7 RDP Encryption on page 167*.

14.3.2.3 VRDP Remote Desktop Authentication

When using the Oracle VirtualBox Extension Pack provided by Oracle for VRDP remote desktop support, you can optionally use various methods to configure RDP authentication. The "null" method is very insecure and should be avoided in a public network. See *10.1.6 RDP Authentication on page 166*.

14.3.2.4 Clipboard

The shared clipboard enables users to share data between the host and the guest. Enabling the clipboard in Bidirectional mode enables the guest to read and write the host clipboard. The Host to Guest mode and the Guest to Host mode limit the access to one direction. If the guest is able to access the host clipboard it can also potentially access sensitive data from the host which is shared over the clipboard.

If the guest is able to read from or write to the host clipboard then a remote user connecting to the guest over the network will also gain this ability, which may not be appropriate. As a consequence, the shared clipboard is disabled for new machines.

14.3.2.5 Shared Folders

If any host folder is shared with the guest then a remote user connected to the guest over the network can access these files too as the folder sharing mechanism cannot be selectively disabled for remote users.

14.3.2.6 CD/DVD Passthrough

Enabling CD/DVD passthrough enables the guest to perform advanced operations on the CD/DVD drive, see *CD/DVD Support*. This could induce a security risk as a guest could overwrite data on a CD/DVD medium.

14.3.2.7 USB Passthrough

Passing USB devices to the guest provides the guest full access to these devices, see *USB Settings*. For instance, in addition to reading and writing the content of the partitions of an external USB disk the guest will be also able to read and write the partition table and hardware data of that disk.

14.3.3 Configuring and Using Authentication

The following components of Oracle VirtualBox can use passwords for authentication:

- When using remote iSCSI storage and the storage server requires authentication, an initiator secret can optionally be supplied with the VBoxManage storageattach command. As long as no settings password is provided, by using the command line option --settingspwfile, then this secret is stored *unencrypted* in the machine configuration and is therefore potentially readable on the host. See *iSCSI Servers* and *15.48 VBoxManage storageattach on page 448*.
- When using the Oracle VirtualBox web service to control an Oracle VirtualBox host remotely, connections to the web service are authenticated in various ways. This is described in detail in the Oracle VirtualBox Software Development Kit (SDK) reference. See *12.1 Oracle VirtualBox Programming Interfaces on page 235*.

14.3.4 Potentially Insecure Operations

The following features of Oracle VirtualBox can present security problems:

- When teleporting a machine, the data stream through which the machine's memory contents are transferred from one host to another is not encrypted. A third party with access to the network through which the data is transferred could therefore intercept that data. An SSH tunnel could be used to secure the connection between the two hosts. But when considering teleporting a VM over an untrusted network the first question to answer is how both VMs can securely access the same virtual disk image with a reasonable performance.

  If the network is not sufficiently trusted, the password should be changed for each teleportation as a third party could detect the unecrypted password hash when it is transferred between the target and source host machines.
- When *Page Fusion*, is enabled, it is possible that a side-channel opens up that enables a malicious guest to determine the address space of another VM running on the same host layout. For example, where DLLs are typically loaded. This information leak in itself is harmless, however the malicious guest may use it to optimize attack against that VM through unrelated attack vectors. It is recommended to only enable Page Fusion if you do not think this is a concern in your setup.
- When using the Oracle VirtualBox web service to control an Oracle VirtualBox host remotely, connections to the web service, over which the API calls are transferred using SOAP XML, are not encrypted. They use plain HTTP by default. This is a potential security risk. For details about the web service, see *12.1 Oracle VirtualBox Programming Interfaces on page 235*.

  The web services are not started by default. See *11.16 Starting the Oracle VirtualBox Web Service Automatically on page 207* to find out how to start this service and how to enable SSL/TLS support. It has to be started as a regular user and only the VMs of that user can be controlled. By default, the service binds to localhost preventing any remote connection.
- Traffic sent over a UDP Tunnel network attachment is not encrypted. You can either encrypt it on the host network level, with IPsec, or use encrypted protocols in the guest network, such as SSH. The security properties are similar to bridged Ethernet.

- Because of shortcomings in older Windows versions, using Oracle VirtualBox on Windows versions older than Vista with Service Pack 1 is not recommended.

14.3.5 Encryption

The following components of Oracle VirtualBox use encryption to protect sensitive data:

- When using the Oracle VirtualBox Extension Pack provided by Oracle for VRDP remote desktop support, RDP data can optionally be encrypted. See *10.1.7 RDP Encryption on page 167*. Only the Enhanced RDP Security method (RDP5.2) with TLS protocol provides a secure connection. Standard RDP Security (RDP4 and RDP5.1) is vulnerable to a man-in-the-middle attack.
- When using the Oracle VirtualBox Extension Pack provided by Oracle for disk encryption, the data stored in disk images can optionally be encrypted. See *11.27 Encryption of Disk Images on page 219*. This feature covers disk image content only. All other data for a virtual machine is stored unencrypted, including the VM's memory and device state which is stored as part of a saved state, both when created explicitly or part of a snapshot of a running VM.

14.4 Security Recommendations

This section contains security recommendations for specific issues. By default VirtualBox will configure the VMs to run in a secure manner, however this may not always be possible without additional user actions such as host OS or firmware configuration changes.

14.4.1 CVE-2018-3646

This security issue affect a range of Intel CPUs with nested paging. AMD CPUs are expected not to be impacted (pending direct confirmation by AMD). Also the issue does not affect VMs running with hardware virtualization disabled or with nested paging disabled.

For more information about nested paging, see *5.10 Nested Paging and VPIDs on page 69*.

The following mitigation options are available.

14.4.1.1 Disable Nested Paging

By disabling nested paging (EPT), the VMM will construct page tables shadowing the ones in the guest. It is not possible for the guest to insert anything suspicious into the page tables, since the VMM carefully validates each entry before shadowing it.

As a side effect of disabling nested paging, several CPU features will not be made available to the guest. Among these features are AVX, AVX2, XSAVE, AESNI, and POPCNT. Not all guests may be able to cope with dropping these features after installation. Also, for some guests, especially in SMP configurations, there could be stability issues arising from disabling nested paging. Finally, some workloads may experience a performance degradation.

14.4.1.2 Flushing the Level 1 Data Cache

This aims at removing potentially sensitive data from the level 1 data cache when running guest code. However, it is made difficult by hyper-threading setups sharing the level 1 cache and thereby potentially letting the other thread in a pair refill the cache with data the user does

not want the guest to see. In addition, flushing the level 1 data cache is usually not without performance side effects.

Up-to-date CPU microcode is a prerequisite for the cache flushing mitigations. Some host OSes may install these automatically, though it has traditionally been a task best performed by the system firmware. So, please check with your system / mainboard manufacturer for the latest firmware update.

We recommend disabling hyper threading on the host. This is traditionally done from the firmware setup, but some OSes also offers ways disable HT. In some cases it may be disabled by default, but please verify as the effectiveness of the mitigation depends on it.

The default action taken by VirtualBox is to flush the level 1 data cache when a thread is scheduled to execute guest code, rather than on each VM entry. This reduces the performance impact, while making the assumption that the host OS will not handle security sensitive data from interrupt handlers and similar without taking precautions.

A more aggressive flushing option is provided using the VBoxManage modifyvm --l1d-flush-on-vm-entry option. When enabled the level 1 data cache will be flushed on every VM entry. The performance impact is greater than with the default option, though this of course depends on the workload. Workloads producing a lot of VM exits (like networking, VGA access, and similiar) will probably be most impacted.

For users not concerned by this security issue, the default mitigation can be disabled using the VBoxManage modifyvm *name* --l1d-flush-on-sched off command.

14.4.2 CVE-2018-12126, CVE-2018-12127, CVE-2018-12130, CVE-2019-11091

These security issues affect a range of Intel CPUs starting with Nehalem. The CVE-2018-12130 also affects some Atom Silvermont, Atom Airmont, and Knights family CPUs, however the scope is so limited that the host OS should deal with it and Oracle VirtualBox is therefore not affected. Leaks only happens when entering and leaving C states.

The following mitigation option is available.

14.4.2.1 Buffer Overwriting and Disabling Hyper-Threading

First, up-to-date CPU microcode is a prerequisite for the buffer overwriting (clearing) mitigations. Some host OSes may install these automatically, though it has traditionally been a task best performed by the system firmware. Please check with your system or mainboard manufacturer for the latest firmware update.

This mitigation aims at removing potentially sensitive data from the affected buffers before running guest code. Since this means additional work each time the guest is scheduled, there might be some performance side effects.

We recommend disabling hyper-threading (HT) on hosts affected by CVE-2018-12126 and CVE-2018-12127, because the affected sets of buffers are normally shared between thread pairs and therefore cause leaks between the threads. This is traditionally done from the firmware setup, but some OSes also offers ways disable HT. In some cases it may be disabled by default, but please verify as the effectiveness of the mitigation depends on it.

The default action taken by Oracle VirtualBox is to clear the affected buffers when a thread is scheduled to execute guest code, rather than on each VM entry. This reduces the performance

impact, while making the assumption that the host OS will not handle security sensitive data from interrupt handlers and similar without taking precautions.

The VBoxManage modifyvm command provides a more aggressive flushing option is provided by means of the --mds-clear-on-vm-entry option. When enabled the affected buffers will be cleared on every VM entry. The performance impact is greater than with the default option, though this of course depends on the workload. Workloads producing a lot of VM exits (like networking, VGA access, and similiar) will probably be most impacted.

For users not concerned by this security issue, the default mitigation can be disabled using the VBoxManage modifyvm name --mds-clear-on-sched off command.

15 VBoxManage

15.1 Introduction

VBoxManage is the CLI to Oracle VirtualBox. With it, you can control Oracle VirtualBox from the command line of the host operating system. VBoxManage supports all the features that the graphical user interface gives you access to, plus the features of the virtualization engine that can't be accessed from the GUI.

You need to use the command line to do the following:

- Use a different user interface than the main GUI such as the VBoxHeadless server.
- Control some more advanced and experimental configuration settings for a VM.

For more information, refer to the VBoxManage command *15.3.2 Description on page 286* and *15.3.3 Examples on page 287*.

15.2 Commands Overview

When running VBoxManage without parameters or when supplying an invalid command line, the following command syntax list is shown. Note that the output will be slightly different depending on the host platform. If in doubt, check the output of VBoxManage for the commands available on your particular host.

VBoxManage [#q | ##nologo] [##settingspw=*password*] [##settingspwfile=*pw#file*] [*@response#file*] [*subcommand*]

VBoxManage help [*subcommand*]

VBoxManage commands

VBoxManage [#V | ##version]

VBoxManage [##dump#build#type]

VBoxManage adoptstate <*uuid* | *vmname*> <*state#filename*>

VBoxManage bandwidthctl <*uuid* | *vmname*> add <*bandwidth#group#name*> <##limit=*bandwidth#limit*[k|m|g|K|M|G]> <##type=disk | network>

VBoxManage bandwidthctl <*uuid* | *vmname*> list [##machinereadable]

VBoxManage bandwidthctl <*uuid* | *vmname*> remove <*bandwidth#group#name*>

VBoxManage bandwidthctl <*uuid* | *vmname*> set <*bandwidth#group#name*> <##limit=*bandwidth#limit*[k|m|g|K|M|G]>

VBoxManage checkmediumpwd <*uuid* | *filename*> <*password#file*>

VBoxManage clonemedium <*uuid* | *source#medium*> <*uuid* | *target#medium*> [disk | dvd | floppy] [##existing] [##format=VDI | VMDK | VHD | RAW | *other*] [##variant=Standard|Fixed|Split2G|Stream|ESX...]

VBoxManage clonevm <*vmname*|*uuid*> [##basefolder=*basefolder*] [##groups=*group*,...] [##mode=machine | ##mode=machinechildren | ##mode=all] [##name=*name*] [##options=*option*,...] [##register] [##snapshot=*snapshot#name*] [##uuid=*uuid*]

VBoxManage closemedium [disk | dvd | floppy] <*uuid* | *filename*> [##delete]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list instances [##state=*string*] [##compartment#id=*string*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list images <##compartment#id=*string*> [##state=*string*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list vnicattachments <##compartment#id=*string*> [##filter=instanceId | vnicId | availabilityDomain=*value*...]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance create <##domain#name=*name*> <##image#id=*id* | ##boot#volume#id=*id*> <##display#name=*name*> <##shape=*type*> <##subnet=*id*> [##boot#disk#size=*size in GB*] [##publicip=true | false] [##privateip=*IP address*] [##public#ssh#key=*key string*...] [##launch#mode=NATIVE | EMULATED | PARAVIRTUALIZED] [##cloud#init#script#path=*path to a script*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance info <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance terminate <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance start <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance pause <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance reset <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance clone <##id=*unique id*> [##clone#name=*name for a clone instance*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance metriclist <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance metricdata <##id=*unique id*> <##metric#name=*metric name*> <##metric#points=*number of history metric points*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image create <##display#name=*name*> [##bucket#name=*name*] [##object#name=*name*]
[##instance#id=*unique id*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image info <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image delete <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image import <##id=*unique id*> [##bucket#name=*name*] [##object#name=*name*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image export <##id=*unique id*> <##display#name=*name*> [##bucket#name=*name*] [##object#name=*name*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
network setup [##gateway#os#name=*string*] [##gateway#os#version=*string*] [##gateway#shape=*string*]
[##tunnel#network#name=*string*] [##tunnel#network#range=*string*] [##proxy=*string*]
[##compartment#id=*string*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
network create <##name=*string*> <##network#id=*string*> [##enable | ##disable]

VBoxManage cloud network update <##name=*string*> [##network#id=*string*] [##enable | ##disable]

VBoxManage cloud network delete <##name=*string*>

VBoxManage cloud network info <##name=*string*>

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> add [##clouduser=*unique id*]
[##fingerprint=*MD5 string*] [##keyfile=*path*] [##passphrase=*string*] [##tenancy=*unique id*]
[##compartment=*unique id*] [##region=*string*]

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> update [##clouduser=*unique id*]
[##fingerprint=*MD5 string*] [##keyfile=*path*] [##passphrase=*string*] [##tenancy=*unique id*]
[##compartment=*unique id*] [##region=*string*]

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> delete

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> show

VBoxManage controlvm <*uuid* | *vmname*> pause

VBoxManage controlvm <*uuid* | *vmname*> resume

VBoxManage controlvm <*uuid* | *vmname*> reset

VBoxManage controlvm <*uuid* | *vmname*> poweroff

VBoxManage controlvm <*uuid* | *vmname*> savestate

VBoxManage controlvm <*uuid* | *vmname*> acpipowerbutton

VBoxManage controlvm <*uuid* | *vmname*> acpisleepbutton

VBoxManage controlvm <*uuid* | *vmname*> reboot

VBoxManage controlvm <*uuid* | *vmname*> shutdown [##force]

VBoxManage controlvm <*uuid* | *vmname*> keyboardputscancode <*hex*> [*hex*...]

VBoxManage controlvm <*uuid* | *vmname*> keyboardputstring <*string*> [*string*...]

VBoxManage controlvm <*uuid* | *vmname*> keyboardputfile <*filename*>

VBoxManage controlvm <*uuid* | *vmname*> setlinkstate*N* <on | off>

VBoxManage controlvm <*uuid* | *vmname*> nic*N* <null | nat | bridged | intnet | hostonly | generic | natnetwork> [*device#name*]

VBoxManage controlvm <*uuid* | *vmname*> nictrace*N* <on | off>

VBoxManage controlvm <*uuid* | *vmname*> nictracefile*N* <*filename*>

VBoxManage controlvm <*uuid* | *vmname*> nicproperty*N* <*prop#name=prop#value*>

VBoxManage controlvm <*uuid* | *vmname*> nicpromisc*N* <deny | allow#vms | allow#all>

VBoxManage controlvm <*uuid* | *vmname*> natpf*N* <[*rulename*],<tcp|udp>,[*host#IP*],*hostport*,[*guest#IP*],*guestport*>

VBoxManage controlvm <*uuid* | *vmname*> natpf*N*delete <*rulename*>

VBoxManage controlvm <*uuid* | *vmname*> guestmemoryballoon <*balloon#size*>

VBoxManage controlvm <*uuid* | *vmname*> usbattach <*uuid* | *address*> [##capturefile=*filename*]

VBoxManage controlvm <*uuid* | *vmname*> usbdetach <*uuid* | *address*>

VBoxManage controlvm <*uuid* | *vmname*> audioin <on | off>

VBoxManage controlvm <*uuid* | *vmname*> audioout <on | off>

VBoxManage controlvm <*uuid* | *vmname*> clipboard mode <disabled | hosttoguest | guesttohost | bidirectional>

VBoxManage controlvm <*uuid* | *vmname*> clipboard filetransfers <on | off>

VBoxManage controlvm <*uuid* | *vmname*> draganddrop <disabled | hosttoguest | guesttohost | bidirectional>

VBoxManage controlvm <*uuid* | *vmname*> vrde <on | off>

VBoxManage controlvm <*uuid* | *vmname*> vrdeport <*port*>

VBoxManage controlvm <*uuid* | *vmname*> vrdeproperty <*prop#name=prop#value*>

VBoxManage controlvm <*uuid* | *vmname*> vrdevideochannelquality <*percentage*>

VBoxManage controlvm <*uuid* | *vmname*> setvideomodehint <*xres*> <*yres*> <*bpp*> [*display* [<yes | no> [*x#origin y#origin*]]]

VBoxManage controlvm <*uuid* | *vmname*> setscreenlayout <*display*> <on | primary *x#origin y#origin x#resolution y#resolution bpp* | off>

VBoxManage controlvm <*uuid* | *vmname*> screenshotpng <*filename*> [*display*]

VBoxManage controlvm <*uuid* | *vmname*> recording <on | off> VBoxManage controlvm <*uuid* | *vmname*> recording start [##wait] VBoxManage controlvm <*uuid* | *vmname*> recording stop VBoxManage controlvm <*uuid* | *vmname*> recording attach VBoxManage controlvm <*uuid* | *vmname*> recording screens <all | none | *screen#ID ,screen#ID...*> VBoxManage controlvm <*uuid* | *vmname*> recording filename <filename> VBoxManage controlvm <*uuid* | *vmname*> recording videores <<*width*>x <*height*>> VBoxManage controlvm <*uuid* | *vmname*> recording videorate <*rate*> VBoxManage controlvm <*uuid* | *vmname*> recording videofps <*fps*> VBoxManage controlvm <*uuid* | *vmname*> recording maxtime <*sec*> VBoxManage controlvm <*uuid* | *vmname*> recording maxfilesize <*MB*> VBoxManage controlvm <*uuid* | *vmname*> recording opts <*key*=[*value*]>

VBoxManage controlvm <*uuid* | *vmname*> setcredentials <*username*> ##passwordfile=<*filename* | *password*> <*domain#name*> ##allowlocallogon=<yes | no>

VBoxManage controlvm <*uuid* | *vmname*> teleport <##host=*host#name*> <##port=*port#name*> [##maxdowntime=*msec*] [##passwordfile=*filename* | ##password=*password*]

VBoxManage controlvm <*uuid* | *vmname*> plugcpu <*ID*>

VBoxManage controlvm <*uuid* | *vmname*> unplugcpu <*ID*>

VBoxManage controlvm <*uuid* | *vmname*> cpuexecutioncap <*num*>

VBoxManage controlvm <*uuid* | *vmname*> vm#process#priority <default | flat | low | normal | high>

VBoxManage controlvm <*uuid* | *vmname*> webcam attach [*pathname* [*settings*]]

VBoxManage controlvm <*uuid* | *vmname*> webcam detach [*pathname*]

VBoxManage controlvm <*uuid* | *vmname*> webcam list

VBoxManage controlvm <*uuid* | *vmname*> addencpassword <*ID*> <*password#file* | #> [##removeonsuspend=yes | no]

VBoxManage controlvm <*uuid* | *vmname*> removeencpassword <*ID*>

VBoxManage controlvm <*uuid* | *vmname*> removeallencpasswords

VBoxManage controlvm <*uuid* | *vmname*> changeuartmode*N* disconnected | server *pipe#name* | client *pipe#name* | tcpserver *port* | tcpclient *hostname*:*port* | file *filename* | *device#name*

VBoxManage controlvm <*uuid* | *vmname*> autostart#enabled*N* on | off

VBoxManage controlvm <*uuid* | *vmname*> autostart#delay <*seconds*>

VBoxManage convertfromraw <*inputfile*> <*outputfile*> [##format=VDI | VMDK | VHD] [##uuid=*uuid*] [##variant=Standard|Fixed|Split2G|Stream|ESX...]

VBoxManage convertfromraw stdin <*outputfile*> <*bytes*> [##format=VDI | VMDK | VHD] [##uuid=*uuid*] [##variant=Standard|Fixed|Split2G|Stream|ESX...]

VBoxManage createmedium [*disk* | *dvd* | *floppy*] <##filename=*filename*> [##size=*megabytes* | ##sizebyte=*bytes*] [##diffparent=*UUID* | *filename*] [##format=*VDI* | *VMDK* | *VHD*] [##variant=Standard|Fixed|Split2G|Stream|ESX|Formatted|RawDisk...] [##property=*name=value*...] [##property#file=*name=/path/to/file/with/value*...]

VBoxManage createvm <##name=*name*> <##platform#architecture=x86 | arm> [##basefolder=*basefolder*] [##default] [##groups=*group#ID* [,...]] [##ostype=*ostype*] [##register] [##uuid=*uuid*] [##cipher=*cipher*] [##password#id=*password#id*] [##password=*file*]

VBoxManage debugvm <*uuid* | *vmname*> dumpvmcore <##filename=*name*>

VBoxManage debugvm <*uuid* | *vmname*> info <*item*> [*args*...]

VBoxManage debugvm <*uuid* | *vmname*> injectnmi

VBoxManage debugvm <*uuid* | *vmname*> log [##release | ##debug] [*group#settings*...]

VBoxManage debugvm <*uuid* | *vmname*> logdest [##release | ##debug] [*destinations*...]

VBoxManage debugvm <*uuid* | *vmname*> logflags [##release | ##debug] [*flags*...]

VBoxManage debugvm <*uuid* | *vmname*> osdetect

VBoxManage debugvm <*uuid* | *vmname*> osinfo

VBoxManage debugvm <*uuid* | *vmname*> osdmesg [##lines=*lines*]

VBoxManage debugvm <*uuid* | *vmname*> getregisters [##cpu=*id*] [*reg#set.reg#name*...]

VBoxManage debugvm <*uuid* | *vmname*> setregisters [##cpu=*id*] [*reg#set.reg#name=value*...]

VBoxManage debugvm <*uuid* | *vmname*> show [##human#readable | ##sh#export | ##sh#eval | ##cmd#set] [*settings#item*...]

VBoxManage debugvm <*uuid* | *vmname*> stack [##cpu=*id*]

VBoxManage debugvm <*uuid* | *vmname*> statistics [##reset] [##descriptions] [##pattern=*pattern*]

VBoxManage debugvm <*uuid* | *vmname*> guestsample [##filename=*filename*] [##sample#interval#us=*interval*] [##sample#time#us=*time*]

VBoxManage dhcpserver add <##network=*netname* | ##interface=*ifname*> <##server#ip=*address*> <##netmask=*mask*> <##lower#ip=*address*> <##upper#ip=*address*> <##enable | ##disable> [[##global] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*]...] [<##group=*name*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##incl#mac=*address*...] [##excl#mac=*address*...] [##incl#mac#wild=*pattern*...] [##excl#mac#wild=*pattern*...] [##incl#vendor=*string*...] [##excl#vendor=*string*...] [##incl#vendor#wild=*pattern*...] [##excl#vendor#wild=*pattern*...] [##incl#user=*string*...] [##excl#user=*string*...] [##incl#user#wild=*pattern*...] [##excl#user#wild=*pattern*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*]...] [<##vm=*name|uuid*> [##nic=*1#N*] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*]...] [<##mac#address=*address*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*]...]

VBoxManage dhcpserver modify <##network=*netname* | ##interface=*ifname*> [##server#ip=*address*] [##lower#ip=*address*] [##upper#ip=*address*] [##netmask=*mask*] [##enable | ##disable] [[##global] [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##remove#config]...] [<##group=*name*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##del#mac=*address*...] [##incl#mac=*address*...] [##excl#mac=*address*...] [##del#mac#wild=*pattern*...] [##incl#mac#wild=*pattern*...] [##excl#mac#wild=*pattern*...] [##del#vendor=*string*...] [##incl#vendor=*string*...] [##excl#vendor=*string*...] [##del#vendor#wild=*pattern*...] [##incl#vendor#wild=*pattern*...] [##excl#vendor#wild=*pattern*...] [##del#user=*string*...] [##incl#user=*string*...] [##excl#user=*string*...] [##del#user#wild=*pattern*...] [##incl#user#wild=*pattern*...] [##excl#user#wild=*pattern*...] [##zap#conditions] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##remove#config]...] [<##vm=*name|uuid*> [##nic=*1#N*] [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*] [##remove#config]...] [<##mac#address=*address*> [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*] [##remove#config]...]

VBoxManage dhcpserver remove <##network=*netname* | ##interface=*ifname*>

VBoxManage dhcpserver start <##network=*netname* | ##interface=*ifname*>

VBoxManage dhcpserver restart <##network=*netname* | ##interface=*ifname*>

VBoxManage dhcpserver stop <##network=*netname* | ##interface=*ifname*>

VBoxManage dhcpserver findlease <##network=*netname* | ##interface=*ifname*> <##mac#address=*mac*>

VBoxManage discardstate <*uuid* | *vmname*>

VBoxManage encryptmedium <*uuid* | *filename*> [##cipher=*cipher#ID*] [##newpassword=*password*] [##newpasswordid=*password#ID*] [##oldpassword=*password*]

VBoxManage encryptvm <*uuid* | *vmname*> setencryption ##old#password*file* ##cipher*cipher#identifier* ##new#password*file* ##new#password#id*password#identifier* ##force

VBoxManage encryptvm <*uuid* | *vmname*> checkpassword <*file*>

VBoxManage encryptvm <*uuid* | *vmname*> addpassword ##password*file* ##password#id*password#identifier*

VBoxManage encryptvm <*uuid* | *vmname*> removepassword <*password#identifier*>

VBoxManage export <*machines*> <##output=*name*> [##legacy09 | ##ovf09 | ##ovf10 | ##ovf20] [##manifest] [##options=manifest | iso | nomacs | nomacsbutnat...] [##vsys=*virtual#system#number*] [##description=*description#info*] [##eula=*license#text*] [##eulafile=*filename*] [##product=*product#name*] [##producturl=*product#URL*] [##vendor=*vendor#name*] [##vendorurl=*vendor#URL*] [##version=*version#info*] [##vmname=*vmname*]

VBoxManage export <*machine*> <##output=*cloud#service#provider*> [##opc10] [##vmname=*vmname*] [##cloud=*virtual#system#number*] [##cloudprofile=*cloud#profile#name*] [##cloudshape=*cloud#shape#name*] [##clouddomain=*cloud#domain*] [##clouddisksize=*disk#size#in#GB*] [##cloudbucket=*bucket#name*] [##cloudocivcn=*OCI#VCN#ID*] [##cloudocisubnet=*OCI#subnet#ID*] [##cloudkeepobject=true | false] [##cloudlaunchinstance=true | false] [##cloudlaunchmode=EMULATED | PARAVIRTUALIZED] [##cloudpublicip=true | false]

VBoxManage extpack install [##replace] [##accept#license=*sha256*] <*tarball*>

VBoxManage extpack uninstall [##force] <*name*>

VBoxManage extpack cleanup

VBoxManage getextradata <global | *uuid* | *vmname*> <*keyword* | enumerate>

VBoxManage guestcontrol <*uuid* | *vmname*> run [##arg0=*argument 0*] [##domain=*domainname*] [##dos2unix] [##exe=*filename*] [##ignore#orphaned#processes] [##no#wait#stderr | ##wait#stderr] [##no#wait#stdout | ##wait#stdout] [##passwordfile=*password#file* | ##password=*password*] [##profile] [##putenv=*var#name*=[*value*]] [##quiet] [##timeout=*msec*] [##unix2dos] [##unquoted#args] [##username=*username*] [##cwd=*directory*] [##verbose] <##[*argument...*]>

VBoxManage guestcontrol <*uuid* | *vmname*> start [##arg0=*argument 0*] [##domain=*domainname*] [##exe=*filename*] [##ignore#orphaned#processes] [##passwordfile=*password#file* | ##password=*password*] [##profile] [##putenv=*var#name*=[*value*]] [##quiet] [##timeout=*msec*] [##unquoted#args] [##username=*username*] [##cwd=*directory*] [##verbose] <##[*argument...*]>

VBoxManage guestcontrol *<uuid | vmname>* copyfrom [##dereference] [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##no#replace] [##recursive] [##target#directory=*host#destination#dir*] [##update] [##username=*username*] [##verbose] <*guest#source0*> *guest#source1*[...] <*host#destination*>

VBoxManage guestcontrol *<uuid | vmname>* copyto [##dereference] [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##no#replace] [##recursive] [##target#directory=*guest#destination#dir*] [##update] [##username=*username*] [##verbose] <*host#source0*> *host#source1*[...]

VBoxManage guestcontrol *<uuid | vmname>* mkdir [##domain=*domainname*] [##mode=*mode*] [##parents] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*guest#directory...*>

VBoxManage guestcontrol *<uuid | vmname>* rmdir [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##recursive] [##username=*username*] [##verbose] <*guest#directory...*>

VBoxManage guestcontrol *<uuid | vmname>* rm [##domain=*domainname*] [##force] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*guest#directory...*>

VBoxManage guestcontrol *<uuid | vmname>* mv [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*source...*> <*destination#directory*>

VBoxManage guestcontrol *<uuid | vmname>* mktemp [##directory] [##domain=*domainname*] [##mode=*mode*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##secure] [##tmpdir=*directory#name*] [##username=*username*] [##verbose] <*template#name*>

VBoxManage guestcontrol *<uuid | vmname>* mount [##passwordfile=*password#file* | ##password=*password*] [##username=*username*] [##verbose]

VBoxManage guestcontrol *<uuid | vmname>* fsinfo [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##human#readable] [##quiet] [##total] [##username=*username*] [##verbose] <*path*>

VBoxManage guestcontrol *<uuid | vmname>* stat [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*filename*>

VBoxManage guestcontrol *<uuid | vmname>* list <all | files | processes | sessions> [##quiet] [##verbose]

VBoxManage guestcontrol *<uuid | vmname>* closeprocess [##session#id=*ID* | ##session#name=*name#or#pattern*] [##quiet] [##verbose] <*PID...*>

VBoxManage guestcontrol *<uuid | vmname>* closesession [##all | ##session#id=*ID* | ##session#name=*name#or#pattern*] [##quiet] [##verbose]

VBoxManage guestcontrol *<uuid | vmname>* updatega [##quiet] [##verbose] [##source=*guest#additions.ISO*] [##wait#start] [##[*argument...*]]

VBoxManage guestcontrol *<uuid | vmname>* watch [##quiet] [##verbose]

VBoxManage guestproperty get <*uuid* | *vmname*> <*property#name*> [##verbose]

VBoxManage guestproperty enumerate <*uuid* | *vmname*> [##no#timestamp] [##no#flags] [##relative] [##old#format] [*patterns*...]

VBoxManage guestproperty set <*uuid* | *vmname*> <*property#name*> [*property#value* [##flags=*flags*]]

VBoxManage guestproperty unset <*uuid* | *vmname*> <*property#name*>

VBoxManage guestproperty wait <*uuid* | *vmname*> <*patterns*> [##timeout=*msec*] [##fail#on#timeout]

VBoxManage hostonlyif ipconfig <*ifname*> [##dhcp | ##ip=*IPv4#address* ##netmask=*IPv4#netmask* | ##ipv6=*IPv6#address* ##netmasklengthv6=*length*]

VBoxManage hostonlyif create

VBoxManage hostonlyif remove <*ifname*>

VBoxManage hostonlynet add <##name=*netname*> [##id=*netid*] <##netmask=*mask*> <##lower#ip=*address*> <##upper#ip=*address*> [##enable | ##disable]

VBoxManage hostonlynet modify <##name=*netname* | ##id=*netid*> [##lower#ip=*address*] [##upper#ip=*address*] [##netmask=*mask*] [##enable | ##disable]

VBoxManage hostonlynet remove <##name=*netname* | ##id=*netid*>

VBoxManage import <*ovfname* | *ovaname*> [##dry#run] [##options=keepallmacs | keepnatmacs | importtovdi | keepextradata] [##vsys=*n*] [##ostype=*ostype*] [##vmname=*name*] [##settingsfile=*filename*] [##basefolder=*folder*] [##group=*group*] [##memory=*MB*] [##cpus=*n*] [##description=*text*] [##eula=show | accept] [##unit=*n*] [##ignore] [##scsitype=BusLogic | LsiLogic] [##disk=*path*] [##controller=*index*] [##port=*n*]

VBoxManage import OCI:// ##cloud [##ostype=*ostype*] [##vmname=*name*] [##basefolder=*folder*] [##memory=*MB*] [##cpus=*n*] [##description=*text*] <##cloudprofile=*profile*> <##cloudinstanceid=*id*> [##cloudbucket=*bucket*]

VBoxManage list [##long] [##platform#arch=x86 | arm] [##sorted] [bridgedifs | cloudnets | cloudprofiles | cloudproviders | cpu#profiles | dhcpservers | dvds | extpacks | floppies | groups | hddbackends | hdds | hostcpuids | hostdrives | hostdvds | hostfloppies | hostinfo | hostonlyifs | hostonlynets | intnets | natnets | ostypes | ossubtypes | runningvms | screenshotformats | systemproperties | usbfilters | usbhost | vms | webcams]

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] formatfat [##quick]

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] cat [##hex] [##offset=*byte#offset*] [##size=*bytes*] [##output=*#*|*filename*]

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] stream [##format=*image#format*] [##variant=*image#variant*] [##output=*#*|*filename*]

VBoxManage mediumproperty [disk | dvd | floppy] set <*uuid* | *filename*> <*property#name*> <*property#value*>

VBoxManage mediumproperty [disk | dvd | floppy] get <*uuid* | *filename*> <*property#name*>

VBoxManage mediumproperty [disk | dvd | floppy] delete <*uuid* | *filename*> <*property#name*>

VBoxManage metrics collect [##detach] [##list] [##period=*seconds*] [##samples=*count*] [* | host | *vmname metric#list*]

VBoxManage metrics disable [##list] [* | host | *vmname metric#list*]

VBoxManage metrics enable [##list] [* | host | *vmname metric#list*]

VBoxManage metrics list [* | host | *vmname metric#list*]

VBoxManage metrics query [* | host | *vmname metric#list*]

VBoxManage metrics setup [##list] [##period*seconds*] [##samples*count*] [* | host | *vmname metric#list*]

VBoxManage modifymedium [disk | dvd | floppy] <*uuid* | *filename*> [##autoreset=on | off] [##compact] [##description=*description*] [##move=*pathname*] [##property=*name*=[*value*]] [##resize=*megabytes* | ##resizebyte=*bytes*] [##setlocation=*pathname*] [##type=normal | writethrough | immutable | shareable | readonly | multiattach]

VBoxManage modifynvram <*uuid* | *vmname*> inituefivarstore

VBoxManage modifynvram <*uuid* | *vmname*> enrollmssignatures

VBoxManage modifynvram <*uuid* | *vmname*> enrollorclpk

VBoxManage modifynvram <*uuid* | *vmname*> enrollpk [##platform#key=*filename*] [##owner#uuid=*uuid*]

VBoxManage modifynvram <*uuid* | *vmname*> enrollmok [##mok=*filename*] [##owner#uuid=*uuid*]

VBoxManage modifynvram <*uuid* | *vmname*> secureboot <##enable | ##disable>

VBoxManage modifynvram <*uuid* | *vmname*> listvars

VBoxManage modifynvram <*uuid* | *vmname*> queryvar [##name=*name*] [##filename=*filename*]

VBoxManage modifynvram <*uuid* | *vmname*> deletevar [##name=*name*] [##owner#uuid=*uuid*]

VBoxManage modifynvram <*uuid* | *vmname*> changevar [##name=*name*] [##filename=*filename*]

VBoxManage modifyvm <*uuid* | *vmname*> [##name=*name*] [##groups=*group* [,*group*...]]
[##description=*description*] [##os#type=*OS#type*] [##icon#file=*filename*] [##memory=*size#in#MB*]
[##page#fusion=on | off] [##vram=*size#in#MB*] [##acpi=on | off] [##ioapic=on | off]
[##hardware#uuid=*UUID*] [##cpus=*CPU#count*] [##cpu#hotplug=on | off] [##plug#cpu=*CPU#ID*]
[##unplug#cpu=*CPU#ID*] [##cpu#execution#cap=*number*] [##x86#pae=on | off]
[##x86#long#mode=on | off] [##ibpb#on#vm#exit=on | off] [##ibpb#on#vm#entry=on |
off] [##spec#ctrl=on | off] [##l1d#flush#on#sched=on | off] [##l1d#flush#on#vm#entry=on
| off] [##mds#clear#on#sched=on | off] [##mds#clear#on#vm#entry=on | off]
[##cpu#profile=host | Intel 8086 | Intel 80286 | Intel 80386] [##x86#hpet=on | off]
[##hwvirtex=on | off] [##triple#fault#reset=on | off] [##apic=on | off] [##x86#x2apic=on
| off] [##arm#gic#its=on | off] [##paravirt#provider=none | default | legacy | minimal |
hyperv | kvm] [##paravirt#debug=*key=value*[,*key=value*...]] [##nested#paging=on | off]
[##large#pages=on | off] [##x86#vtx#vpid=on | off] [##x86#vtx#ux=on | off] [##nested#hw#virt=on
| off] [##virt#vmsave#vmload=on | off] [##accelerate#3d=on | off] [##chipset=ich9 | piix3 |
armv8virtual] [##iommu=none | automatic | amd | intel] [##tpm#type=none | 1.2 | 2.0 | host | swtpm]
[##tpm#location=*location*] [##firmware#logo#fade#in=on | off] [##firmware#logo#fade#out=on
| off] [##firmware#logo#display#time=*msec*] [##firmware#logo#image#path=*pathname*]
[##firmware#boot#menu=disabled | menuonly | messageandmenu] [##firmware#apic=disabled
| apic | x2apic] [##firmware#system#time#offset=*msec*] [##firmware#pxe#debug=on
| off] [##system#uuid#le=on | off] [##boot*X*= none | floppy | dvd | disk | net]
[##rtc#use#utc=on | off] [##graphicscontroller=none | vboxvga | vmsvga | vboxsvga |
qemuramfb] [##snapshot#folder=default | *pathname*] [##firmware=bios | efi | efi32 |
efi64] [##guest#memory#balloon=*size#in#MB*] [##default#frontend=default | *name*]
[##vm#process#priority=default | flat | low | normal | high] [##vm#execution#engine=default | hm |
hwvirt | nem | native#api | interpreter | recompiler]

VBoxManage modifyvm <*uuid* | *vmname*> [##nic*N*= none | null | nat | bridged | intnet | hostonly
| hostonlynet | generic | natnetwork | cloud] [##nic#type*N*= Am79C970A | Am79C973
| 82540EM | 82543GC | 82545EM | virtio | usbnet] [##cable#connected*N*= on | off]
[##nic#trace*N*= on | off] [##nic#trace#file*N*=*filename*] [##nic#property*N*=*name*= [*value*]]
[##nic#speed*N*=*kbps*] [##nic#boot#prio*N*=*priority*] [##nic#promisc*N*= deny | allow#vms |
allow#all] [##nic#bandwidth#group*N*= none | *name*] [##bridge#adapter*N*= none | *device#name*]
[##cloud#network*N*=*network#name*] [##host#only#adapter*N*= none | *device#name*]
[##host#only#net*N*=*network#name*] [##intnet*N*=*network#name*] [##nat#network*N*=*network#name*]
[##nic#generic#drv*N*=*driver#name*] [##mac#address*N*= auto | *MAC#address*]

VBoxManage modifyvm <*uuid* | *vmname*> [##nat#net*N*= *network* | default] [##nat#pf*N*=
[*rule#name*],tcp | udp,[*host#IP*],*hostport*,[*guest#IP*],*guestport*] [##nat#pf*N*=delete=*rule#name*]
[##nat#tftp#prefix*N*=*prefix*] [##nat#tftp#file*N*=*filename*] [##nat#tftp#server*N*=*IP#address*]
[##nat#bind#ip*N*=*IP#address*] [##nat#dns#pass#domain*N*= on | off] [##nat#localhostreachable*N*= on
| off] [##nat#settings*N*=[*mtu*]] [##nat#forward#broadcast*N*= on | off] [##nat#enable#tftp*N*= on | off]

VBoxManage modifyvm <*uuid* | *vmname*> [##mouse=ps2 | usb | usbtablet | usbmultitouch |
usbmtscreenpluspad] [##keyboard=ps2 | usb] [##uart*N*= off | *IO#base IRQ*] [##uart#mode*N*=
disconnected | server*pipe* | client*pipe* | tcpserver*port* | tcpclient*hostname*:*port* | file*filename*
| *device#name*] [##uart#type*N*= 16450 | 16550A | 16750] [##lpt#mode*N*=*device#name*]
[##lpt*N*= off | *IO#base IRQ*] [##audio#controller=ac97 | hda | sb16] [##audio#codec=stac9700
| ad1980 | stac9221 | sb16] [##audio#driver=none | default | null | dsound | was
| oss | alsa | pulse | coreaudio] [##audio#enabled=on | off] [##audio#in=on | off]
[##audio#out=on | off] [##clipboard#mode=disabled | hosttoguest | guesttohost | bidirectional]
[##clipboard#file#transfers=enabled | disabled] [##drag#and#drop=disabled | hosttoguest |
guesttohost | bidirectional] [##monitor#count=*number*] [##usb#ehci=on | off] [##usb#ohci=on | off]
[##usb#xhci=on | off] [##usb#rename=*old#name new#name*]

VBoxManage modifyvm <*uuid* | *vmname*> [##recording=on | off] [##recording#screens=all | none | *screen#ID*[,*screen#ID*...]] [##recording#file=*filename*] [##recording#max#size=*MB*] [##recording#max#time=*seconds*] [##recording#opts= *key*=*value*[,*key*=*value*...]] [##recording#video#fps=*fps*] [##recording#video#rate=*rate*] [##recording#video#res=*width*x*height*]

VBoxManage modifyvm <*uuid* | *vmname*> [##vrde=on | off] [##vrde#property=*property#name*=[*property#value*]] [##vrde#extpack=default | *name*] [##vrde#port=*port*] [##vrde#address=*hostip*] [##vrde#auth#type=null | external | guest] [##vrde#auth#library=default | *name*] [##vrde#multi#con=on | off] [##vrde#reuse#con=on | off] [##vrde#video#channel=on | off] [##vrde#video#channel#quality=*percent*]

VBoxManage modifyvm <*uuid* | *vmname*> [##teleporter=on | off] [##teleporter#port=*port*] [##teleporter#address=*address* | empty] [##teleporter#password=*password*] [##teleporter#password#file=*filename* | stdin] [##cpuid#portability#level=*level*] [##cpuid#set=*leaf* [:*subleaf*] *eax ebx ecx edx*] [##cpuid#remove=*leaf* [:*subleaf*]] [##cpuid#remove#all]

VBoxManage modifyvm <*uuid* | *vmname*> [##tracing#enabled=on | off] [##tracing#config=*string*] [##tracing#allow#vm#access=on | off]

VBoxManage modifyvm <*uuid* | *vmname*> [##usb#card#reader=on | off]

VBoxManage modifyvm <*uuid* | *vmname*> [##autostart#enabled=on | off] [##autostart#delay=*seconds*]

VBoxManage modifyvm <*uuid* | *vmname*> [##guest#debug#provider=none | native | gdb | kd] [##guest#debug#io#provider=none | tcp | udp | ipc] [##guest#debug#address=*IP#Address* | *path*] [##guest#debug#port=*port*]

VBoxManage modifyvm <*uuid* | *vmname*> [##pci#attach=*host#PCI#address* [*@guest#PCI#bus#address*]] [##pci#detach=*host#PCI#address*]

VBoxManage modifyvm <*uuid* | *vmname*> [##testing#enabled=on | off] [##testing#mmio=on | off] [##testing#cfg#dword*idx*=*value*]

VBoxManage movevm <*uuid* | *vmname*> [##type=basic] [##folder=*folder#name*]

VBoxManage natnetwork add [##disable | ##enable] <##netname=*name*> <##network=*network*> [##dhcp=on|off] [##ipv6=on|off] [##loopback#4=*rule*] [##loopback#6=*rule*] [##port#forward#4=*rule*] [##port#forward#6=*rule*]

VBoxManage natnetwork list [*filter#pattern*]

VBoxManage natnetwork modify [##dhcp=on|off] [##disable | ##enable] <##netname=*name*> <##network=*network*> [##ipv6=on|off] [##loopback#4=*rule*] [##loopback#6=*rule*] [##port#forward#4=*rule*] [##port#forward#6=*rule*]

VBoxManage natnetwork remove <##netname=*name*>

VBoxManage natnetwork start <##netname=*name*>

VBoxManage natnetwork stop <##netname=*name*>

VBoxManage objtracker ifaces

VBoxManage objtracker objlist <##ifacename=*VirtualBox interface name*>

VBoxManage objtracker objinfo <##ifacename=*VirtualBox interface name*> <##id=*Unique object Id*>

VBoxManage registervm <*filename*> ##password*file*

VBoxManage setextradata <global | *uuid* | *vmname*> <*keyword*> [*value*]

VBoxManage setproperty <*property#name*> <*property#value*>

VBoxManage sharedfolder add <global | *uuid* | *vmname*> <##name=*share#name*> <##hostpath=*hostpath*> [##readonly] [##transient] [##automount] [##auto#mount#point=*path*]

VBoxManage sharedfolder remove <global | *uuid* | *vmname*> <##name=*share#name*> [##transient]

VBoxManage sharedfolder modify <*uuid* | *vmname*> <##name=*share#name*> <##readonly= true | false > <##automount= true | false > <##auto#mount#point=*path*> <##symlink#policy= forbidden | subtree | relative | any>

VBoxManage showmediuminfo [disk | dvd | floppy] <*uuid* | *filename*>

VBoxManage showvminfo <*uuid* | *vmname*> [##details] [##machinereadable] [##password#id] [##password]

VBoxManage showvminfo <*uuid* | *vmname*> <##log=*index*> [##password#id*id*] [##password*file*|#]

VBoxManage signova <*ova*> <##certificate=*file*> <##private#key=*file*> [##private#key#password#file=*password#file* | ##private#key#password=*password*] [##digest#type=*type*] [##pkcs7 | ##no#pkcs7] [##intermediate#cert=*file*] [##force] [##verbose] [##quiet] [##dry#run]

VBoxManage snapshot <*uuid* | *vmname*>

VBoxManage snapshot <*uuid* | *vmname*> take <*snapshot#name*> [##description=*description*] [##live] [##uniquename Number,Timestamp,Space,Force]

VBoxManage snapshot <*uuid* | *vmname*> delete <*snapshot#name*>

VBoxManage snapshot <*uuid* | *vmname*> restore <*snapshot#name*>

VBoxManage snapshot <*uuid* | *vmname*> restorecurrent

VBoxManage snapshot <*uuid* | *vmname*> edit <*snapshot#name* | ##current> [##description=*description*] [##name=*new#name*]

VBoxManage snapshot <*uuid* | *vmname*> list [##details | ##machinereadable]

VBoxManage snapshot <*uuid* | *vmname*> showvminfo <*snapshot#name*>

VBoxManage startvm [##putenv=*name*[=*value*]] [##type=<gui|headless|sdl|separate>] [##password=*file*] [##password#id=*password#identifier*] <*uuid* | *vmname*...>

VBoxManage storageattach <*uuid* | *vmname*> <##storagectl=*name*> [##bandwidthgroup=name | none] [##comment=*text*] [##device=*number*] [##discard=on | off] [##encodedlun=*lun*] [##forceunmount] [##hotpluggable=on | off] [##initiator=*initiator*] [##intnet] [##lun=*lun*] [##medium=none | emptydrive | additions | *uuid* | *filename* | host:*drive* | iscsi] [##mtype=normal | writethrough | immutable | shareable | readonly | multiattach] [##nonrotational=on | off] [##passthrough=on | off] [##passwordfile=*file*] [##password=*password*] [##port=*number*] [##server=*name* | *ip*] [##setparentuuid=*uuid*] [##setuuid=*uuid*] [##target=*target*] [##tempeject=on | off] [##tport=*port*] [##type=dvddrive | fdd | hdd] [##username=*username*]

VBoxManage storagectl <*uuid* | *vmname*> <##name=*controller#name*> [##add=floppy | ide | pcie | sas | sata | scsi | usb] [##controller=BusLogic | I82078 | ICH6 | IntelAhci | LSILogic | LSILogicSAS | NVMe | PIIX3 | PIIX4 | USB | VirtIO] [##bootable=on | off] [##hostiocache=on | off] [##portcount=*count*] [##remove] [##rename=*new#controller#name*]

VBoxManage unattended detect <##iso=*install#iso*> [##machine#readable]

VBoxManage unattended install <*uuid* | *vmname*> <##iso=*install#iso*> [##user=*login*] [##user#password=*password*] [##user#password#file=*file*] [##admin#password=*password*] [##admin#password#file=*file*] [##full#user#name=*name*] [##key=*product#key*] [##install#additions] [##no#install#additions] [##additions#iso=*add#iso*] [##install#txs] [##no#install#txs] [##validation#kit#iso=*testing#iso*] [##locale=*ll_CC*] [##country=*CC*] [##time#zone=*tz*] [##proxy=*url*] [##hostname=*fqdn*] [##package#selection#adjustment=*keyword*] [##dry#run] [##auxiliary#base#path=*path*] [##image#index=*number*] [##script#template=*file*] [##post#install#template=*file*] [##post#install#command=*command*] [##extra#install#kernel#parameters=*params*] [##language=*lang*] [##start#vm=*session#type*]

VBoxManage unregistervm <*uuid* | *vmname*> [##delete] [##delete#all]

VBoxManage updatecheck perform [##machine#readable]

VBoxManage updatecheck list [##machine#readable]

VBoxManage updatecheck modify [##disable | ##enable] [##channel=*stable* | *withbetas* | *all*] [##frequency=*days*]

VBoxManage usbdevsource add <*source#name*> <##backend=*backend*> <##address=*address*>

VBoxManage usbdevsource remove <*source#name*>

VBoxManage usbfilter add <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>> <##name=*string*> <##action=ignore | hold> [##active=yes | no] [##vendorid=*XXXX*] [##productid=*XXXX*] [##revision=*IIFF*] [##manufacturer=*string*] [##product=*string*] [##port=*hex*] [##remote=yes | no] [##serialnumber=*string*] [##maskedinterfaces=*XXXXXXXX*]

VBoxManage usbfilter modify <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>> [##name=*string*] [##action=ignore | hold] [##active=yes | no] [##vendorid=*XXXX*| ""] [##productid=*XXXX*| ""] [##revision=*IIFF*| ""] [##manufacturer=*string*| ""] [##product=*string*| ""] [##port=*hex*] [##remote=yes | no] [##serialnumber=*string*| ""] [##maskedinterfaces=*XXXXXXXX*]

VBoxManage usbfilter remove <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>>

Each time VBoxManage is invoked, only one command can be executed. However, a command might support several subcommands which then can be invoked in one single call. The following sections provide detailed reference information on the different commands.

15.3 VBoxManage

Oracle VirtualBox command-line interface

15.3.1 Synopsis

VBoxManage [#q | ##nologo] [##settingspw=*password*] [##settingspwfile=*pw#file*] [*@response#file*] [*subcommand*]

VBoxManage help [*subcommand*]

VBoxManage commands

VBoxManage [#V | ##version]

VBoxManage [##dump#build#type]

15.3.2 Description

The **VBoxManage** command is the command-line interface (CLI) for the Oracle VirtualBox software. The CLI supports all the features that are available with the Oracle VirtualBox graphical user interface (GUI). In addition, you can use the **VBoxManage** command to manage the features of the virtualization engine that cannot be managed by the GUI.

Each time you invoke the **VBoxManage** command, only one command is executed. Note that some **VBoxManage** subcommands invoke several subcommands.

Run the **VBoxManage** command from the command line of the host operating system (OS) to control Oracle VirtualBox software.

The **VBoxManage** command is stored in the following locations on the host system:

- *Linux:* /usr/bin/VBoxManage
- *Mac OS X:* /Applications/VirtualBox.app/Contents/MacOS/VBoxManage
- *Oracle Solaris:* /opt/VirtualBox/bin/VBoxManage
- *Windows:* C:\Program Files\Oracle\VirtualBox\VBoxManage.exe

The **VBoxManage** command performs particular tasks by using subcommands, such as **list**, **createvm**, and **startvm**. See the associated information for each **VBoxManage** subcommand.

If required, specify the VM by its name or by its Universally Unique Identifier (UUID).

Use the **VBoxManage list vms** command to obtain information about all currently registered VMs, including the VM names and associated UUIDs.

Note that VM names which contain spaces or special characters must be enclosed in quotes.

15.3.2.1 General Options

--nologo

Suppresses the output of the logo information, which is useful for scripts.

The short version of this option is -q.

--settingspw=[*password*]

Specifies the settings password. You can optionally specify the password as an argument to this option. If you do not specify the password in this way, the **VBoxManage** command prompts you for the password.

The settings password is a security feature that encrypts stored settings, which are stored as plain text by default.

Settings which have been encrypted are done so using a one-way encryption algorithm so cannot be decrypted. Thus, if the settings are encrypted you must include the --settingspw or --settingspwfile option every time **VBoxManage** is used.

Only the iSCSI secret is encrypted at this time.

--settingspwfile=*pw-filename*

Specifies the file that contains the settings password.

--version

Shows version information about the **VBoxManage** command.

The short version of this option is -V.

@response-file

Loads arguments from the specified Bourne shell response file.

subcommand

Specifies one of the **VBoxManage** subcommands, such as **controlvm**, **createvm**, **list**, **modifyvm**, **showvminfo**, **startvm**, **storageattach**, and **storagectl**.

Each subcommand is described in its own command topic, some of which are shown in See Also sections.

15.3.3 Examples

The following command creates a virtual machine called Win8 and registers it with Oracle VirtualBox by using the --register option.

```
$ VBoxManage createvm --name "Win8" --register
Virtual machine 'Win8' is created.
UUID: UUID-string
Settings file: '/home/username/VirtualBox VMs/Win8/Win8.vbox'
```

The command output shows that the Win8 VM is assigned a UUID and an XML machine settings file.

You can use the **VBoxManage showvminfo** command to view the configuration information of a VM.

The following example uses the **VBoxManage modifyvm** command to change the amount of memory for the Windows XP VM to be 1024 megabytes:

```
$ VBoxManage modifyvm "Windows XP" --memory 1024
```

Note that you can use the **VBoxManage modifyvm** command only for VMs that are powered off.

You can use the **VBoxManage storagectl** command or the **VBoxManage storageattach** command to modify the storage configuration for a VM. For example, to create a SATA storage controller called sata01 and add it to the ol7 VM:

```
$ VBoxManage storagectl ol7 --name "sata01" --add sata
```

Use the **VBoxManage startvm** command to start a VM that is currently powered off. For example, to start the win7 VM:

```
$ VBoxManage startvm win7
```

Use the **VBoxManage controlvm** command to pause or save a VM that is currently running. You can also use this command to modify settings for the VM. For example, to enable audio input for the ol6u9 VM.

```
$ VBoxManage controlvm ol6u9 audioin on
```

15.3.4 See Also

15.12 VBoxManage controlvm on page 309, *15.15 VBoxManage createvm on page 330*, *15.29 VBoxManage list on page 384*, *15.35 VBoxManage modifyvm on page 402*, *15.44 VBoxManage showvminfo on page 439*, *15.47 VBoxManage startvm on page 446*, *15.48 VBoxManage storageattach on page 448*, *15.49 VBoxManage storagectl on page 454*

15.4 VBoxManage adoptstate

Change a virtual machine's state based on a saved state file

15.4.1 Synopsis

VBoxManage adoptstate *<uuid | vmname> <state#filename>*

15.4.2 Description

The **VBoxManage adoptstate** command enables you to change the state of a virtual machine (VM) to a state described in a saved state file (.sav). This action is referred to as a VM *adopting* a saved state file. The saved state file must be separate from the VM configuration.

When you start the VM after adopting the saved state, the VM restores its state from the saved state file.

Only use this command for custom deployments.

uuid | vmname

Specifies the Universally Unique Identifier (UUID) or name of the VM.

state-filename

Specifies the name of the saved state file.

15.4.3 Examples

The following command adopts a saved state file called mystate.sav by a VM called vm2. A subsequent start of the VM called vm2 restores the state from the saved state file mystate.sav.

```
$ VBoxManage adoptstate vm2 /home/user/mystate.sav
```

15.4.4 See Also

15.18 VBoxManage discardstate on page 350

15.5 VBoxManage bandwidthctl

Manage bandwidth groups

15.5.1 Synopsis

VBoxManage bandwidthctl <*uuid* | *vmname*> add <*bandwidth#group#name*> <##limit=*bandwidth#limit*[k|m|g|K|M|G]> <##type=disk | network>

VBoxManage bandwidthctl <*uuid* | *vmname*> list [##machinereadable]

VBoxManage bandwidthctl <*uuid* | *vmname*> remove <*bandwidth#group#name*>

VBoxManage bandwidthctl <*uuid* | *vmname*> set <*bandwidth#group#name*> <##limit=*bandwidth#limit*[k|m|g|K|M|G]>

15.5.2 Description

The **VBoxManage bandwidthctl** command enables you to manage bandwidth groups for virtual machines (VMs). A bandwidth group specifies the bandwidth limit for the disks or for the network adapters of a VM.

Note that a network bandwidth limit applies only to the outbound traffic from the VM. The inbound traffic is unlimited.

15.5.2.1 Create a Bandwidth Group

VBoxManage bandwidthctl <*uuid* | *vmname*> add <*bandwidth#group#name*> <##limit=*bandwidth#limit*[k|m|g|K|M|G]> <##type=disk | network>

The **VBoxManage bandwidthctl add** command creates a bandwidth group for the specified VM. You must specify whether the bandwidth group is for disks or for networks and specify the bandwidth limit.

uuid | vmname

Specifies the Universally Unique Identifier (UUID) or the name of the VM.

bandwidth-group-name

Specifies the name of the bandwidth group.

--type=disk|network

Specifies the type of the bandwidth group: disk or network. For more information, see *8.8 Limiting Bandwidth for Disk Images on page 137* or *9.13 Limiting Bandwidth for Network Input/Output on page 158*.

--limit=*bandwidth-limit[k|m|g|K|M|G]*

Specifies the bandwidth limit for a bandwidth group. The default unit is megabytes per second. You can modify this value while the VM is running.

You can change the unit by appending one of the following unit specifiers to the bandwidth limit:

- k – kilobits per second
- m – megabits per second
- g – gigabits per second
- K – kilobytes per second
- M – megabytes per second
- G – gigabytes per second

15.5.2.2 List Bandwidth Groups

VBoxManage bandwidthctl <*uuid* | *vmname*> list [##machinereadable]

The **VBoxManage bandwidthctl list** command lists the all the bandwidth groups that have been defined for the specified VM. Use the --machinereadable option to produce the output in a machine-readable format, which uses name-value pairs.

uuid | vmname

Specifies the UUID or the name of the VM.

--machinereadable

Outputs the information about the bandwidth groups in name-value pairs.

15.5.2.3 Remove a Bandwidth Group

VBoxManage bandwidthctl <*uuid* | *vmname*> remove <*bandwidth#group#name*>

The **VBoxManage bandwidthctl remove** command removes a bandwidth group.

> **Note:**
>
> To successfully remove a bandwidth group, ensure that it is not referenced by any disk or adapter in the running VM.

uuid | vmname

Specifies the UUID or the name of the VM.

bandwidth-group-name

Specifies the name of the bandwidth group.

15.5.2.4 Modify the Bandwidth Limit of a Bandwidth Group

VBoxManage bandwidthctl <*uuid* | *vmname*> set <*bandwidth#group#name*> <##limit=*bandwidth#limit*[k|m|g|K|M|G]>

The **VBoxManage bandwidthctl set** command modifies the bandwidth limit for a bandwidth group.

uuid | vmname

Specifies the UUID or the name of the VM.

bandwidth-group-name

Specifies the name of the bandwidth group.

--limit=*bandwidth-limit[k|m|g|K|M|G]*

Specifies the bandwidth limit for a bandwidth group. The default unit is megabytes per second. You can modify this value while the VM is running.

You can change the unit by appending one of the following unit specifiers to the bandwidth limit:

- k – kilobits per second
- m – megabits per second
- g – gigabits per second
- K – kilobytes per second
- M – megabytes per second
- G – gigabytes per second

15.5.3 Examples

The following example shows how to use the **VBoxManage bandwidthctl** command to create the Limit bandwidth group and set the limit to 20 Mbps. Then use the **VBoxManage modifyvm** command to assign this bandwidth group to the first and second adapters of the vm1 VM.

```
$ VBoxManage bandwidthctl "vm1" add Limit --type network --limit 20m
$ VBoxManage modifyvm "vm1" --nicbandwidthgroup1 Limit
$ VBoxManage modifyvm "vm1" --nicbandwidthgroup2 Limit
```

You can dynamically modify the limit of a bandwidth group while the VM is running. The following example shows how to modify the limit for the Limit bandwidth group from 20 Mbps to 100 kbps:

```
$ VBoxManage bandwidthctl "vm1" set Limit --limit 100k
```

The following command disables shaping for all adapters in the Limit bandwidth group by specifying a limit of zero (0):

```
$ VBoxManage bandwidthctl "vm1" set Limit --limit 0
```

15.6 VBoxManage checkmediumpwd

Check encryption password on a DEK-encrypted medium or a disk image

15.6.1 Synopsis

VBoxManage checkmediumpwd <*uuid* | *filename*> <*password#file*>

15.6.2 Description

The **VBoxManage checkmediumpwd** command checks the current encryption password on a DEK-encrypted medium or a disk image. See *11.27.2 Encrypting Disk Images on page 220*.

The command response indicates if the specified password is correct.

uuid | filename

Specifies the Universally Unique Identifier (UUID) or the absolute path name of the medium or image.

password-file

Specifies the password to check. The password can be the absolute path name of a password file on the host OS or the dash character (-) to prompt you for the password on the command line.

15.6.3 Examples

The following example checks the encryption password for the ol7u4-1.vdi disk image. The password is contained in a file called pwfile.

The command returns a message indicating that the specified password is correct.

```
$ VBoxManage checkmediumpwd "$HOME/VirtualBox VMs/ol7u4/ol7u4-1.vdi" /home/user/pwfile
 The given password is correct
```

15.6.4 See Also

15.19 VBoxManage encryptmedium on page 351

15.7 VBoxManage clonemedium

Create a clone of a medium

15.7.1 Synopsis

VBoxManage clonemedium <*uuid* | *source#medium*> <*uuid* | *target#medium*> [disk | dvd | floppy] [##existing] [##format=VDI | VMDK | VHD | RAW | *other*] [##variant=Standard|Fixed|Split2G|Stream|ESX...]

15.7.2 Description

The **VBoxManage clonemedium** command enables you to clone an existing medium (virtual disk, DVD, or floppy), which is typically an image file. Only the Universally Unique Identifier (UUID) differs between the original image and the cloned image.

You can use the Virtual Media Manager to transfer the cloned image to another host system or reimport it into Oracle VirtualBox. See *8.3 The Virtual Media Manager on page 128* and *8.6 Cloning Disk Images on page 136*.

uuid* | *source-medium

Specifies the UUID or the absolute or relative pathname of the source medium to clone. You can specify the UUID of the medium only if it is registered. Use the **VBoxManage list hdds** command to list registered images.

uuid* | *target-medium

Specifies the UUID or the absolute or relative pathname of the target (clone) medium. You can specify the UUID of the target medium only if it is registered. Use the **VBoxManage list hdds** command to list registered images.

disk | dvd | floppy

Specifies the type of the medium to clone. Valid values are disk, dvd, and floppy. The default value is disk.

--existing

Performs the clone operation by overwriting an existing target medium. The result is that only the portion of the source medium that fits into the existing target medium is copied.

If the target medium is smaller than the source, only the portion of the source medium up to the size of the target medium is copied.

If the target medium is larger than the source, the remaining part of the target medium is unchanged.

--format

Specifies the file format of the target medium if it differs from the format of the source medium. Valid values are VDI, VMDK, VHD, RAW, and *other*.

--variant=Standard | Fixed | Split2G | Stream | ESX [,...]

Specifies the file format variant for the target medium, which is a comma-separated list of variants. Following are the valid values:

- Standard is the default disk image type, which has a dynamically allocated file size.
- Fixed uses a disk image that has a fixed file size.
- Split2G indicates that the disk image is split into 2GB segments. This value is for VMDK only.
- Stream optimizes the disk image for downloading. This value is for VMDK only.
- ESX is used for some VMWare products. This value is for VMDK only.

Note that not all variant combinations are valid. Specifying incompatible variant values in the list will produce an error message.

> **Note:**
>
> For compatibility with earlier versions of Oracle VirtualBox, you can use the **clonevdi** and **clonehd** commands instead of the **clonemedium** command.

15.7.3 Examples

The following command creates a clone of the disk01.vdi disk image file. The clone is called disk02.vdi.

```
$ VBoxManage clonemedium disk01.vdi disk02.vdi
```

The following command creates a clone of the disk01.vdi disk image file. The clone is in VMDK format and is called disk02.vmdk.

```
$ VBoxManage clonemedium disk01.vdi disk02.vmdk --format VMDK
```

15.7.4 See Also

15.29 VBoxManage list on page 384

15.8 VBoxManage clonevm

Create a clone of an existing virtual machine

15.8.1 Synopsis

VBoxManage clonevm <*vmname*|*uuid*> [##basefolder=*basefolder*] [##groups=*group*,...]
[##mode=machine | ##mode=machinechildren | ##mode=all] [##name=*name*] [##options=*option*,...]
[##register] [##snapshot=*snapshot#name*] [##uuid=*uuid*]

15.8.2 Description

The **VBoxManage clonevm** command creates a clone of an existing virtual machine (VM). The clone can be a full copy of the VM or a linked copy of a VM.

You must specify the name or the universal unique identifier (UUID) of the VM you want to clone.

15.8.3 Command Operand and Options

The following list describes the operand and the options that you can use with the **VBoxManage clonevm** command:

vmname*|*uuid

Specifies the name or UUID of the VM to clone.

--basefolder=*basefolder*

Specifies the name of the folder in which to save the configuration for the new VM.

--groups=*group*,...

Assigns the clone to the specified group or groups. If you specify more than one group, separate each group name with a comma.

Note that each group is identified by a group ID that starts with a slash character (/) so that groups can be nested. By default, a clone is always assigned membership to the / group.

--mode=machine|machineandchildren|all

Specifies which of the following cloning modes to use:

- machine mode clones the current state of the existing VM without any snapshots. This is the default mode.
- machineandchildren mode clones the snapshot specified by by the --snapshot option and all child snapshots.
- all mode clones all snapshots and the current state of the existing VM.

--name=*name*

Specifies a new name for the new VM. The default value is *original-name* Clone where *original-name* is the original name of the VM.

--options=*option*,...

Specifies how to create the new clone.

The --options argument can be used multiple times to enable multiple options, or the options can be given as a comma separated list. The options are case insensitive.

The following options (case-insensitive) are recognized:

Link

Creates a linked clone from a snapshot only.

KeepAllMACs

Specifies that the new clone reuses the MAC addresses of each virtual network card from the existing VM.

If you do not specify this option or the --options=keepnatmacs option, the default behavior is to reinitialize the MAC addresses of each virtual network card.

KeepNATMACs

Specifies that the new clone reuses the MAC addresses of each virtual network card from the existing VM when the network type is NAT.

If you do not specify this option or the KeepAllMACs option, the default behavior is to reinitialize the MAC addresses of each virtual network card.

KeepDiskNames

Specifies that the new clone reuses the disk image names from the existing VM. By default, disk images are renamed.

KeepHwUUIDs

Specifies that the new clone reuses the hardware IDs from the existing VM. By default, new UUIDs are used.

--register

Automatically registers the new clone in this Oracle VirtualBox installation. You can manually register the new VM later by using the **VBoxManage registervm** command. See *15.39 VBoxManage registervm on page 432*.

--snapshot=*snapshot-name*

Specifies the snapshot on which to base the new VM. By default, the clone is created from the current state of the specified VM.

--uuid=*uuid*

Specifies the UUID for the new VM. Ensure that this ID is unique for the Oracle VirtualBox instance if you decide to register this new VM. By default, Oracle VirtualBox provides a new UUID.

15.8.4 Examples

The following command creates and registers an exact clone of the ol7 VM. The clone is called ol7-dev-001.

The new clone includes all of the source VM's snapshots. The new VM also reuses all network interface MAC addresses, disk names, and UUIDs from the source VM.

```
$ VBoxManage clonevm ol7 --name="ol7-dev-001" --register --mode=all \
   --options=keepallmacs --options=keepdisknames --options=keephwuuids
```

The following command creates and registers a clone of the Snapshot 1 snapshot of the ol7 VM. The clone is called ol7-dev-002.

```
$ VBoxManage clonevm ol7 --name="ol7-dev-002" --register --snapshot="Snapshot 1"
```

15.8.5 See Also

15.39 VBoxManage registervm on page 432

15.9 VBoxManage closemedium

Remove a hard disk, DVD, or floppy image from the media registry

15.9.1 Synopsis

VBoxManage closemedium [disk | dvd | floppy] <*uuid* | *filename*> [##delete]

15.9.2 Description

The **VBoxManage closemedium** command removes a hard disk, DVD, or floppy image from the list of known media used by Oracle VirtualBox. The image is then unavailable for selection in the Virtual Media Manager.

To use this command, the image must not be attached to any VMs.

Optionally, you can request that the image be deleted.

disk|dvd|floppy

Specifies the type of medium. Valid values are disk (hard drive), dvd, or floppy.

uuid|filename

Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

--delete

Deletes the image file.

15.9.3 Examples

The following command removes the disk image file called disk01.vdi from the registry.

```
$ VBoxManage closemedium disk01.vdi
```

The following command removes the disk image file called disk01.vdi from the registry and deletes the image file.

```
$ VBoxManage closemedium disk01.vdi --delete
```

15.10 VBoxManage cloud

Manage the cloud entities

15.10.1 Synopsis

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list instances [##state=*string*] [##compartment#id=*string*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list images <##compartment#id=*string*> [##state=*string*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list vnicattachments <##compartment#id=*string*> [##filter=instanceId | vnicId |
availabilityDomain=*value*...]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance create <##domain#name=*name*> <##image#id=*id* | ##boot#volume#id=*id*>
<##display#name=*name*> <##shape=*type*> <##subnet=*id*> [##boot#disk#size=*size in GB*] [##publicip=true | false] [##privateip=*IP address*] [##public#ssh#key=*key string*...] [##launch#mode=NATIVE | EMULATED | PARAVIRTUALIZED] [##cloud#init#script#path=*path to a script*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance info <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance terminate <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance start <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance pause <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance reset <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance clone <##id=*unique id*> [##clone#name=*name for a clone instance*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance metriclist <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance metricdata <##id=*unique id*> <##metric#name=*metric name*> <##metric#points=*number of history metric points*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image create <##display#name=*name*> [##bucket#name=*name*] [##object#name=*name*]
[##instance#id=*unique id*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image info <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image delete <##id=*unique id*>

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image import <##id=*unique id*> [##bucket#name=*name*] [##object#name=*name*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image export <##id=*unique id*> <##display#name=*name*> [##bucket#name=*name*] [##object#name=*name*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
network setup [##gateway#os#name=*string*] [##gateway#os#version=*string*] [##gateway#shape=*string*]
[##tunnel#network#name=*string*] [##tunnel#network#range=*string*] [##proxy=*string*]
[##compartment#id=*string*]

VBoxManage cloud <##provider=*name*> <##profile=*name*>
network create <##name=*string*> <##network#id=*string*> [##enable | ##disable]

VBoxManage cloud network update <##name=*string*> [##network#id=*string*] [##enable | ##disable]

VBoxManage cloud network delete <##name=*string*>

VBoxManage cloud network info <##name=*string*>

15.10.2 Description

15.10.2.1 Common options

The word cloud is an umbrella term for all commands related to intercommunication with the Cloud. The following common options must be placed after the cloud argument and before the following sub-commands:

--provider=*name*

Short cloud provider name.

--profile=*name*

Cloud profile name.

15.10.2.2 cloud list instances

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list instances [##state=*string*] [##compartment#id=*string*]

Displays a list of the cloud instances for a specified compartment.

--state=*running|paused|terminated*

The state of cloud instance. The possible states are running, paused, and terminated. If a state isn't provided a list of instances with all possible states is returned.

--compartment-id

A compartment is the logical container used to organize and isolate cloud resources. Different cloud providers may use different names for this entity.

15.10.2.3 cloud list images

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list images <##compartment#id=*string*> [##state=*string*]

Displays the list of the images for a specified compartment.

--state=*available|disabled|deleted*

The state of the cloud image. The possible states are available, disabled and deleted. If a state isn't provided a list of images with all possible states is returned.

--compartment-id

A compartment is the logical container used to organize and isolate cloud resources. Different cloud providers may use different names for this entity.

15.10.2.4 cloud list vnic attachments

VBoxManage cloud <##provider=*name*> <##profile=*name*>
list vnicattachments <##compartment#id=*string*> [##filter=instanceId | vnicId |
availabilityDomain=*value*...]

Displays the list of the vnic attachments for a specified compartment.

--filter={instanceId|vnicId|domainName}=*string*

Filters are used to narrow down the set of Vnic attachments of interest. This parameter can be specified multiple times. The possible filter types are instanceId, vnicId, or availabilityDomain.

Filters have a syntax of *type=[value]* as seen in the following examples:

- instanceId=ocid1.instance.oc1.iad.anuwcl...js6
- vnicId=ocid1.vnic.oc1.iad.abuwcl...jsm
- domainName=ergw:US-ASHBURN-AD-2

If a filter isn't provided the entire list of vnic attachments for a specified compartment is returned.

--compartment-id

A compartment is the logical container used to organize and isolate cloud resources. Different cloud providers may use different names for this entity.

15.10.2.5 cloud instance create

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance create <##domain#name=*name*> <##image#id=*id* | ##boot#volume#id=*id*>
<##display#name=*name*> <##shape=*type*> <##subnet=*id*> [##boot#disk#size=*size in GB*] [##publicip=true | false] [##privateip=*IP address*] [##public#ssh#key=*key string*...] [##launch#mode=NATIVE | EMULATED | PARAVIRTUALIZED] [##cloud#init#script#path=*path to a script*]

Creates new instance in the Cloud. There are two standard ways to create an instance in the Cloud:

1. Create an instance from an existing custom image.
2. Create an instance from an existing bootable volume. This bootable volume shouldn't be attached to any instance.

The first approach requires the following two options: image-id, boot-disk-size. The second approach requires the following option: boot-volume-id.

The following options are common to both cases: display-name, launch-mode, subnet-id, publicIP, privateIP, shape, domain.

--domain-name

Cloud domain where the new instance is to be created.

--image-id

Unique identifier which fully identifies a custom image in the Cloud.

--boot-volume-id

Unique identifier which fully identifies a boot volume in the Cloud.

--display-name

Name for the new instance in the Cloud.

--shape

The shape of the instance which defines the number of CPUs and memory (RAM).

--subnet

Unique identifier which fully identifies an existing subnet in the Cloud which will be used by the instance.

--boot-disk-size

The size of the bootable image in GB. Default is 50GB.

--publicip

Public IP address for the created instance.

--privateip

Private IP address for the created instance.

--public-ssh-key

Public SSH key to use to connect to the instance via SSH. This parameter may be repeated if using more than one key: --public-ssh-key=firstSSHKey --public-ssh-key=secondSSHKey.

--launch-mode

Supported values are EMULATED, NATIVE, and PARAVIRTUALIZED.

--cloud-init-script-path

Absolute path to the cloud-init script.

15.10.2.6 cloud instance info

Display information about a cloud instance with a specified ID.

--id

Unique identifier which fully identifies the instance in the Cloud.

15.10.2.7 cloud instance termination

Delete a cloud instance with a specified ID.

--id

Unique identifier which fully identifies the instance in the Cloud.

15.10.2.8 cloud instance start

Start a cloud instance with a specified ID.

--id

Unique identifier which fully identifies the instance in the Cloud.

15.10.2.9 cloud instance pause

Pause a cloud instance with a specified ID.

--id

Unique identifier which fully identifies the instance in the Cloud.

15.10.2.10 cloud instance reset

Force reset a cloud instance with a specified ID.

--id

Unique identifier which fully identifies the instance in the Cloud.

15.10.2.11 cloud instance clone

Clone a cloud instance with the specified ID. Only works for the instances accessible through Oracle VirtualBox, i.e., not every instance in the cloud may be cloned.

--id

Unique identifier which fully identifies the instance in the Cloud.

--clone-name

Name for the clone instance

15.10.2.12 available list of metrics for cloud instances

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance metriclist <##id=*unique id*>

Displays the list of the available metrics for the instance. The returned names must be used with the command **VBoxManage cloud instance metricdata**.

--id

Unique identifier which fully identifies the instance in the Cloud.

15.10.2.13 Displays cloud instance metric data

VBoxManage cloud <##provider=*name*> <##profile=*name*>
instance metricdata <##id=*unique id*> <##metric#name=*metric name*> <##metric#points=*number of history metric points*>

Displays the metric data with the resolution of 1 minute for the requested cloud instances. The timestamps are returned in the format described in RFC2822.

--id

Unique identifier which fully identifies the instance in the Cloud.

--metric-name

Metric name

--metric-points

Metric points begin at the current time, which has a value of one, and continue into the past with the values increasing. If only the most recent metric point is desired supply the value 1. If the most recent value and the preceding value are desired then supply a value of 2.

15.10.2.14 cloud image create

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image create <##display#name=*name*> [##bucket#name=*name*] [##object#name=*name*] [##instance#id=*unique id*]

Creates new image in the Cloud. There are two standard ways to create an image in the Cloud:

1. Create an image from an object in the Cloud Storage.
2. Create an image from an existing cloud instance.

For the first approach the following three options are required: bucket-name, object-name, and display-name.

For the second approach the following two options are required: instance-id, display-name

--display-name

Name for new image in the Cloud.

--bucket-name

The name of the Cloud bucket where the image (object) is located..

--object-name

Name of object in the bucket.

--instance-id

Unique identifier which fully identifies the instance in the Cloud.

15.10.2.15 cloud image info

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image info <##id=*unique id*>

Display information about a cloud image with a specified ID.

--id

Unique identifier which fully identifies the image in the Cloud.

15.10.2.16 cloud image delete

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image delete <##id=*unique id*>

Delete an image with a specified ID from the Cloud.

--id

Unique identifier which fully identifies the image in the Cloud.

15.10.2.17 cloud image import

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image import <##id=*unique id*> [##bucket#name=*name*] [##object#name=*name*]

Import an image with the specified ID from the Cloud to a local host. The result is an object in the local "temp" folder on the local host. There are two possible approaches when importing from the Cloud:

1. Create an object from an image in the Cloud Storage.
2. Download the object to the local host.

--id

Unique identifier which fully identifies the image in the Cloud.

--bucket-name

The name of the Cloud bucket where the object will be created.

--object-name

Name of the created object in the bucket or the name of the downloaded object. If no --object-name option is supplied a default image name is used.

15.10.2.18 cloud image export

VBoxManage cloud <##provider=*name*> <##profile=*name*>
image export <##id=*unique id*> <##display#name=*name*> [##bucket#name=*name*] [##object#name=*name*]

Export an existing VBox image with the specified uuid from a local host to the Cloud. The result is new image in the Cloud. There are two possible approaches when exporting to the Cloud:

1. Upload a VBox image to the Cloud Storage.
2. Create an image from the uploaded object.

--id

Unique identifier of the image in Oracle VirtualBox.

--display-name

The name of the new image in the Cloud.

--bucket-name

The name of the Cloud bucket where the image (object) will be uploaded.

--object-name

Name of the object in the bucket.

15.10.2.19 cloud network setup

VBoxManage cloud <##provider=*name*> <##profile=*name*>
network setup [##gateway#os#name=*string*] [##gateway#os#version=*string*] [##gateway#shape=*string*]
[##tunnel#network#name=*string*] [##tunnel#network#range=*string*] [##proxy=*string*]
[##compartment#id=*string*]

Set up a cloud network environment for the specified cloud profile.

--gateway-os-name

The name of OS to use for the cloud gateway.

--gateway-os-version

The version of the OS to use for the cloud gateway.

--gateway-shape

The instance shape to use for the cloud gateway.

--tunnel-network-name

The name of the VCN/subnet to use for tunneling.

--tunnel-network-range

The IP address range to use for tunneling.

--proxy

The proxy URL to be used in a local gateway installation.

--compartment-id

The compartment to create the tunnel network in.

15.10.2.20 cloud network create

VBoxManage cloud <##provider=*name*> <##profile=*name*>
network create <##name=*string*> <##network#id=*string*> [##enable | ##disable]

Create a new cloud network descriptor associated with an existing cloud subnet.

--name

The name to assign to the cloud network descriptor.

--network-id

The unique identifier of an existing subnet in the cloud.

--enable, --disable

Whether to enable the network descriptor or disable it. If not specified, the network will be enabled.

15.10.2.21 cloud network update

VBoxManage cloud network update <##name=*string*> [##network#id=*string*] [##enable | ##disable]

Modify an existing cloud network descriptor.

--name

The name of an existing cloud network descriptor.

--network-id

The unique identifier of an existing subnet in the Cloud.

--enable, --disable

Whether to enable the network descriptor or disable it.

15.10.2.22 cloud network delete

VBoxManage cloud network delete <##name=*string*>

Delete an existing cloud network descriptor.

--name

The name of an existing cloud network descriptor.

15.10.2.23 cloud network info

VBoxManage cloud network info <##name=*string*>

Display information about a cloud network descriptor.

--name

The name of an existing cloud network descriptor.

15.11 VBoxManage cloudprofile

Manage the cloud profiles

15.11.1 Synopsis

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> add [##clouduser=*unique id*] [##fingerprint=*MD5 string*] [##keyfile=*path*] [##passphrase=*string*] [##tenancy=*unique id*] [##compartment=*unique id*] [##region=*string*]

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> update [##clouduser=*unique id*] [##fingerprint=*MD5 string*] [##keyfile=*path*] [##passphrase=*string*] [##tenancy=*unique id*] [##compartment=*unique id*] [##region=*string*]

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> delete

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> show

15.11.2 Description

15.11.2.1 Common options

The subcommands of **cloudprofile** implement the standard Create, Read, Update, and Delete (CRUD) operations for a cloud profile. The following common options must be placed after the **cloudprofile** argument and before the following sub-commands:

--provider=*name*

Short cloud provider name.

--profile=*name*

Cloud profile name.

15.11.2.2 cloudprofile add

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> add [##clouduser=*unique id*] [##fingerprint=*MD5 string*] [##keyfile=*path*] [##passphrase=*string*] [##tenancy=*unique id*] [##compartment=*unique id*] [##region=*string*]

Add a new cloud profile for the specified cloud provider.

--clouduser=*unique id*

The name which fully identifies the user in the specified cloud provider.

--fingerprint=*MD5 string*

Fingerprint of the key pair being used.

--keyfile=*path*

Full path and filename of the private key.

--passphrase=*string*

Passphrase used for the key if it is encrypted.

--tenancy=*unique id*

ID of your tenancy.

--compartment=*unique id*

ID of your compartment.

--region=*string*

Region name. Region is where you plan to deploy an application.

15.11.2.3 cloudprofile show

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> show

Display information about a cloud profile for the specified cloud provider.

15.11.2.4 cloudprofile update

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> update [##clouduser=*unique id*] [##fingerprint=*MD5 string*] [##keyfile=*path*] [##passphrase=*string*] [##tenancy=*unique id*] [##compartment=*unique id*] [##region=*string*]

Modify a cloud profile for the specified cloud provider.

--clouduser=*unique id*

The name which fully identifies the user in the specified cloud provider.

--fingerprint=*MD5 string*

Fingerprint for the key pair being used.

--keyfile=*path*

Full path and filename of the private key.

--passphrase=*string*

Passphrase used for the key if it is encrypted.

--tenancy=*unique id*

ID of the tenancy.

--compartment=*unique id*

ID of the compartment.

--region=*string*

Region name. Region is where you plan to deploy an application.

15.11.2.5 cloudprofile delete

VBoxManage cloudprofile <##provider=*name*> <##profile=*name*> delete

Delete a cloud profile for a specified cloud provider.

15.12 VBoxManage controlvm

Change state and settings for a running virtual machine

15.12.1 Synopsis

VBoxManage controlvm <*uuid* | *vmname*> pause

VBoxManage controlvm <*uuid* | *vmname*> resume

VBoxManage controlvm <*uuid* | *vmname*> reset

VBoxManage controlvm <*uuid* | *vmname*> poweroff

VBoxManage controlvm <*uuid* | *vmname*> savestate

VBoxManage controlvm <*uuid* | *vmname*> acpipowerbutton

VBoxManage controlvm <*uuid* | *vmname*> acpisleepbutton

VBoxManage controlvm <*uuid* | *vmname*> reboot

VBoxManage controlvm <*uuid* | *vmname*> shutdown [##force]

VBoxManage controlvm <*uuid* | *vmname*> keyboardputscancode <*hex*> [*hex*...]

VBoxManage controlvm <*uuid* | *vmname*> keyboardputstring <*string*> [*string*...]

VBoxManage controlvm <*uuid* | *vmname*> keyboardputfile <*filename*>

VBoxManage controlvm <*uuid* | *vmname*> setlinkstate*N* <on | off>

VBoxManage controlvm <*uuid* | *vmname*> nic*N* <null | nat | bridged | intnet | hostonly | generic | natnetwork> [*device#name*]

VBoxManage controlvm <*uuid* | *vmname*> nictrace*N* <on | off>

VBoxManage controlvm <*uuid* | *vmname*> nictracefile*N* <*filename*>

VBoxManage controlvm <*uuid* | *vmname*> nicproperty*N* <*prop#name=prop#value*>

VBoxManage controlvm <*uuid* | *vmname*> nicpromisc*N* <deny | allow#vms | allow#all>

VBoxManage controlvm <*uuid* | *vmname*> natpf*N* <[*rulename*],<tcp|udp>,[*host#IP*],*hostport*,[*guest#IP*],*guestport*>

VBoxManage controlvm <*uuid* | *vmname*> natpf*N*delete <*rulename*>

VBoxManage controlvm <*uuid* | *vmname*> guestmemoryballoon <*balloon#size*>

VBoxManage controlvm <*uuid* | *vmname*> usbattach <*uuid* | *address*> [##capturefile=*filename*]

VBoxManage controlvm <*uuid* | *vmname*> usbdetach <*uuid* | *address*>

VBoxManage controlvm <*uuid* | *vmname*> audioin <on | off>

VBoxManage controlvm <*uuid* | *vmname*> audioout <on | off>

VBoxManage controlvm <*uuid* | *vmname*> clipboard mode <disabled | hosttoguest | guesttohost | bidirectional>

VBoxManage controlvm <*uuid* | *vmname*> clipboard filetransfers <on | off>

VBoxManage controlvm <*uuid* | *vmname*> draganddrop <disabled | hosttoguest | guesttohost | bidirectional>

VBoxManage controlvm <*uuid* | *vmname*> vrde <on | off>

VBoxManage controlvm <*uuid* | *vmname*> vrdeport <*port*>

VBoxManage controlvm <*uuid* | *vmname*> vrdeproperty <*prop#name=prop#value*>

VBoxManage controlvm <*uuid* | *vmname*> vrdevideochannelquality <*percentage*>

VBoxManage controlvm <*uuid* | *vmname*> setvideomodehint <*xres*> <*yres*> <*bpp*> [*display* [<yes | no> [*x#origin y#origin*]]]

VBoxManage controlvm <*uuid* | *vmname*> setscreenlayout <*display*> <on | primary *x#origin y#origin x#resolution y#resolution bpp* | off>

VBoxManage controlvm <*uuid* | *vmname*> screenshotpng <*filename*> [*display*]

VBoxManage controlvm <*uuid* | *vmname*> recording <on | off> VBoxManage controlvm <*uuid* | *vmname*> recording start [##wait] VBoxManage controlvm <*uuid* | *vmname*> recording stop VBoxManage controlvm <*uuid* | *vmname*> recording attach VBoxManage controlvm <*uuid* | *vmname*> recording screens <all | none | *screen#ID ,screen#ID...*> VBoxManage controlvm <*uuid* | *vmname*> recording filename <filename> VBoxManage controlvm <*uuid* | *vmname*> recording videores <<*width*>x <*height*>> VBoxManage controlvm <*uuid* | *vmname*> recording videorate <*rate*> VBoxManage controlvm <*uuid* | *vmname*> recording videofps <*fps*> VBoxManage controlvm <*uuid* | *vmname*> recording maxtime <*sec*> VBoxManage controlvm <*uuid* | *vmname*> recording maxfilesize <*MB*> VBoxManage controlvm <*uuid* | *vmname*> recording opts <*key*= [*value*]>

VBoxManage controlvm <*uuid* | *vmname*> setcredentials <*username*> ##passwordfile=<*filename* | *password*> <*domain#name*> ##allowlocallogon=<yes | no>

VBoxManage controlvm <*uuid* | *vmname*> teleport <##host=*host#name*> <##port=*port#name*> [##maxdowntime=*msec*] [##passwordfile=*filename* | ##password=*password*]

VBoxManage controlvm <*uuid* | *vmname*> plugcpu <*ID*>

VBoxManage controlvm <*uuid* | *vmname*> unplugcpu <*ID*>

VBoxManage controlvm <*uuid* | *vmname*> cpuexecutioncap <*num*>

VBoxManage controlvm <*uuid* | *vmname*> vm#process#priority <default | flat | low | normal | high>

VBoxManage controlvm <*uuid* | *vmname*> webcam attach [*pathname* [*settings*]]

VBoxManage controlvm <*uuid* | *vmname*> webcam detach [*pathname*]

VBoxManage controlvm <*uuid* | *vmname*> webcam list

VBoxManage controlvm <*uuid* | *vmname*> addencpassword <*ID*> <*password#file* | #>
[##removeonsuspend=yes | no]

VBoxManage controlvm <*uuid* | *vmname*> removeencpassword <*ID*>

VBoxManage controlvm <*uuid* | *vmname*> removeallencpasswords

VBoxManage controlvm <*uuid* | *vmname*> changeuartmode*N* disconnected | server *pipe#name* | client *pipe#name* | tcpserver *port* | tcpclient *hostname*:*port* | file *filename* | *device#name*

VBoxManage controlvm <*uuid* | *vmname*> autostart#enabled*N* on | off

VBoxManage controlvm <*uuid* | *vmname*> autostart#delay <*seconds*>

15.12.2 Description

The **VBoxManage controlvm** command enables you to change the state of a running virtual machine (VM). The following sections describe the subcommands that you can use:

15.12.2.1 Pause a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> pause

The **VBoxManage controlvm** *vmname* **pause** command temporarily stops the execution of a VM. When paused, the VM's state is not permanently changed.

The VM window appears as gray and the title bar of the window indicates that the VM is currently Paused. This action is equivalent to selecting *Pause* from the *Machine* menu of the GUI.

15.12.2.2 Resume a Paused Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> resume

The **VBoxManage controlvm** *vmname* **resume** command restarts the execution of a paused VM. This action is equivalent to selecting *Resume* from the *Machine* menu of the GUI.

15.12.2.3 Reset a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> reset

The **VBoxManage controlvm** *vmname* **reset** command performs a cold reset the VM. This command has the same effect on a VM as pressing the Reset button on a physical computer.

A cold reboot immediately restarts and reboots the guest operating system (OS). The state of the VM is not saved prior to the reset, so data might be lost. This action is equivalent to selecting *Reset* from the *Machine* menu of the GUI.

15.12.2.4 Power Off a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> poweroff

The **VBoxManage controlvm** *vmname* **poweroff** command powers off the VM. This command has the same effect on a VM as pulling the power cable on a physical computer.

The state of the VM is not saved prior to poweroff, so data might be lost. This action is equivalent to selecting *Close* from the *Machine* menu of the GUI or to clicking the VM window's Close button, and then selecting *Power Off the Machine*.

The **poweroff** subcommand places a VM into the Powered Off state from which you can restart the VM using *15.47 VBoxManage startvm on page 446*.

15.12.2.5 Save the State of a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> savestate

The **VBoxManage controlvm** *vmname* **savestate** command saves the current state of the VM to disk and then stops the VM.

This action is equivalent to selecting *Close* from the *Machine* menu of the GUI or to clicking the VM window's Close button, and then selecting *Save the Machine State*.

The **savestate** subcommand places a VM into the Saved state from which you can restart the VM using *15.47 VBoxManage startvm on page 446*. The VM will resume from the exact point at which it was saved.

15.12.2.6 Send an APCI Shutdown Signal to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> acpipowerbutton

The **VBoxManage controlvm** *vmname* **acpipowerbutton** command sends an ACPI shutdown signal to the VM. This command has the same effect on a VM as pressing the Power button on a physical computer.

So long as the VM runs a guest OS that provides appropriately configured ACPI support, this command triggers an operating system shutdown from within the VM.

15.12.2.7 Send an APCI Sleep Signal to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> acpisleepbutton

The **VBoxManage controlvm** *vmname* **acpisleepbutton** command sends an ACPI sleep signal to the VM.

So long as the VM runs a guest OS that provides appropriately configured ACPI support, this command triggers a sleep mechanism from within the VM.

15.12.2.8 Reboot the guest OS

VBoxManage controlvm <*uuid* | *vmname*> reboot

The **VBoxManage controlvm** *vmname* **reboot** command asks the guest OS to reboot itself.

This command requires the Oracle VirtualBox Guest Additions to be installed in the VM.

15.12.2.9 Shut down the guest OS

VBoxManage controlvm <*uuid* | *vmname*> shutdown [##force]

The **VBoxManage controlvm** *vmname* **shutdown** command asks the guest OS to halt + shutdown, optionally forcing the shutdown.

This command requires the Oracle VirtualBox Guest Additions to be installed in the VM.

15.12.2.10 Send Keyboard Scancodes to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> keyboardputscancode <*hex*> [*hex*...]

The **VBoxManage controlvm** *vmname* **keyboardputscancode** command sends keyboard scancode commands to the VM.

For information about keyboard scancodes, see *www.win.tue.nl/~aeb/linux/kbd/scancodes-1.html*.

15.12.2.11 Send Keyboard Strings to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> keyboardputstring <*string*> [*string*...]

The **VBoxManage controlvm** *vmname* **keyboardputstring** command sends keyboard strings to the VM.

15.12.2.12 Send a File to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> keyboardputfile <*filename*>

The **VBoxManage controlvm** *vmname* **keyboardputfile** command sends a file to the VM.

15.12.2.13 Set the Link State for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> setlinkstate*N* <on | off>

VBoxManage controlvm *vmname* **setlinkstate***N* command enables you to connect or disconnect the virtual network cable from the network interface instance (*N*). Valid values are on and off. The default value is on.

15.12.2.14 Set the Type of Networking to Use for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> nic*N* <null | nat | bridged | intnet | hostonly | generic | natnetwork> [*device#name*]

The **VBoxManage controlvm** *vmname* **nic***N* command specifies the type of networking to use on the specified VM's virtual network card. *N* numbering begins with 1.

The following valid network types are also described in *9.3 Introduction to Networking Modes on page 145*:

- null specifies that the VM is is not connected to the host system.
- nat specifies that the VM uses Network Address Translation (NAT).
- bridged specifies that the VM uses bridged networking.
- intnet specifies that the VM communicates with other VMs by using internal networking.
- hostonly specifies that the VM uses host-only networking.
- natnetwork specifies that the VM uses NAT networking.
- generic specifies that the VM has access to rarely used submodes

15.12.2.15 Trace the Network Traffic of a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> nictrace*N* <on | off>

The **VBoxManage controlvm** *vmname* **nictrace***N* command enables you to trace the network traffic on the specified virtual network card (*N*). *N* numbering begins with 1. Valid values are on and off. The default value is off.

If you do not configure a file name for the trace file then a default one is used, placing it in the VM subdirectory.

15.12.2.16 Specify the Network Traffic Trace Log File for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> nictracefile*N* <*filename*>

The **VBoxManage controlvm** *vmname* **nictracefile***N* command enables you to specify the name of the network traffic trace log file for the specified virtual network card (*N*). *N* numbering begins with 1.

15.12.2.17 Specify the Promiscuous Mode to Use for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> nicpromisc*N* <deny | allow#vms | allow#all>

The **VBoxManage controlvm** *vmname* **nicpromisc***N* command enables you to specify how to handle promiscuous mode for a bridged network. The default value of deny hides any traffic that is not intended for this VM. The allow-vms value hides all host traffic from this VM but enables the VM to see traffic to and from other VMs. The allow-all value removes this restriction completely.

15.12.2.18 Specify the Network Backend Property Values for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> nicproperty*N* <*prop#name=prop#value*>

The **VBoxManage controlvm** *vmname* **nicproperty***N prop-name=prop-value* command, in combination with nicgenericdrv, enables you to pass property values to rarely-used network backends.

Those properties are backend engine-specific and are different between UDP Tunnel and the Virtual Distributed Ethernet (VDE) backend drivers. See *9.10 UDP Tunnel Networking on page 156*.

15.12.2.19 Specify a NAT Port Forwarding Rule for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> natpf*N*
<[*rulename*],<tcp|udp>,[*host#IP*],*hostport*,[*guest#IP*],*guestport*>

The **VBoxManage controlvm** *vmname* **natpf***N* command specifies a NAT port-forwarding rule. See *9.4.1 Configuring Port Forwarding with NAT on page 147*.

15.12.2.20 Delete a NAT Port Forwarding Rule for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> natpf*N*delete <*rulename*>

The **VBoxManage controlvm** *vmname* **natpf***N* **delete** command deletes the specified NAT port-forwarding rule. See *9.4.1 Configuring Port Forwarding with NAT on page 147*.

15.12.2.21 Change Size of a Virtual Machine's Guest Memory Balloon

VBoxManage controlvm <*uuid* | *vmname*> guestmemoryballoon <*balloon#size*>

The **VBoxManage controlvm** *vmname* **guestmemoryballoon** command changes the size of the guest memory balloon. The guest memory balloon is the memory allocated by the Oracle VirtualBox Guest Additions from the guest OS and returned to the hypervisor for reuse by other VMs. The value you specify is in megabytes. See *7.11.1 Memory Ballooning on page 121*.

15.12.2.22 Make a Host System USB Device Visible to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> usbattach <*uuid* | *address*> [##capturefile=*filename*]

The **VBoxManage controlvm** *vmname* **usbattach** command dynamically attaches a host USB device to the VM, which makes it visible. You do not need to create a filter.

Specify a USB device by its Universally Unique Identifier (UUID) or by its address on the host system. Use the **VBoxManage list usbhost** command to obtain information about USB devices on the host system.

Use the --capturefile option to specify the absolute path of a file in which to write logging data.

15.12.2.23 Make a Host System USB Device Invisible to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> usbdetach <*uuid* | *address*>

The **VBoxManage controlvm** *vmname* **usbdetach** command dynamically detaches a host USB device from the VM, which makes it invisible. You do not need to create a filter.

Specify a USB device by its UUID or by its address on the host system. Use the **VBoxManage list usbhost** command to obtain information about USB devices on the host system.

15.12.2.24 Enable or Disable Audio Capture From the Host System

VBoxManage controlvm <*uuid* | *vmname*> audioin <on | off>

The **VBoxManage controlvm** *vmname* **audioin** command specifies whether to enable or disable audio capture from the host system. Valid values are on, which enables audio capture and off, which disables audio capture. The default value is off.

15.12.2.25 Enable or Disable Audio Playback From a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> audioout <on | off>

The **VBoxManage controlvm** *vmname* **audioout** command specifies whether to enable or disable audio playback from the guest VM. Valid values are on, which enables audio playback and off, which disables audio playback. The default value is off.

15.12.2.26 Specify How to Share the Host OS or Guest OS Clipboard

VBoxManage controlvm <*uuid* | *vmname*> clipboard mode <disabled | hosttoguest | guesttohost | bidirectional>

The **VBoxManage controlvm** *vmname* **clipboard mode** command specifies how to share the guest or host OS's clipboard with the host system or VM. Valid values are disabled, hosttoguest, guesttohost, and bidirectional. The default value is disabled. See *5.12 General Settings on page 70*.

This feature requires the Oracle VirtualBox Guest Additions to be installed in the VM.

15.12.2.27 Specify If Files Can Be Transferred Through the Clipboard

VBoxManage controlvm <*uuid* | *vmname*> clipboard filetransfers <on | off>

The **VBoxManage controlvm** *vmname* **clipboard filetransfers** command specifies if it is possible to transfer files through the clipboard between the host and VM in the direction(s) configured for the **clipboard mode**. Valid values are off and on. The default value is off.

This feature requires the Oracle VirtualBox Guest Additions to be installed in the VM.

15.12.2.28 Set the Drag and Drop Mode Between the Host System and a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> draganddrop <disabled | hosttoguest | guesttohost | bidirectional>

The **VBoxManage controlvm** *vmname* **draganddrop** command specifies the current drag and drop mode to use between the host system and the VM. Valid values are disabled, hosttoguest, guesttohost, and bidirectional. The default value is disabled. See *7.5 Drag and Drop on page 115*.

This feature requires the Oracle VirtualBox Guest Additions to be installed in the VM.

15.12.2.29 Enable or Disable the VRDE Server

VBoxManage controlvm <*uuid* | *vmname*> vrde <on | off>

The **VBoxManage controlvm** *vmname* **vrde** command enables or disables the VirtualBox Remote Desktop Extension (VRDE) server, if installed. Valid values are on and off. The default value is off.

15.12.2.30 Specify VRDE Server Ports

VBoxManage controlvm <*uuid* | *vmname*> vrdeport <*port*>

The **VBoxManage controlvm** *vmname* **vrdeport** command specifies the port or range of ports to which the VRDE server can bind. The default value is default or 0, which uses the standard RDP port, 3389.

See also the --vrde-port option description in *15.35 VBoxManage modifyvm on page 402*.

15.12.2.31 Specify VRDE Server Port Numbers and IP Addresses

VBoxManage controlvm *<uuid | vmname>* vrdeproperty *<prop#name=prop#value>*

The **VBoxManage controlvm** *vmname* **vrdeproperty** command specifies the port numbers and IP address on the VM to which the VRDE server can bind.

- TCP/Ports specifies a port or a range of ports to which the VRDE server can bind. The default value is default or 0, which is the standard RDP port, 3389.

  See also the --vrde-port option description in *15.35 VBoxManage modifyvm on page 402*.
- TCP/Address specifies the IP address of the host network interface to which the VRDE server binds. When specified, the server accepts connections only on the specified host network interface.

  See also the --vrde-address option description in *15.35 VBoxManage modifyvm on page 402*.
- VideoChannel/Enabled specifies whether to enable the VirtualBox Remote Desktop Protocol (VRDP) video channel. Valid values are 1 to enable the video channel and 0 to disable the video channel. The default value is 0. See *10.1.10 VRDP Video Redirection on page 169*.
- VideoChannel/Quality specifies the JPEG compression level on the VRDE server video channel. Valid values are between 10% and 100%, inclusive. Lower values mean lower quality but higher compression. The default value is 100. See *10.1.10 VRDP Video Redirection on page 169*.
- VideoChannel/DownscaleProtection specifies whether to enable the video channel downscale protection feature. Specify 1 to enable the feature. This feature is disabled by default.

  When enabled, if the video's size equals the shadow buffer size, the video is shown in full-screen mode. If the video's size is between full-screen mode and the downscale threshold, the video is not shown as it might be an application window that is unreadable when downscaled. When disabled, the downscale protection feature always attempts to show videos.
- Client/DisableDisplay specifies whether to disable the VRDE server display feature. Valid values are 1 to disable the feature and an empty string ("") to enable the feature. The default value is an empty string. See *10.1.11 VRDP Customization on page 169*.
- Client/DisableInput specifies whether to disable the VRDE server input feature. Valid values are 1 to disable the feature and an empty string ("") to enable the feature. The default value is 1. See *10.1.11 VRDP Customization on page 169*.
- Client/DisableAudio specifies whether to disable the VRDE server audio feature. Valid values are 1 to disable the feature and an empty string ("") to enable the feature. The default value is 1. See *10.1.11 VRDP Customization on page 169*.
- Client/DisableUSB specifies whether to disable the VRDE server USB feature. Valid values are 1 to disable the feature and an empty string ("") to enable the feature. The default value is 1. See *10.1.11 VRDP Customization on page 169*.
- Client/DisableClipboard specifies whether to disable the VRDE clipboard feature. Valid values are 1 to disable the feature and an empty string ("") to enable the feature. To re-enable the feature, use Client/DisableClipboard=. The default value is 1. See *10.1.11 VRDP Customization on page 169*.
- Client/DisableUpstreamAudio specifies whether to disable the VRDE upstream audio feature. Valid values are 1 to disable the feature and an empty string ("") to enable the feature. To re-enable the feature, use Client/DisableUpstreamAudio=. The default value is 1. See *10.1.11 VRDP Customization on page 169*.

- Client/DisableRDPDR specifies whether to disable the RDP Device Redirection For Smart Cards feature on the VRDE server. Valid values are 1 to disable the feature and an empty string ("") to enable the feature. The default value is 1. See *10.1.11 VRDP Customization on page 169*.
- H3DRedirect/Enabled specifies whether to enable the VRDE server 3D redirection feature. Valid values are 1 to enable the feature and an empty string ("") to disable the feature. See *10.1.11 VRDP Customization on page 169*.
- Security/Method specifies the security method to use for a connection. See *10.1.7 RDP Encryption on page 167*.
  - Negotiate accepts both enhanced (TLS) and standard RDP security connections. The security method is negotiated with the client. This is the default value.
  - RDP accepts only standard RDP security connections.
  - TLS accepts only enhanced RDP security connections. The client must support TLS.
- Security/ServerCertificate specifies the absolute path of the server certificate to use for a connection. See *10.1.7 RDP Encryption on page 167*.
- Security/ServerPrivateKey specifies the absolute path of the server private key. See *10.1.7 RDP Encryption on page 167*.
- Security/CACertificate specifies the absolute path of the CA self-signed certificate. See *10.1.7 RDP Encryption on page 167*.
- Audio/RateCorrectionMode specifies the rate correction mode to use.
  - VRDP_AUDIO_MODE_VOID indicates that no mode is specified. Use this value to unset any audio mode that is already set.
  - VRDP_AUDIO_MODE_RC specifies to use the rate correction mode.
  - VRDP_AUDIO_MODE_LPF specifies to use the low pass filter mode.
  - VRDP_AUDIO_MODE_CS specifies to use the client sync mode to prevent underflow or overflow of the client queue.
- Audio/LogPath specifies the absolute path of the audio log file.

15.12.2.32 Specify the Image Quality for VRDP Video Redirection

VBoxManage controlvm <*uuid* | *vmname*> vrdevideochannelquality <*percentage*>

The **VBoxManage controlvm** *vmname* **vrdevideochannelquality** command sets the image quality, as a JPEG compression level value, for video redirection. Valid values are between 10% and 100%, inclusive. Lower values mean lower quality but higher compression. See *10.1.10 VRDP Video Redirection on page 169*.

15.12.2.33 Specify the Video Mode for the Guest VM

VBoxManage controlvm <*uuid* | *vmname*> setvideomodehint <*xres*> <*yres*> <*bpp*> [*display* [<yes | no> [*x#origin y#origin*]]]

The **VBoxManage controlvm** *vmname* **setvideomodehint** command specifies the video mode for the guest VM to use. You must have the Oracle VirtualBox Guest Additions installed. Note that this feature does not work for all guest systems.

15.12.2.34 Specify the Screen Layout for a Display on the Guest VM

VBoxManage controlvm <*uuid* | *vmname*> setscreenlayout <*display*> <on | primary *x#origin y#origin x#resolution y#resolution bpp* | off>

The **VBoxManage controlvm** *vmname* **setscreenlayout** command can be used to configure multiscreen displays. The specified screen on the guest VM can be enabled or disabled, or a custom screen layout can be configured.

15.12.2.35 Take a Screen Shot of the Virtual Machine Display

VBoxManage controlvm <*uuid* | *vmname*> screenshotpng <*filename*> [*display*]

The **VBoxManage controlvm** *vmname* **screenshotpng** command takes a screenshot of the guest display and saves it as PNG in the specified file.

- *filename* specifies the name of the PNG file to create.
- *display* specifies the display number for the screen shot. For a single monitor guest display, this is 0.

15.12.2.36 Recording of a Virtual Machine Session

VBoxManage controlvm <*uuid* | *vmname*> recording <on | off> VBoxManage controlvm <*uuid* | *vmname*> recording start [##wait] VBoxManage controlvm <*uuid* | *vmname*> recording stop VBoxManage controlvm <*uuid* | *vmname*> recording attach VBoxManage controlvm <*uuid* | *vmname*> recording screens <all | none | *screen#ID ,screen#ID...*> VBoxManage controlvm <*uuid* | *vmname*> recording filename <filename> VBoxManage controlvm <*uuid* | *vmname*> recording videores <<*width*>x <*height*>> VBoxManage controlvm <*uuid* | *vmname*> recording videorate <*rate*> VBoxManage controlvm <*uuid* | *vmname*> recording videofps <*fps*> VBoxManage controlvm <*uuid* | *vmname*> recording maxtime <*sec*> VBoxManage controlvm <*uuid* | *vmname*> recording maxfilesize <*MB*> VBoxManage controlvm <*uuid* | *vmname*> recording opts <*key*=[*value*]>

The **VBoxManage controlvm** *vmname* **recording** command enables or disables the recording of a VM session into a WebM/VP8 file. Valid values are on, which begins recording when the VM session starts and off, which disables recording. The default value is off.

The **VBoxManage controlvm** *vmname* **recording start** command starts the recording of a VM session into a WebM/VP8 file.

The **VBoxManage controlvm** *vmname* **recording stop** command stops the recording of a VM session.

The **VBoxManage controlvm** *vmname* **recording attach** command attaches to a running recording of a VM session.

The **VBoxManage controlvm** *vmname* **recording screens** command enables you to specify which VM screens to record. The recording for each screen that you specify is saved to its own file in the machine folder. You cannot modify this setting while a screen recording is in progress.

- all specifies that you record all VM screens.
- none specifies that you do not record any VM screens.
- *screen-ID* specifies one or more VM screens to record.

The **VBoxManage controlvm** *vmname* **recording filename** command specifies the file in which to save the recording. You cannot modify this setting while a screen recording is in progress.

The default setting is to store a recording in the machine folder, using the VM name as the file name, with a webm file name extension.

The **VBoxManage controlvm** *vmname* **recording videores** command specifies the resolution of the recorded video in pixels. You cannot modify this setting while a screen recording is in progress.

The *Recording* settings in the GUI which are located in the *Display* page show the current video recording settings which are based on the resolution (frame size). The *Frame Size* field shows the default value for the recording video resolution.

Specify the resolution as *width*x*height*:

- *width* specifies the width in pixels.
- *height* specifies the height in pixels.

The **VBoxManage controlvm** *vmname* **recording videorate** command specifies the *bit-rate*, of the video in kilobits per second. Increasing this value improves the appearance of the video at the cost of an increased file size. You cannot modify this setting while a VM is running with recording enabled.

The *Recording* settings in the GUI which are located in the *Display* page show the current video recording settings which are based on the resolution (frame size). The *Video Quality* field shows the default value for the recording video quality.

The **VBoxManage controlvm** *vmname* **recording videofps** command specifies the maximum frequency of the video to record. Video frequency is measured in frames per second (FPS). The recording skips any frames that have a frequency higher than the specified maximum. Increasing the frequency reduces the number of skipped frames and increases the file size. You cannot modify this setting while a VM is running with recording enabled.

The *Recording* settings in the GUI which are located in the *Display* page show the current video recording settings which are based on the resolution (frame size). The *Frame Rate* field shows the default value for the recording frame rate.

The **VBoxManage controlvm** *vmname* **recording maxtime** command specifies the maximum amount time to record in seconds. The recording stops after the specified number of seconds elapses. If this value is zero, the recording continues until you stop the VM or stop the recording.

The **VBoxManage controlvm** *vmname* **recording maxfilesize** command specifies the maximum size of the recorded video file in megabytes. The recording stops when the file reaches the specified size. If this value is zero, the recording continues until you stop the VM or stop the recording. You cannot modify this setting while a screen recording is in progress.

The **VBoxManage controlvm** *vmname* **recording opts** command specifies additional recording options in a comma-separated keyword-value format. For example, foo=bar,a=b. You cannot modify this setting while a screen recording is in progress.

Use this option if you are an advanced user only. For information about keywords, see *Oracle VirtualBox Programming Guide and Reference*.

15.12.2.37 Specify Credentials for Remote Logins on Windows Virtual Machines

VBoxManage controlvm <*uuid* | *vmname*> setcredentials <*username*> ##passwordfile=<*filename* | *password*> <*domain#name*> ##allowlocallogon=<yes | no>

The **setcredentials** command enables you to specify the credentials for remotely logging in to Windows VMs. See *11.1 Automated Guest Logins on page 175*.

- *username* specifies the user name with which to log in to the Windows VM.
- --passwordfile=*filename* specifies the file from which to obtain the password for *username*.

  The --passwordfile option is mutually exclusive with the --password option.
- --password=*password* specifies the password for *username*.

The --password option is mutually exclusive with the --passwordfile option.

- --allowlocallogon specifies whether to enable or disable local logins. Valid values are on to enable local logins and off to disable local logins.

15.12.2.38 Configure a Virtual Machine Target for Teleporting

VBoxManage controlvm <*uuid* | *vmname*> teleport <##host=*host#name*> <##port=*port#name*> [##maxdowntime=*msec*] [##passwordfile=*filename* | ##password=*password*]

The **VBoxManage controlvm** *vmname* **teleport** command initiates a teleporting operation between the specified VM and the specified host system. See *10.2 Teleporting on page 169*.

If you specify a password, it must match the password you specified when you issued the **VBoxManage modifyvm** command for the target machine.

--host=*hostname*

Specifies the name of the VM.

--port=*port*

Specifies the port on the VM that should listen for a teleporting request from other VMs. The port number can be any free TCP/IP port number, such as 6000.

--maxdowntime=*msec*

Specifies the maximum downtime, in milliseconds, for the teleporting target VM.

--password=*password*

Specifies the password that the source machine uses for the teleporting request. The request succeeds only if the source machine specifies the same password.

The --password option is mutually exclusive with the --passwordfile option.

--passwordfile=*filename*

Specifies the file from which to obtain the password that the source machine uses for the teleporting request. The request succeeds only if the source machine specifies the same password.

When you specify a file name of stdin, you can read the password from standard input.

The --passwordfile option is mutually exclusive with the --password option.

15.12.2.39 Add a Virtual CPU to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> plugcpu <*ID*>

The **VBoxManage controlvm** *vmname* **plugcpu** command adds a virtual CPU to the specified VM if CPU hot-plugging is enabled. *ID* specifies the index of the virtual CPU to be added and must be a number from 0 to the maximum number of CPUs configured.

15.12.2.40 Remove a Virtual CPU From a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> unplugcpu <*ID*>

The **VBoxManage controlvm** *vmname* **unplugcpu** command removes a virtual CPU from the specified VM if CPU hot-plugging is enabled. *ID* specifies the index of the virtual CPU to be

removed and must be a number from 0 to the maximum number of CPUs configured. You cannot remove CPU 0.

15.12.2.41 Set the Maximum Amount of Physical CPU Time Used by a Virtual CPU

VBoxManage controlvm <*uuid* | *vmname*> cpuexecutioncap <*num*>

The **VBoxManage controlvm** *vmname* **cpuexecutioncap** command specifies the maximum amount of physical CPU time used by a virtual CPU. Valid values are a percentage between 1 and 100. A value of 50 specifies that a single virtual CPU can use up to 50% of a physical CPU. The default value is 100.

Use this feature with caution, it can have unexpected results including timekeeping problems and lower performance than specified. If you want to limit the resource usage of a VM it is more reliable to pick an appropriate number of VCPUs.

15.12.2.42 Change the Priority of a VM Process

VBoxManage controlvm <*uuid* | *vmname*> vm#process#priority <default | flat | low | normal | high>

The **VBoxManage controlvm** *vmname* **vm-process-priority** command specifies the priority scheme of the VM process to use when starting the specified VM and while the VM runs.

Valid values are:

- default – Default process priority determined by the OS.
- flat – Uses a scheduling policy which puts the process at the default priority and with all threads at the same priority.
- low – Uses a scheduling policy which puts the process mostly below the default priority of the host OS.
- normal – Uses a scheduling policy which shares the CPU resources fairly with other processes running with the default priority of the host OS.
- high – Uses a scheduling policy which puts the task above the default priority of the host OS. This policy might easily cause other tasks in the system to starve.

15.12.2.43 Attach a Webcam to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> webcam attach [*pathname* [*settings*]]

The **VBoxManage controlvm** *vmname* **webcam attach** command attaches a webcam to a running VM. Specify the webcam as the absolute path of the webcam on the host OS or as an alias. Use the **VBoxManage list webcams** command to obtain the webcam alias.

Note that the .0 alias is the default video input device on the host OS. .1 is the first video input device, .2 is the second video input device, and so on. The order of the devices is specific to the host system.

You can specify optional settings in the form of semicolon-separated (;) name-value pairs. These properties enable you to configure the emulated webcam device.

The following settings are supported:

MaxFramerate

Specifies the highest rate at which to send video frames to the VM. The rate is in frames per second. Higher frame rates increase CPU load, so you can use this setting to reduce CPU load. The default value is no maximum limit. This value enables the VM to use any frame rate supported by the webcam.

MaxPayloadTransferSize

Specifies the maximum number of bytes that the VM receives from the emulated webcam in one buffer. The default setting is 3060 bytes, which is used by some webcams. If the VM is able to use larger buffers, higher values might reduce CPU load slightly. Note that some guest OSes might not support higher MaxPayloadTransferSize values.

15.12.2.44 Detach a Webcam From a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> webcam detach [*pathname*]

The **VBoxManage controlvm** *vmname* **webcam detach** command detaches a webcam from a running VM. Specify the webcam as the absolute path of the webcam on the host OS or as an alias. Use the **VBoxManage list webcams** command to obtain the webcam alias.

When a webcam device is detached from the host, the host OS determines how the emulated webcam behaves.

- *Windows hosts:* The emulated webcam device is detached from the VM automatically.
- *Mac OS X hosts that run at least OS X 10.7:* The emulated webcam device remains attached to the VM and you must detach it manually by using the **VBoxManage controlvm webcam detach** command.
- *Linux hosts:* The emulated webcam device is detached from the VM automatically only if the webcam is actively streaming video. If the emulated webcam is inactive, manually detach it by using the **VBoxManage controlvm** *vmname* **webcam detach** command.

15.12.2.45 List the Webcams Attached to a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> webcam list

The **VBoxManage controlvm** *vmname* **webcam list** command lists webcams that are attached to the running VM. The output shows a list of absolute paths or aliases of the webcams which were attached to the VM using the **VBoxManage controlvm** *vmname* **webcam attach** command.

15.12.2.46 Starting a Virtual Machine with Encrypted Images

VBoxManage controlvm <*uuid* | *vmname*> addencpassword <*ID*> <*password#file* | *#*>
[##removeonsuspend=yes | no]

You can encrypt the data stored in the hard disk images used by the VM. Oracle VirtualBox uses the AES algorithm in XTS mode and supports 128-bit or 256-bit data encryption keys (DEK). The encrypted DEK is stored in the medium properties and is decrypted during VM startup when you provide the encryption password.

Use the **VBoxManage encryptmedium** command to create a DEK encrypted medium. See *11.27.2 Encrypting Disk Images on page 220*.

When a VM which contains one or more encrypted disk images is started using the Oracle VirtualBox GUI a dialog will open to prompt the user for the password of each encrypted disk attached to the VM. If the **VBoxHeadless** frontend is used, the VM will be paused as soon as the guest tries to access an encrypted disk. The user needs to provide the passwords by using **addencpassword** subcommand.

The **VBoxManage controlvm** *vmname* **addencpassword** command provides the encryption password to the VM named *vmname* which contains encrypted disks that has been started using the **VBoxHeadless** frontend. Specify the absolute path of a password file on the host system. If *filename* is -, **VBoxManage** prompts for the encryption password.

Use the --removeonsuspend option to specify whether to save the passsword or clear it from VM memory when the VM is suspended.

If the VM is suspended and the password is cleared, use the **VBoxManage controlvm** *vmname* **addencpassword** to provide the password to resume execution on the VM. Use this feature when you do not want to store the password in VM memory when the VM is suspended by a host suspend event.

The following is one way to perform a headless start of VM which contains encrypted disk images:

```
$ VBoxManage startvm vmname --type headless
```

The following command provides the encryption password to the VM so that it can resume starting up:

```
$ VBoxManage vmname controlvm addencpassword vmname -
Password: encryption-password
```

15.12.2.47 Disable an Encryption Password for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> removeencpassword <*ID*>

The **VBoxManage controlvm** *vmname* **removeencpassword** command disables a specific encryption password for all encrypted media attached to the VM.

ID is the password identifier for the encryption password that you want to disable.

15.12.2.48 Disable All Encryption Passwords for a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> removeallencpasswords

The **VBoxManage controlvm** *vmname* **removeallencpasswords** command disables all encryption passwords for all encrypted media attached to the VM.

15.12.2.49 Change the Connection Mode for a Virtual Serial Port on a Virtual Machine

VBoxManage controlvm <*uuid* | *vmname*> changeuartmode*N* disconnected | server *pipe#name* | client *pipe#name* | tcpserver *port* | tcpclient *hostname*:*port* | file *filename* | *device#name*

The **VBoxManage controlvm** *vmname* **changeuartmode** command changes the connection mode for the specified virtual serial port. Valid serial port values are integers that start from 1.

disconnected

Disconnects the device.

server *pipe-name*

Specifies the pipe name of the server.

client *pipe-name*

Specifies the pipe name of the client.

tcpserver *port*

Specifies the port number of the TCP server.

tcpclient *hostname*:*port*

Specifies the host name and port number of the TCP client.

file *filename*

Specifies the name of the file.

device-name

Specifies the name of the device.

15.12.2.50 Enabling autostart the VM during host system boot

VBoxManage controlvm <*uuid* | *vmname*> autostart#enabled*N* on | off

The **VBoxManage controlvm** *vmname* **autostart-enabled** command specifies whether to enable or disable automatically starting of the VM at host system boot-up. You must do some host system configuration before you can use this feature. See *11.19 Starting Virtual Machines During System Boot on page 213*. Valid values are on, which enables the autostart feature for the VM and off, which disables it. The default value is off.

15.12.2.51 Setting the delay of starting the VM on host system boot

VBoxManage controlvm <*uuid* | *vmname*> autostart#delay <*seconds*>

The **VBoxManage controlvm** *vmname* **autostart-delay** command specifies the delay in seconds before the VM starts on host system boot-up. See *11.19 Starting Virtual Machines During System Boot on page 213*.

15.12.3 Examples

The following command temporarily stops the execution of the ol7 VM.

```
$ VBoxManage controlvm ol7 pause
```

The following command configures shared clipboard operation for the ol7 VM. Copying of clipboard data is allowed in both directions between the host and guest.

```
$ VBoxManage controlvm ol7 clipboard mode bidirectional
```

15.12.4 See Also

15.29 VBoxManage list on page 384, *15.35 VBoxManage modifyvm on page 402*, *15.47 VBoxManage startvm on page 446*

15.13 VBoxManage convertfromraw

Convert a raw disk image to a virtual disk image

15.13.1 Synopsis

VBoxManage convertfromraw <*inputfile*> <*outputfile*> [##format=VDI | VMDK | VHD] [##uuid=*uuid*] [##variant=Standard|Fixed|Split2G|Stream|ESX...]

VBoxManage convertfromraw stdin <*outputfile*> <*bytes*> [##format=VDI | VMDK | VHD] [##uuid=*uuid*] [##variant=Standard|Fixed|Split2G|Stream|ESX...]

15.13.2 Description

The **VBoxManage convertfromraw** command enables you to convert a raw disk image to an Oracle VirtualBox virtual disk image (VDI).

Note:

For compatibility with earlier versions of Oracle VirtualBox, you can use the **VBoxManage convertdd** command instead of the **VBoxManage convertfromraw** command.

15.13.2.1 Convert a Raw Disk File to a Virtual Disk Image File

VBoxManage convertfromraw <*inputfile*> <*outputfile*> [##format=VDI | VMDK | VHD] [##uuid=*uuid*] [##variant=Standard|Fixed|Split2G|Stream|ESX...]

The **VBoxManage convertfromraw** command converts the specified raw disk image input file to an Oracle VirtualBox VDI file.

inputfile

Specifies the name of the raw disk image file to convert.

outputfile

Specifies the name of the file in which to write the VDI output.

--format=VDI | VMDK | VHD

Specifies the format of the disk image to create. Valid values are VDI, VMDK, and VHD. The default format is VDI.

--uuid=*uuid*

Specifies the Universally Unique Identifier (UUID) of the output file.

--variant=Standard | Fixed | Split2G | Stream | ESX[,...]

Specifies any required file format variants for the output file. This is a comma-separated list of variant values. Following are the valid values:

- Standard is the default disk image type, which has a dynamically allocated file size.
- Fixed uses a disk image that has a fixed file size.
- Split2G indicates that the disk image is split into 2GB segments. This value is for VMDK only.
- Stream optimizes the disk image for downloading. This value is for VMDK only.
- ESX is used for some VMWare products. This value is for VMDK only.

Note that not all variant combinations are valid. Specifying incompatible variant values in the list will produce an error message.

15.13.2.2 Convert Raw Data From Standard Input to a Virtual Disk Image File

VBoxManage convertfromraw stdin <*outputfile*> <*bytes*> [##format=VDI | VMDK | VHD] [##uuid=*uuid*] [##variant=Standard|Fixed|Split2G|Stream|ESX...]

The **VBoxManage convertfromraw stdin** command reads the content of the disk image from standard input. Consider using this form of the command in a pipe sequence.

outputfile

Specifies the name of the file in which to write the disk image output.

bytes

Specifies the capacity of the target image name. This needs to be given explicitly, because generally pipes do not support querying the overall size of the data stream.

--format=VDI | VMDK | VHD

Specifies the format of the disk image to create. Valid values are VDI, VMDK, and VHD. The default format is VDI.

--uuid=*uuid*

Specifies the UUID of the output file.

--variant=Standard,Fixed,Split2G,Stream,ESX

Specifies any required file format variants for the output file. This is a comma-separated list of variant values. The list of valid values is:

- Standard is the default disk image type, which has a dynamically allocated file size.
- Fixed uses a disk image that has a fixed file size.
- Split2G indicates that the disk image is split into 2GB segments. This value is for VMDK only.
- Stream optimizes the disk image for downloading. This value is for VMDK only.
- ESX is used for some VMWare products. This value is for VMDK only.

Note that not all variant combinations are valid. Specifying incompatible variant values in the list will produce an error message.

15.13.3 Examples

The following command converts the raw disk image input file disk01.raw. The output file is a VDI disk image called disk02.vdi.

```
$ VBoxManage convertfromraw disk01.raw disk02.vdi
```

The following command converts the raw disk image input file disk01.raw. The output file is a VMDK disk image called disk02.vmdk.

```
$ VBoxManage convertfromraw disk01.raw disk02.vmdk --format VMDK
```

The following command reads from disk /dev/sda using a pipe and therefore needs the exact disk size in bytes as an additional parameter, which is assumed to be 10737418240. The output file is a VDI disk image called disk.vdi.

```
$ dd if=/dev/sda bs=512 | VBoxManage convertfromraw stdin disk.vdi 10737418240
```

15.14 VBoxManage createmedium

Create a new medium

15.14.1 Synopsis

VBoxManage createmedium [*disk* | *dvd* | *floppy*] <##filename=*filename*> [##size=*megabytes* | ##sizebyte=*bytes*] [##diffparent=*UUID* | *filename*] [##format=*VDI* | *VMDK* | *VHD*] [##variant=Standard|Fixed|Split2G|Stream|ESX|Formatted|RawDisk...] [##property=*name*=*value*...] [##property#file=*name*=*/path/to/file/with/value*...]

15.14.2 Description

The **VBoxManage createmedium** command creates a new medium, such as a disk image file.

> **Note:**
>
> For compatibility with earlier versions of Oracle VirtualBox, you can use the **createvdi** and **createhd** commands instead of the **createmedium** command.

disk | dvd | floppy

Specifies the media type. The default value is disk.

--filename=*filename*

Specifies the absolute path name to a file on the host file system.

--size=*megabytes*

Specifies the image capacity in one megabyte units.

--sizebyte=*bytes*

Specifies the image capacity in one byte units.

--diffparent=*UUID* | *filename*

Specifies the Universally Unique Identifier (UUID) or absolute path name of a differencing image parent file on the host file system.

Use this file to share a base box disk image among VMs.

--format=VDI | VMDK | VHD

Specifies the file format of the output file. Valid formats are VDI, VMDK, and VHD. The default format is VDI.

--variant=Standard | Fixed | Split2G | Stream | ESX | Formatted | RawDisk [,...]

Specifies the file format variant for the target medium, which is a comma-separated list of variants. Following are the valid values:

- Standard is the default disk image type, which has a dynamically allocated file size.
- Fixed uses a disk image that has a fixed file size.
- Split2G indicates that the disk image is split into 2GB segments. This value is valid for VMDK disk images only.
- Stream optimizes the disk image for downloading. This value is valid for VMDK disk images only.
- ESX is used for some VMWare products. This value is valid for VMDK disk images only.
- Formatted formats the medium automatically. This value is valid for floppy images only.
- RawDisk is used for creating a VMDK image which provides direct access to the hard disk on the host using its raw interface. This value is valid for VMDK disk images only. For detailed information about raw disk access, see *11.5 Advanced Storage Configuration on page 183*.

Note that not all variant combinations are valid. Specifying incompatible variant values in the list will produce an error message.

--property=*name=value*

Specifies any required file format dependent parameters in key=value form. Optional.

--property-file=*name=/path/to/file/with/value*

Specifies any required file format dependent parameters in key=file/with/value form. The value is taken from the file. Optional.

15.14.3 Examples

The following command creates a new disk image file named disk01.vdi. The file size is 1024 megabytes.

```
$ VBoxManage createmedium --filename disk01.vdi --size 1024
```

The following command creates a new floppy disk image file named floppy01.vdi. The file size is 1 megabyte.

```
$ VBoxManage createmedium floppy --filename floppy01.img --size 1
```

The following command creates a raw disk image of an entire physical disk on a Linux host.

```
$ VBoxManage createmedium disk --filename=/path/to/rawdisk.vmdk --variant=RawDisk --format=VMDK
 --property RawDrive=/dev/sda
```

15.15 VBoxManage createvm

Create a new virtual machine

15.15.1 Synopsis

VBoxManage createvm <##name=*name*> <##platform#architecture=x86 | arm> [##basefolder=*basefolder*] [##default] [##groups=*group#ID* [,...]] [##ostype=*ostype*] [##register] [##uuid=*uuid*] [##cipher=*cipher*] [##password#id=*password#id*] [##password=*file*]

15.15.2 Description

The **VBoxManage createvm** command creates a new XML virtual machine (VM) definition file.

You must specify the name of the VM by using --name *name*. This name is used by default as the name of the settings file that has the .vbox extension and the machine folder, which is a subfolder of the $HOME/VirtualBox VMs directory.

The actual file name may not correspond directly to the VM name if it violates the host OS file name requirements (such as using the path separator or other reserved characters, they will be substituted with a placeholder). If you later rename the VM, the file and folder names will be updated to match the new name automatically.

Also, the intended platform architecture for the VM must be specified by using --platform-architecture*architecture* .

15.15.3 Command Options

In addition to specifying the name or UUID of the VM and the platform architecture, which is required, you can specify any of the following options:

--basefolder=*basefolder*

Specifies the name of the folder in which to save the machine configuration file for the new VM.

Note that the names of the file and the folder do not change if you rename the VM.

--default

Applies a default hardware configuration for the specified guest OS. By default, the VM is created with minimal hardware.

--groups=*group-ID*[,...]

Assigns the VM to the specified groups. If you specify more than one group, separate each group name with a comma.

Note that each group is identified by a group ID that starts with a slash character (/) so that groups can be nested. By default, a VM is always assigned membership to the / group.

--ostype=*ostype*

Specifies the guest OS to run in the VM. Run the **VBoxManage list ostypes** command to see the available OS types.

--register

Registers the VM with your Oracle VirtualBox installation. By default, the **VBoxManage createvm** command creates only the XML configuration for the VM but does not register the VM. If you do not register the VM at creation, you can run the **VBoxManage registervm** command after you create the VM.

--uuid=*uuid*

Specifies the Universally Unique Identifier (UUID) of the VM. Ensure that this UUID is unique within the Oracle VirtualBox namespace of the host or of its VM group memberships if you decide to register the VM. By default, Oracle VirtualBox provides the UUID.

--cipher=*cipher*

Specifies the cipher to use for encryption. Valid values are AES-128 or AES-256.

This option enables you to set up encryption on VM.

--password-id=*password-id*

Specifies a new password identifier that is used for correct identification when supplying multiple passwords for the VM.

This option enables you to set up encryption on VM.

--password=*file*

Use the --password to supply the encryption password of the VM. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password on the command line.

This option enables you to set up encryption on VM.

15.15.4 Examples

The following command creates a VM called vm2 where you plan to run a 64-bit version of Oracle Linux.

```
$ VBoxManage createvm --name "vm2" --ostype "Oracle_64"
```

The following command creates and registers a VM called vm3.

```
$ VBoxManage createvm --name "vm3" --register
```

15.15.5 See Also

15.29 VBoxManage list on page 384, *15.39 VBoxManage registervm on page 432*

15.16 VBoxManage debugvm

Introspection and guest debugging

15.16.1 Synopsis

VBoxManage debugvm <*uuid* | *vmname*> dumpvmcore <##filename=*name*>

VBoxManage debugvm <*uuid* | *vmname*> info <*item*> [*args*...]

VBoxManage debugvm <*uuid* | *vmname*> injectnmi

VBoxManage debugvm <*uuid* | *vmname*> log [##release | ##debug] [*group#settings*...]

VBoxManage debugvm <*uuid* | *vmname*> logdest [##release | ##debug] [*destinations*...]

VBoxManage debugvm <*uuid* | *vmname*> logflags [##release | ##debug] [*flags*...]

VBoxManage debugvm <*uuid* | *vmname*> osdetect

VBoxManage debugvm <*uuid* | *vmname*> osinfo

VBoxManage debugvm <*uuid* | *vmname*> osdmesg [##lines=*lines*]

VBoxManage debugvm <*uuid* | *vmname*> getregisters [##cpu=*id*] [*reg#set.reg#name*...]

VBoxManage debugvm <*uuid* | *vmname*> setregisters [##cpu=*id*] [*reg#set.reg#name=value*...]

VBoxManage debugvm <*uuid* | *vmname*> show [##human#readable | ##sh#export | ##sh#eval | ##cmd#set] [*settings#item*...]

VBoxManage debugvm <*uuid* | *vmname*> stack [##cpu=*id*]

VBoxManage debugvm <*uuid* | *vmname*> statistics [##reset] [##descriptions] [##pattern=*pattern*]

VBoxManage debugvm <*uuid* | *vmname*> guestsample [##filename=*filename*] [##sample#interval#us=*interval*] [##sample#time#us=*time*]

15.16.2 Description

The "debugvm" commands are for experts who want to tinker with the exact details of virtual machine execution. Like the VM debugger described in *13.5.2 The Built-In VM Debugger on page 244*, these commands are only useful if you are very familiar with the details of the PC architecture and how to debug software.

15.16.2.1 Common options

The subcommands of **debugvm** all operate on a running virtual machine:

uuid | vmname

Either the UUID or the name (case sensitive) of a VM.

15.16.2.2 debugvm dumpvmcore

VBoxManage debugvm <*uuid* | *vmname*> dumpvmcore <##filename=*name*>

Creates a system dump file of the specified VM. This file will have the standard ELF core format (with custom sections); see *13.5.3 VM Core Format on page 246*.

This corresponds to the **writecore** command in the debugger.

--filename=*filename*

The name of the output file. This option is required.

15.16.2.3 debugvm info

VBoxManage debugvm <*uuid* | *vmname*> info <*item*> [*args*...]

Displays info items relating to the VMM, device emulations and associated drivers.

This corresponds to the **info** command in the debugger.

item

Name of the info item to display. The special name help will list all the available info items and hints about optional arguments.

args

Optional argument string for the info item handler. Most info items do not take any extra arguments. Arguments not recognized are generally ignored.

15.16.2.4 debugvm injectnmi

VBoxManage debugvm <*uuid* | *vmname*> injectnmi

Causes a non-maskable interrupt (NMI) to be injected into the guest. This might be useful for certain debugging scenarios. What happens exactly is dependent on the guest operating system, but an NMI can crash the whole guest operating system. Do not use unless you know what you're doing.

15.16.2.5 debugvm log

VBoxManage debugvm <*uuid* | *vmname*> log [##release | ##debug] [*group#settings*...]

Changes the group settings for either the debug (--debug) or release (--release) logger of the VM process.

The *group-settings* are typically strings of the form em.e.f.l, hm=~0 and -em.f. Basic wildcards are supported for group matching. The all group is an alias for all the groups.

Please keep in mind that the group settings are applied as modifications to the current values.

This corresponds to the **log** command in the debugger.

15.16.2.6 debugvm logdest

VBoxManage debugvm <*uuid* | *vmname*> logdest [##release | ##debug] [*destinations*...]

Changes the destination settings for either the debug (--debug) or release (--release) logger of the VM process. For details on the destination format, the best source is src/VBox/Runtime/common/log/log.cpp.

The *destinations* argument is one or more mnemonics, optionally prefixed by "no" to disable them. Some of these take values after a ":" or "=" separator. Multiple mnemonics can be separated by whitespace or given as separate arguments on the command line.

List of available destinations:

file[=*file*], nofile

Specifies a log file. If no filename is given, one will be generated based on the current UTC time and VM process name and placed in the current directory of the VM process. Note that this will not have any effect if the log file has already been opened.

dir=*directory*, nodir

Specifies the output directory for log files. Note that this will not have any effect if the log file has already been opened.

history=*count*, nohistory

A non-zero value enables log rotation, with the value specifying how many old log files to keep.

histsize=*bytes*

The max size of a log file before it is rotated. Default is infinite.

histtime=*seconds*

The max age (in seconds) of a log file before it is rotated. Default is infinite.

ringbuffer, noringbuffer

Only log to the log buffer until an explicit flush (e.g. via an assertion) occurs. This is fast and saves diskspace.

stdout, nostdout

Write the log content to standard output.

stdout, nostdout

Write the log content to standard error.

debugger, nodebugger

Write the log content to the debugger, if supported by the host OS.

com, nocom

Writes logging to the COM port. This is only applicable for raw-mode and ring-0 logging.

user, nouser

Custom destination which has no meaning to VM processes.

This corresponds to the **logdest** command in the debugger.

15.16.2.7 debugvm logflags

VBoxManage debugvm <*uuid* | *vmname*> logflags [##release | ##debug] [*flags*...]

Changes the flags for either the debug (--debug) or release (--release) logger of the VM process. Please note that the modifications are applied to the existing values, they do not replace them.

The *flags* are a list of flag mnemonics, optionally prefixed by a "no", "!", "~" or "-" to negate their meaning. The "+" prefix can be used to undo a previous negation or as a separator, although it is better to use whitespace or separate arguments for that.

List of log flag mnemonics, with their opposite value where applicable (an asterisk indicates the default value):

enabled*, disabled

Enables or disables logging.

buffered, unbuffered*

Enables buffering of log output before it hits the destinations.

writethrough(/writethru)

Whether to open the destination file with writethru buffering settings or not.

flush

Enables flushing of the output file (to disk) after each log statement.

lockcnts

Prefix each log line with lock counts for the current thread.

cpuid

Prefix each log line with the ID of the current CPU.

pid

Prefix each log line with the current process ID.

flagno

Prefix each log line with the numeric flags corresponding to the log statement.

flag

Prefix each log line with the flag mnemonics corresponding to the log statement.

groupno

Prefix each log line with the log group number for the log statement producing it.

group

Prefix each log line with the log group name for the log statement producing it.

tid

Prefix each log line with the current thread identifier.

thread

Prefix each log line with the current thread name.

time

Prefix each log line with the current UTC wall time.

timeprog

Prefix each log line with the current monotonic time since the start of the program.

msprog

Prefix each log line with the current monotonic timestamp value in milliseconds since the start of the program.

ts

Prefix each log line with the current monotonic timestamp value in nanoseconds.

tsc

Prefix each log line with the current CPU timestamp counter (TSC) value.

rel, abs*

Selects whether the ts and tsc prefixes should be displayed as relative to the previous log line or as absolute time.

hex*, dec

Selects whether the ts and tsc prefixes should be formatted as hexadecimal or decimal.

custom

Custom log prefix, has by default no meaning for VM processes.

usecrlf, uself*

Output with DOS style (CRLF) or just UNIX style (LF) line endings.

overwrite*, append

Overwrite the destination file or append to it.

This corresponds to the **logflags** command in the debugger.

15.16.2.8 debugvm osdetect

VBoxManage debugvm *<uuid | vmname>* osdetect

Make the VMM's debugger facility (re)-detect the guest operating system (OS). This will first load all debugger plug-ins.

This corresponds to the **detect** command in the debugger.

15.16.2.9 debugvm osinfo

VBoxManage debugvm *<uuid | vmname>* osinfo

Displays information about the guest operating system (OS) previously detected by the VMM's debugger facility.

15.16.2.10 debugvm osdmesg

VBoxManage debugvm <*uuid* | *vmname*> osdmesg [##lines=*lines*]

Displays the guest OS kernel log, if detected and supported.

--lines=*lines*

Number of lines of the log to display, counting from the end. The default is infinite.

15.16.2.11 debugvm getregisters

VBoxManage debugvm <*uuid* | *vmname*> getregisters [##cpu=*id*] [*reg#set.reg#name*...]

Retrieves register values for guest CPUs and emulated devices.

reg-set.reg-name

One or more registers, each having one of the following forms:

1. register-set.register-name.sub-field
2. register-set.register-name
3. cpu-register-name.sub-field
4. cpu-register-name
5. all

The *all* form will cause all registers to be shown (no sub-fields). The registers names are case-insensitive.

--cpu=*id*

Selects the CPU register set when specifying just a CPU register (3rd and 4th form). The default is 0.

15.16.2.12 debugvm setregisters

VBoxManage debugvm <*uuid* | *vmname*> setregisters [##cpu=*id*] [*reg#set.reg#name=value*...]

Changes register values for guest CPUs and emulated devices.

reg-set.reg-name=value

One or more register assignment, each having one of the following forms:

1. register-set.register-name.sub-field=value
2. register-set.register-name=value
3. cpu-register-name.sub-field=value
4. cpu-register-name=value

The value format should be in the same style as what **getregisters** displays, with the exception that both octal and decimal can be used instead of hexadecimal.

--cpu=*id*

Selects the CPU register set when specifying just a CPU register (3rd and 4th form). The default is 0.

15.16.2.13 debugvm show

VBoxManage debugvm <*uuid* | *vmname*> show [##human#readable | ##sh#export | ##sh#eval | ##cmd#set] [*settings#item*...]

Shows logging settings for the VM.

--human-readable

Selects human readable output.

--sh-export

Selects output format as bourne shell style **export** commands.

--sh-eval

Selects output format as bourne shell style **eval** command input.

--cmd-set

Selects output format as DOS style **SET** commands.

settings-item

What to display. One or more of the following:

- logdbg-settings - debug log settings.
- logrel-settings - release log settings.
- log-settings - alias for both debug and release log settings.

15.16.2.14 debugvm stack

VBoxManage debugvm <*uuid* | *vmname*> stack [##cpu=*id*]

Unwinds the guest CPU stacks to the best of our ability. It is recommended to first run the **osdetect** command, as this gives both symbols and perhaps unwind information.

--cpu=*id*

Selects a single guest CPU to display the stack for. The default is all CPUs.

15.16.2.15 debugvm statistics

VBoxManage debugvm <*uuid* | *vmname*> statistics [##reset] [##descriptions] [##pattern=*pattern*]

Displays or resets VMM statistics.

Retrieves register values for guest CPUs and emulated devices.

--pattern=*pattern*

DOS/NT-style wildcards patterns for selecting statistics. Multiple patterns can be specified by using the '|' (pipe) character as separator.

--reset

Select reset instead of display mode.

15.16.2.16 debugvm guestsample

VBoxManage debugvm <*uuid* | *vmname*> guestsample [##filename=*filename*] [##sample#interval#us=*interval*] [##sample#time#us=*time*]

Creates a sample report of the guest activity.

Retrieves the filename to dump the report to.

--filename=*filename*

The filename to dump the sample report to.

--sample-interval-us=*interval*

The interval in microseconds between guest samples.

--sample-time-us=*time*

The amount of microseconds to take guest samples.

15.17 VBoxManage dhcpserver

DHCP server management

15.17.1 Synopsis

VBoxManage dhcpserver add <##network=*netname* | ##interface=*ifname*> <##server#ip=*address*> <##netmask=*mask*> <##lower#ip=*address*> <##upper#ip=*address*> <##enable | ##disable>
[[##global] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*]...]
[<##group=*name*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##incl#mac=*address*...] [##excl#mac=*address*...] [##incl#mac#wild=*pattern*...] [##excl#mac#wild=*pattern*...] [##incl#vendor=*string*...] [##excl#vendor=*string*...] [##incl#vendor#wild=*pattern*...] [##excl#vendor#wild=*pattern*...] [##incl#user=*string*...] [##excl#user=*string*...] [##incl#user#wild=*pattern*...] [##excl#user#wild=*pattern*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*]...]
[<##vm=*name*|*uuid*> [##nic=*1#N*] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*]...]
[<##mac#address=*address*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*]...]

VBoxManage dhcpserver modify <##network=*netname* | ##interface=*ifname*> [##server#ip=*address*] [##lower#ip=*address*] [##upper#ip=*address*] [##netmask=*mask*] [##enable | ##disable] [[##global] [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##remove#config]...] [<##group=*name*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##del#mac=*address*...] [##incl#mac=*address*...] [##excl#mac=*address*...] [##del#mac#wild=*pattern*...] [##incl#mac#wild=*pattern*...] [##excl#mac#wild=*pattern*...] [##del#vendor=*string*...] [##incl#vendor=*string*...] [##excl#vendor=*string*...] [##del#vendor#wild=*pattern*...] [##incl#vendor#wild=*pattern*...] [##excl#vendor#wild=*pattern*...] [##del#user=*string*...] [##incl#user=*string*...] [##excl#user=*string*...] [##del#user#wild=*pattern*...] [##incl#user#wild=*pattern*...] [##excl#user#wild=*pattern*...] [##zap#conditions] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##remove#config]...] [<##vm=*name*|*uuid*> [##nic=*1#N*] [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*] [##remove#config]...] [<##mac#address=*address*> [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*] [##remove#config]...]

VBoxManage dhcpserver remove <##network=*netname* | ##interface=*ifname*>

VBoxManage dhcpserver start <##network=*netname* | ##interface=*ifname*>

VBoxManage dhcpserver restart <##network=*netname* | ##interface=*ifname*>

VBoxManage dhcpserver stop <##network=*netname* | ##interface=*ifname*>

VBoxManage dhcpserver findlease <##network=*netname* | ##interface=*ifname*> <##mac#address=*mac*>

15.17.2 Description

The **dhcpserver** commands enable you to control the DHCP server that is built into Oracle VirtualBox. You may find this useful when using internal or host-only networking. Theoretically, you can also enable it for a bridged network, but that may cause conflicts with other DHCP servers in your physical network.

15.17.2.1 Common options

The subcommands of **dhcpserver** all operate on an internal network that can be identified via its name or in the host-only case via the host-only interface name:

--network=*netname*

The internal network name. This is the same name you would supply to the **VBoxManage modifyvm --intnet** option when configuring a VM for internal networking. The internal network name can be found labelled as *VBoxNetworkName* in the output of the following commands: **VBoxManage list intnets**, **VBoxManage list natnets**, or **VBoxManage list hostonlyifs**.

--interface=*ifname*

The host only interface name. This is the same value would supply to the **VBoxManage modifyvm --host-only-adapter** option when configuring a VM to use a host-only network. The value can also be found labelled as *Name* in the output of the **VBoxManage list hostonlyifs** command.

15.17.2.2 dhcpserver add

VBoxManage dhcpserver add <##network=*netname* | ##interface=*ifname*> <##server#ip=*address*> <##netmask=*mask*> <##lower#ip=*address*> <##upper#ip=*address*> <##enable | ##disable>
[[##global] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*]...]
[<##group=*name*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##incl#mac=*address*...] [##excl#mac=*address*...] [##incl#mac#wild=*pattern*...] [##excl#mac#wild=*pattern*...] [##incl#vendor=*string*...] [##excl#vendor=*string*...] [##incl#vendor#wild=*pattern*...] [##excl#vendor#wild=*pattern*...] [##incl#user=*string*...] [##excl#user=*string*...] [##incl#user#wild=*pattern*...] [##excl#user#wild=*pattern*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*]...]
[<##vm=*name|uuid*> [##nic=*1#N*] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*]...]
[<##mac#address=*address*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*]...]

Adds a new DHCP server to a network or host-only interface.

Options configuring the DHCP server core:

--server-ip=*address*

The IP address the DHCP server should use.

--lower-ip=*address*, --upper-ip=*address*

The IP address range for the DHCP server to manage. This should not include the address of the DHCP server itself, but it must be in the same network. The boundaries are inclusive, so both the lower and upper addresses will be handed out to clients.

--netmask=*mask*

The network mask. Typically 255.255.255.0.

--enable, --disable

Whether to enable the DHCP server or disable it. If not specified, the server will be created in a disabled state and no IP addresses will be handed out.

Options selecting the scope:

--global

Set the configuration scope to global. Any subsequent --set-opt options will be applied to all the DHCP clients.

--vm=*vmname|uuid*

Set the configuration scope to the first NIC of the specified VM. Any subsequent --set-opt options will apply just to that interface, nothing else.

--nic=*1-N*

Set the configuration scope to a NIC other than the first NIC of the VM specified in the --vm option.

--mac-address=*address*

Set the configuration scope to the specified MAC address.

--group=*name*

Set the configuration scope to the specified group.

Options configuring the currently selected scope:

--set-opt=*dhcp-opt-no value*

Adds the specified DHCP option number (0-255) and value. The value format is option specific (typically human readable) and will be validated by the API and the DHCP server.

--set-opt-hex=*dhcp-opt-no hexstring*

Adds the specified DHCP option number (0-255) and value. The option value is specified as a raw series of hex bytes optionally separated by colons. No validation is performed on these by the API or the DHCP server, they will be passed as specified to the client.

--force-opt=*dhcp-opt-no*

Forces the specified DHCP option number (0-255) to be sent to the client whether it requested it or not (provided the option is configured with a value at some level).

--suppress-opt=*dhcp-opt-no*

Prevents the specified DHCP option number (0-255) from being sent to the client when present in this or a higher configuration scope.

--min-lease-time=*seconds*

Sets the minimum lease time for the current scope in seconds. Zero means taking the value from a higher option level or use the default value.

--default-lease-time=*seconds*

Sets the default lease time for the current scope in seconds. Zero means taking the value from a higher option level or use the default value.

--max-lease-time=*seconds*

Sets the maximum lease time for the current scope in seconds. Zero means taking the value from a higher option level or use default.

--fixed-address=*address*

Fixed address assignment for a --vm or --mac-address configuration scope. Any empty *address* turns it back to dynamic address assignment.

Options configuring group membership conditions (excludes overrides includes):

--incl-mac=*address*

Include the specific MAC address in the group.

--excl-mac=*address*

Exclude the specific MAC address from the group.

--incl-mac-wild=*pattern*

Include the specific MAC address pattern in the group.

--excl-mac-wild=*pattern*

Exclude the specific MAC address pattern from the group.

--incl-vendor=*string*

Include the specific vendor class ID in the group.

--excl-vendor=*string*

Exclude the specific vendor class ID from the group.

--incl-vendor-wild=*pattern*

Include the specific vendor class ID pattern in the group.

--excl-vendor-wild=*pattern*

Exclude the specific vendor class ID pattern from the group.

--incl-user=*string*

Include the specific user class ID in the group.

--excl-user=*string*

Exclude the specific user class ID from the group.

--incl-user-wild=*pattern*

Include the specific user class ID pattern in the group.

--excl-user-wild=*pattern*

Exclude the specific user class ID pattern from the group.

15.17.2.3 dhcpserver modify

VBoxManage dhcpserver modify <##network=*netname* | ##interface=*ifname*> [##server#ip=*address*] [##lower#ip=*address*] [##upper#ip=*address*] [##netmask=*mask*] [##enable | ##disable] [[##global] [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##remove#config]...] [<##group=*name*> [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##del#mac=*address*...] [##incl#mac=*address*...] [##excl#mac=*address*...] [##del#mac#wild=*pattern*...] [##incl#mac#wild=*pattern*...] [##excl#mac#wild=*pattern*...] [##del#vendor=*string*...] [##incl#vendor=*string*...] [##excl#vendor=*string*...] [##del#vendor#wild=*pattern*...] [##incl#vendor#wild=*pattern*...] [##excl#vendor#wild=*pattern*...] [##del#user=*string*...] [##incl#user=*string*...] [##excl#user=*string*...] [##del#user#wild=*pattern*...] [##incl#user#wild=*pattern*...] [##excl#user#wild=*pattern*...] [##zap#conditions] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##remove#config]...] [<##vm=*name*|*uuid*> [##nic=*1#N*] [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*] [##remove#config]...] [<##mac#address=*address*> [##del#opt=*dhcp#opt#no*...] [##set#opt=*dhcp#opt#no value*...] [##set#opt#hex=*dhcp#opt#no hexstring*...] [##force#opt=*dhcp#opt#no*...] [##unforce#opt=*dhcp#opt#no*...] [##suppress#opt=*dhcp#opt#no*...] [##unsuppress#opt=*dhcp#opt#no*...] [##min#lease#time=*seconds*] [##default#lease#time=*seconds*] [##max#lease#time=*seconds*] [##fixed#address=*address*] [##remove#config]...]

The **dhcpserver modify** command modifies an existing DHCP server configuration. It takes the same options as the **add** command with the addition of the following options which have variable configuration scope:

--del-opt=*dhcp-opt-no*

Counterpart to --set-opt that will cause the specified DHCP option number (0-255) to be deleted from the server settings. Similar to --set-opt the scope of the deletion is governed by the --global, --vm, --mac-address and --group options.

--unforce-opt=*dhcp-opt-no*

Removes the specified DHCP option number (0-255) from the forced option list (i.e. the reverse of --force-opt). Similar to --set-opt the scope of the deletion is governed by the --global, --vm, --mac-address and --group options.

--unsuppress-opt=*dhcp-opt-no*

Removes the specified DHCP option number (0-255) from the suppressed option list (i.e. the reverse of --suppress-opt). Similar to --set-opt the scope of the deletion is governed by the --global, --vm, --mac-address and --group options.

--remove-config

Removes the configuration currently being scoped. The --global scope is not removable. The configuration scope will change to --global after this option.

And the addition of these group membership condition options:

--del-mac=*address*

Delete the specific MAC address from the group conditions.

--del-mac-wild=*pattern*

Delete the specific MAC address pattern from the group conditions.

--del-vendor=*string*

Delete the specific vendor class ID from the group conditions.

--del-vendor-wild=*pattern*

Delete the specific vendor class ID pattern from the group conditions.

--del-user=*string*

Delete the specific user class ID from the group conditions.

--del-user-wild=*pattern*

Delete the specific user class ID pattern from the group conditions.

--zap-conditions

Deletes all the group conditions.

15.17.2.4 dhcpserver remove

VBoxManage dhcpserver remove <##network=*netname* | ##interface=*ifname*>

Removes the specified DHCP server.

15.17.2.5 dhcpserver start

VBoxManage dhcpserver start <##network=*netname* | ##interface=*ifname*>

Start the specified DHCP server.

15.17.2.6 dhcpserver restart

VBoxManage dhcpserver restart <##network=*netname* | ##interface=*ifname*>

Restarts the specified DHCP server. The DHCP server must be running.

15.17.2.7 dhcpserver stop

VBoxManage dhcpserver stop <##network=*netname* | ##interface=*ifname*>

Stops the specified DHCP server.

15.17.2.8 dhcpserver findlease

VBoxManage dhcpserver findlease <##network=*netname* | ##interface=*ifname*> <##mac#address=*mac*>

Performs a lease database lookup. This is mainly for getting the IP address of a running VM.

--mac-address=*mac*

The MAC address to lookup in the lease database.

15.17.2.9 Common DHCP Options:

1 - SubnetMask

IPv4 netmask. Set to the value of the --netmask option by default.

2 - TimeOffset

UTC offset in seconds (32-bit decimal value).

3 - Routers

Space separated list of IPv4 router addresses.

4 - TimeServers

Space separated list of IPv4 time server (RFC 868) addresses.

5 - NameServers

Space separated list of IPv4 name server (IEN 116) addresses.

6 - DomainNameServers

Space separated list of IPv4 DNS addresses.

7 - LogServers

Space separated list of IPv4 log server addresses.

8 - CookieServers

Space separated list of IPv4 cookie server (RFC 865) addresses.

9 - LPRServers

Space separated list of IPv4 line printer server (RFC 1179) addresses.

10 - ImpressServers

Space separated list of IPv4 imagen impress server addresses.

11 - ResourseLocationServers

Space separated list of IPv4 resource location (RFC 887) addresses.

12 - HostName

The client name. See RFC 1035 for character limits.

13 - BootFileSize

Number of 512 byte blocks making up the boot file (16-bit decimal value).

14 - MeritDumpFile

Client core file.

15 - DomainName

Domain name for the client.

16 - SwapServer

IPv4 address of the swap server that the client should use.

17 - RootPath

The path to the root disk the client should use.

18 - ExtensionPath

Path to a file containing additional DHCP options (RFC2123).

19 - IPForwarding

Whether IP forwarding should be enabled by the client (boolean).

20 - OptNonLocalSourceRouting

Whether non-local datagrams should be forwarded by the client (boolean)

21 - PolicyFilter

List of IPv4 addresses and masks pairs controlling non-local source routing.

22 - MaxDgramReassemblySize

The maximum datagram size the client should reassemble (16-bit decimal value).

23 - DefaultIPTTL

The default time-to-leave on outgoing (IP) datagrams (8-bit decimal value).

24 - PathMTUAgingTimeout

RFC1191 path MTU discovery timeout value in seconds (32-bit decimal value).

25 - PathMTUPlateauTable

RFC1191 path MTU discovery size table, sorted in ascending order (list of 16-bit decimal values).

26 - InterfaceMTU

The MTU size for the interface (16-bit decimal value).

27 - AllSubnetsAreLocal

Indicates whether the MTU size is the same for all subnets (boolean).

28 - BroadcastAddress

Broadcast address (RFC1122) for the client to use (IPv4 address).

29 - PerformMaskDiscovery

Whether to perform subnet mask discovery via ICMP (boolean).

30 - MaskSupplier

Whether to respond to subnet mask requests via ICMP (boolean).

31 - PerformRouterDiscovery

Whether to perform router discovery (RFC1256) (boolean).

32 - RouterSolicitationAddress

Where to send router solicitation requests (RFC1256) (IPv4 address).

33 - StaticRoute

List of network and router address pairs addresses.

34 - TrailerEncapsulation

Whether to negotiate the use of trailers for ARP (RTF893) (boolean).

35 - ARPCacheTimeout

The timeout in seconds for ARP cache entries (32-bit decimal value).

36 - EthernetEncapsulation

Whether to use IEEE 802.3 (RTF1042) rather than of v2 (RFC894) ethernet encapsulation (boolean).

37 - TCPDefaultTTL

Default time-to-live for TCP sends (non-zero 8-bit decimal value).

38 - TCPKeepaliveInterval

The interface in seconds between TCP keepalive messages (32-bit decimal value).

39 - TCPKeepaliveGarbage

Whether to include a byte of garbage in TCP keepalive messages for backward compatibility (boolean).

40 - NISDomain

The NIS (Sun Network Information Services) domain name (string).

41 - NISServers

Space separated list of IPv4 NIS server addresses.

42 - NTPServers

Space separated list of IPv4 NTP (RFC1035) server addresses.

43 - VendorSpecificInfo

Vendor specific information. Only accessible using --set-opt-hex.

44 - NetBIOSNameServers

Space separated list of IPv4 NetBIOS name server (NBNS) addresses (RFC1001,RFC1002).

45 - NetBIOSDatagramServers

Space separated list of IPv4 NetBIOS datagram distribution server (NBDD) addresses (RFC1001,RFC1002).

46 - NetBIOSNodeType

NetBIOS node type (RFC1001,RFC1002): 1=B-node, 2=P-node, 4=M-node, and 8=H-node (8-bit decimal value).

47 - NetBIOSScope

NetBIOS scope (RFC1001,RFC1002). Only accessible using --set-opt-hex.

48 - XWindowsFontServers

Space separated list of IPv4 X windows font server addresses.

49 - XWindowsDisplayManager

Space separated list of IPv4 X windows display manager addresses.

62 - NetWareIPDomainName

Netware IP domain name (RFC2242) (string).

63 - NetWareIPInformation

Netware IP information (RFC2242). Only accessible using --set-opt-hex.

64 - NISPlusDomain

The NIS+ domain name (string).

65 - NISPlusServers

Space separated list of IPv4 NIS+ server addresses.

66 - TFTPServerName

TFTP server name (string).

67 - BootfileName

Bootfile name (string).

68 - MobileIPHomeAgents

Space separated list of IPv4 mobile IP agent addresses.

69 - SMTPServers

Space separated list of IPv4 simple mail transport protocol (SMTP) server addresses.

70 - POP3Servers

Space separated list of IPv4 post office protocol 3 (POP3) server addresses.

71 - NNTPServers

Space separated list of IPv4 network news transport protocol (NTTP) server addresses.

72 - WWWServers

Space separated list of default IPv4 world wide web (WWW) server addresses.

73 - FingerServers

Space separated list of default IPv4 finger server addresses.

74 - IRCServers

Space separated list of default IPv4 internet relay chat (IRC) server addresses.

75 - StreetTalkServers

Space separated list of IPv4 StreetTalk server addresses.

76 - STDAServers

Space separated list of IPv4 StreetTalk directory assistance (STDA) server addresses.

78 - SLPDirectoryAgent

Address of one or more service location protocol (SLP) directory agents, and an indicator of whether their use is mandatory. Only accessible using --set-opt-hex.

79 - SLPServiceScope

List of service scopes for the service location protocol (SLP) and whether using the list is mandatory. Only accessible using --set-opt-hex.

119 - DomainSearch

Domain search list, see RFC3397 and section 4.1.4 in RFC1035 for encoding. Only accessible using --set-opt-hex.

15.18 VBoxManage discardstate

Discard the saved state of a virtual machine

15.18.1 Synopsis

VBoxManage discardstate <*uuid* | *vmname*>

15.18.2 Description

The **VBoxManage discardstate** command discards the saved state of a virtual machine (VM) that is not currently running. This command causes the VM's operating system to restart the next time you start the VM.

Note:

Where possible, avoid performing this action. The effects of this command are equivalent to unplugging the power cable on a physical machine.

uuid* | *vmname

Specifies the Universally Unique Identifier (UUID) or name of the VM.

15.18.3 Examples

The following command discards the saved state file for the VM called vm2. When you next start the VM, the VM's operating system is restarted.

```
$ VBoxManage discardstate vm2
```

15.18.4 See Also

15.4 VBoxManage adoptstate on page 288

15.19 VBoxManage encryptmedium

Manage a DEK-encrypted medium or image

15.19.1 Synopsis

VBoxManage encryptmedium <*uuid* | *filename*> [##cipher=*cipher#ID*] [##newpassword=*password*] [##newpasswordid=*password#ID*] [##oldpassword=*password*]

15.19.2 Description

The **VBoxManage encryptmedium** command enables you to create and manage a DEK-encrypted medium or image. You can encrypt an image, decrypt an image, and change the encryption password of an image. See *11.27.2 Encrypting Disk Images on page 220*.

uuid* | *filename

Specifies the Universally Unique Identifier (UUID) or the absolute path name of the medium or image to encrypt.

--newpassword=*password*

Specifies the new encryption password. *password* is either the absolute path name of a password file on the host operating system or -, which prompts you for the password.

You must use the --newpasswordid option with this --newpassword option.

--oldpassword=*password*

Specifies the original encryption password. *password* is either the absolute path name of a password file on the host operating system or -, which prompts you for the original password.

This option enables you to gain access to an encrypted medium or image to do the following:

- Decrypt an encrypted image by using this option by itself.
- Change the password of the encrypted image by using the --newpassword option.
- Change the encryption cipher of the image by using the --cipher option.

--cipher=*cipher-ID*

Specifies the cipher to use for encryption. Valid values are AES-XTS128-PLAIN64 or AES-XTS256-PLAIN64.

This option enables you to set up or change encryption on the medium or image.

--newpasswordid=*password-ID*

Specifies a new password identifier that is used for correct identification when supplying multiple passwords during VM startup.

If you use the same password and password identifier when encrypting multiple images, you need to supply the password only one time during VM startup.

15.19.3 Examples

The following example shows how to encrypt the ol7u4-1.vdi image by using the AES-XTS128-PLAIN64 cipher, specifying a password identifier of 1001, and using the $HOME/pwfile password file:

```
$ VBoxManage encryptmedium "$HOME/VirtualBox VMs/ol7u4/ol7u4-1.vdi" \
 --cipher="AES-XTS128-PLAIN64" --newpasswordid="1001" --newpassword=$HOME/pwfile
```

The following example shows how to decrypt an encrypted image called ol7u4-2.vdi:

```
$ VBoxManage encryptmedium "$HOME/VirtualBox VMs/ol7u4/ol7u4-2.vdi" \
 --oldpassword=-
 Password: original-password
```

The following example shows how to change the password for an encrypted image called ol7u4-3.vdi. The command reads the original password from the $HOME/pwfile.orig file, reads the new password from the $HOME/pwfile file, and assigns a password identifier of 1001.

```
$ VBoxManage encryptmedium "$HOME/VirtualBox VMs/ol7u4/ol7u4-3.vdi" \
 --oldpassword=$HOME/pwfile.orig --newpassword=$HOME/pwfile --newpasswordid="1001"
```

15.20 VBoxManage encryptvm

Change encryption and passwords of the VM

15.20.1 Synopsis

VBoxManage encryptvm <*uuid* | *vmname*> setencryption ##old#password*file* ##cipher*cipher#identifier* ##new#password*file* ##new#password#id*password#identifier* ##force

VBoxManage encryptvm <*uuid* | *vmname*> checkpassword <*file*>

VBoxManage encryptvm <*uuid* | *vmname*> addpassword ##password*file* ##password#id*password#identifier*

VBoxManage encryptvm <*uuid* | *vmname*> removepassword <*password#identifier*>

15.20.2 Description

The **VBoxManage encryptvm** command enables you to change the encryption or add and remove user passwords for the virtual machine (VM). The following sections describe the subcommands that you can use:

15.20.2.1 Set encryption of the Virtual Machine

VBoxManage encryptvm <*uuid* | *vmname*> setencryption ##old#password*file* ##cipher*cipher#identifier* ##new#password*file* ##new#password#id*password#identifier* ##force

The **VBoxManage encryptvm** *vmname* **setencryption** command changes encryption of a VM.

Use the --old-password to supply old encryption password. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the old password.

Use the --cipher option to specify the new cipher for encryption of the VM. Only AES-128 and AES-256 are supported. Appropriate mode GCM, CTR or XTS will be selected by VM depending on encrypting component.

Use the --new-password option to specify the new password for encryption of the VM. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the new password.

Use the --new-password-id option to specify the new id for the password for encryption of the VM.

Use the --force option to make the system to reencrypt the VM instead of simple changing the password.

15.20.2.2 Check the supplied password is correct

VBoxManage encryptvm <*uuid* | *vmname*> checkpassword <*file*>

The **VBoxManage encryptvm** *vmname* **checkpassword** command checks the correctness of the supplied password.

The password can be supplied from file. Specify the absolute pathname of a password file on the host operating system. Also, you can specify - to prompt you for the password.

15.20.2.3 Add password for decrypting the Virtual Machine

VBoxManage encryptvm <*uuid* | *vmname*> addpassword ##password*file*
##password#id*password#identifier*

The **VBoxManage encryptvm** *vmname* **addpassword** command adds a password for decrypting the VM.

Use the --password to supply the encryption password. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password.

Use the --password-id option to specify the id the password is supplied for.

15.20.2.4 Remove password used for decrypting the Virtual Machine

VBoxManage encryptvm <*uuid* | *vmname*> removepassword <*password#identifier*>

The **VBoxManage encryptvm** *vmname* **removepassword** command removes a password used for decrypting the VM.

Specify the password identifier for removing. The password becomes unknown and the VM can not be decrypted.

15.20.3 Examples

The following command encrypts the ol7 VM using AES-256 giving password via command prompt:

```
$ VBoxManage encryptvm ol7 setencryption --cipher=AES-256 --new-password - --new-password-id vmid
```

15.20.4 See Also

15.15 VBoxManage createvm on page 330,

15.21 VBoxManage export

Export one or more virtual machines to a virtual appliance or to a cloud service

15.21.1 Synopsis

VBoxManage export <*machines*> <##output=*name*> [##legacy09 | ##ovf09 | ##ovf10 | ##ovf20] [##manifest] [##options=manifest | iso | nomacs | nomacsbutnat...] [##vsys=*virtual#system#number*] [##description=*description#info*] [##eula=*license#text*] [##eulafile=*filename*] [##product=*product#name*] [##producturl=*product#URL*] [##vendor=*vendor#name*] [##vendorurl=*vendor#URL*] [##version=*version#info*] [##vmname=*vmname*]

VBoxManage export <*machine*> <##output=*cloud#service#provider*> [##opc10] [##vmname=*vmname*] [##cloud=*virtual#system#number*] [##cloudprofile=*cloud#profile#name*] [##cloudshape=*cloud#shape#name*] [##clouddomain=*cloud#domain*] [##clouddisksize=*disk#size#in#GB*] [##cloudbucket=*bucket#name*] [##cloudocivcn=*OCI#VCN#ID*] [##cloudocisubnet=*OCI#subnet#ID*] [##cloudkeepobject=true | false] [##cloudlaunchinstance=true | false] [##cloudlaunchmode=EMULATED | PARAVIRTUALIZED] [##cloudpublicip=true | false]

15.21.2 Description

The **VBoxManage export** command enables you to export one or more virtual machines (VMs) from Oracle VirtualBox into to one of the following formats:

- *A virtual appliance in OVF format.* This includes copying the VM's virtual disk images to compressed VMDK.
- *A cloud service such as Oracle Cloud Infrastructure.* Exports a single VM.

For more information about exporting VMs from Oracle VirtualBox, see *5.3 Importing and Exporting Virtual Machines on page 60*.

15.21.2.1 Export a Virtual Machine to an OVF Virtual Appliance

VBoxManage export <*machines*> <##output=*name*> [##legacy09 | ##ovf09 | ##ovf10 | ##ovf20] [##manifest] [##options=manifest | iso | nomacs | nomacsbutnat...] [##vsys=*virtual#system#number*] [##description=*description#info*] [##eula=*license#text*] [##eulafile=*filename*] [##product=*product#name*] [##producturl=*product#URL*] [##vendor=*vendor#name*] [##vendorurl=*vendor#URL*] [##version=*version#info*] [##vmname=*vmname*]

The **VBoxManage export** command enables you to export a VM as a virtual appliance in OVF format.

machines

Specifies a comma-separated list of one or more machines to export to the same OVF file.

--output=*filename*

Specifies the target OVF file. The file can be OVF, OVA, or a ZIP file compressed with the **gzip** command. Because the directory that contains the target OVF file will also store the exported disk images in the compressed VMDK format, ensure that this directory has sufficient disk space in which to store the images.

The short form of this option is -o.

--legacy09

Exports in OVF 0.9 legacy mode if the virtualization product is not fully compatible with the OVF 1.0 standard.

--ovf09

Exports in OVF 0.9 format.

--ovf10

Exports in OVF 1.0 format.

--ovf20

Exports in OVF 2.0 format.

--manifest

Creates a manifest of the exported files.

--options=*argument,...*

Specifies information to control the exact content of the appliance file. Specify one or more comma-separated arguments:

manifest

Produces a manifest file that detects corrupted appliances on import.

iso

Exports DVD images in an ISO file.

nomacs

Excludes all MAC addresses.

nomacsbutnat

Excludes all MAC addresses except for those in a NAT network.

--description=*description-info*

Specifies a description of the VM.

--eula=*license-text*

Specifies an end-user license text.

--eulafile=*filename*

Specifies an end-user license file.

--product=*product-name*

Specifies a product name.

--producturl=*product-URL*

Specifies a product URL.

--vendor=*vendor-name*

Specifies a vendor name.

--vendorurl=*vendor-URL*

Specifies a vendor URL.

--version=*version-info*

Specifies version information.

--vmname=*vmname*

Specifies the name of the VM to export.

--vsys=*virtual-system-number*

Specifies the number of the virtual system.

15.21.2.2 Export a Virtual Machine to Oracle Cloud Infrastructure

VBoxManage export <*machine*> <##output=*cloud#service#provider*> [##opc10] [##vmname=*vmname*] [##cloud=*virtual#system#number*] [##cloudprofile=*cloud#profile#name*] [##cloudshape=*cloud#shape#name*] [##clouddomain=*cloud#domain*] [##clouddisksize=*disk#size#in#GB*] [##cloudbucket=*bucket#name*] [##cloudocivcn=*OCI#VCN#ID*] [##cloudocisubnet=*OCI#subnet#ID*] [##cloudkeepobject=true | false] [##cloudlaunchinstance=true | false] [##cloudlaunchmode=EMULATED | PARAVIRTUALIZED] [##cloudpublicip=true | false]

The **VBoxManage export** command enables you to export a VM to a cloud service provider such as Oracle Cloud Infrastructure. By default, the exported disk image is converted into compressed VMDK format. This minimizes the amount of data to transfer to the cloud service.

Some of the following options are configuration settings for the VM instance. As a result, specify an Oracle Cloud Identifier (OCID) for a resource. Use the Oracle Cloud Infrastructure Console to view OCIDs.

--output=*cloud-service-provider*

Specifies the short name of the cloud service provider to which you export the VM. For Oracle Cloud Infrastructure, specify OCI://.

The short form of this option is -o.

--opc10

Exports in Oracle Cloud Infrastructure format.

--cloud=*number-of-virtual-system*

Specifies a number that identifies the VM to export. Numbering starts at 0 for the first VM.

--vmname=*vmname*

Specifies the name of the exported VM, which is used as the VM instance name in Oracle Cloud Infrastructure.

--cloudprofile=*cloud-profile-name*

Specifies the cloud profile to use to connect to the cloud service provider. The cloud profile contains your Oracle Cloud Infrastructure account details, such as your user OCID and the fingerprint for your public key.

To use a cloud profile, you must have the required permissions on Oracle Cloud Infrastructure.

--cloudshape=*cloud-shape-name*

Specifies the shape used by the VM instance. The shape defines the number of CPUs and the amount of memory that is allocated to the VM instance. Ensure that the shape is compatible with the exported image.

--clouddomain=*cloud-domain*

Specifies the availability domain to use for the VM instance. Enter the full name of the availability domain.

--clouddisksize=*disk-size-in-GB*

Specifies the amount of disk space, in gigabytes, to use for the exported disk image. Valid values are from 50 GB to 300 GB.

--cloudbucket=*bucket-name*

Specifies the bucket in which to store uploaded files. In Oracle Cloud Infrastructure, a bucket is a logical container for storing objects.

--cloudocivcn=*OCI-VCN-ID*

Specifies the OCID of the virtual cloud network (VCN) to use for the VM instance.

--cloudocisubnet=*OCI-subnet-ID*

Specifies the OCID of the VCN subnet to use for the VM instance.

--cloudkeepobject=true | false

Specifies whether to store the exported disk image in Oracle Object Storage.

--cloudlaunchinstance=true | false

Specifies whether to start the VM instance after the export to Oracle Cloud Infrastructure completes.

--cloudlaunchinstance=EMULATED | PARAVIRTUALIZED

Specifies the launch mode used for the instance. Paravirtualized mode gives improved performance.

--cloudpublicip=true | false

Specifies whether to enable a public IP address for the VM instance.

15.21.3 Example

The following example shows how to export the myVM VM to Oracle Cloud Infrastructure. The command's option arguments describe the configuration of the myVM_Cloud VM in Oracle Cloud Infrastructure.

```
# VBoxManage export myVM --output=OCI:// --cloud=0 --vmname=myVM_Cloud \
--cloudprofile="standard user" --cloudbucket=myBucket \
--cloudshape=VM.Standard2.1 --clouddomain=US-ASHBURN-AD-1 --clouddisksize=50  \
--cloudocivcn=ocid1.vcn.oc1.iad.aaaa... --cloudocisubnet=ocid1.subnet.oc1.iad.aaaa... \
--cloudkeepobject=true --cloudlaunchinstance=true --cloudpublicip=true
```

15.22 VBoxManage extpack

Extension package management

15.22.1 Synopsis

VBoxManage extpack install [##replace] [##accept#license=*sha256*] <*tarball*>

VBoxManage extpack uninstall [##force] <*name*>

VBoxManage extpack cleanup

15.22.2 Description

15.22.2.1 extpack install

VBoxManage extpack install [##replace] [##accept#license=*sha256*] <*tarball*>

Installs a new extension pack on the system. This command will fail if an older version of the same extension pack type is already installed and the --replace isn't supplied. The --replace option uninstalls any previously installed extension packs of the same type being installed before the new extension pack is installed.

--replace

Uninstall existing extension pack before installing the specified extension pack.

--accept-license=*sha256*

Accept the license text with the given SHA-256 hash value.

VBoxManage will display the SHA-256 value when performing a manual installation. The hash can be calculated manually by extracting the license file from the extension pack using tar(1) and running sha256sum or similar to generate the hash value.

tarball

The file containing the extension pack to be installed.

15.22.2.2 extpack uninstall

VBoxManage extpack uninstall [##force] <*name*>

Uninstalls an extension pack from the system. The subcommand will also succeed in the case where the specified extension pack is not present on the system. You can use VBoxManage list extpacks to list the names of the extension packs which are currently installed.

--force

Overrides most refusals to uninstall an extension pack

name

The name of the extension pack to be uninstalled.

15.22.2.3 extpack cleanup

VBoxManage extpack cleanup

Used to remove temporary files and directories that may have been left behind if a previous install or uninstall command failed.

15.22.3 Examples

How to list extension packs:

```
$ VBoxManage list extpacks
Extension Packs: 1
Pack no. 0:   Oracle VirtualBox Extension Pack
Version:      4.1.12
Revision:     77218
Edition:
Description:  USB 2.0 Host Controller, VirtualBox RDP, PXE ROM with E1000 support.
VRDE Module:  VBoxVRDP
Usable:       true
Why unusable:
```

How to remove an extension pack:

```
$ VBoxManage extpack uninstall "Oracle VirtualBox Extension Pack"
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
Successfully uninstalled "Oracle VirtualBox Extension Pack".
```

15.23 VBoxManage getextradata

View keyword values that are associated with a virtual machine or configuration

15.23.1 Synopsis

VBoxManage getextradata <global | *uuid* | *vmname*> <*keyword* | enumerate>

15.23.2 Description

The **VBoxManage getextradata** command enables you to retrieve keyword data that is associated with a virtual machine (VM) or with an Oracle VirtualBox configuration.

global

Specifies to retrieve information about the configuration rather than a VM.

uuid | vmname

Specifies the Universally Unique Identifier (UUID) or name of the VM.

enumerate

Shows all keyword values for the specified VM or configuration.

keyword

Specifies the keyword for which to retrieve its value.

15.23.3 Examples

The following command retrieves the installdate keyword value for the Fedora5 VM:

```
$ VBoxManage getextradata Fedora5 installdate
Value: 2006.01.01
```

The following command retrieves the information for all keywords of the OracleLinux7u4 VM:

```
$ VBoxManage getextradata OracleLinux7u4 enumerate
Key: GUI/LastCloseAction, Value: PowerOff
Key: GUI/LastGuestSizeHint, Value: 1048,696
Key: GUI/LastNormalWindowPosition, Value: 851,286,1048,738
```

The following command retrieves the information for all keywords in the configuration:

```
$ VBoxManage getextradata global enumerate
Key: GUI/LastItemSelected, Value: m=OracleLinux7u4
Key: GUI/LastWindowPosition, Value: 951,510,960,520
Key: GUI/SplitterSizes, Value: 318,637
Key: GUI/Toolbar/MachineTools/Order, Value: Details
Key: GUI/Tools/LastItemsSelected, Value: Welcome,Details
Key: GUI/UpdateCheckCount, Value: 71
Key: GUI/UpdateDate, Value: 1 d, 2022-10-10, stable, 7.0.0
Key: GUI/VirtualMediaManager/Details/Expanded, Value: true
```

15.23.4 See Also

15.40 VBoxManage setextradata on page 432

15.24 VBoxManage guestcontrol

Control a virtual machine from the host system

15.24.1 Synopsis

VBoxManage guestcontrol <*uuid* | *vmname*> run [##arg0=*argument 0*] [##domain=*domainname*] [##dos2unix] [##exe=*filename*] [##ignore#orphaned#processes] [##no#wait#stderr | ##wait#stderr] [##no#wait#stdout | ##wait#stdout] [##passwordfile=*password#file* | ##password=*password*] [##profile] [##putenv=*var#name*=[*value*]] [##quiet] [##timeout=*msec*] [##unix2dos] [##unquoted#args] [##username=*username*] [##cwd=*directory*] [##verbose] <##[*argument...*]>

VBoxManage guestcontrol *<uuid | vmname>* start [##arg0=*argument 0*] [##domain=*domainname*] [##exe=*filename*] [##ignore#orphaned#processes] [##passwordfile=*password#file* | ##password=*password*] [##profile] [##putenv=*var#name*=[*value*]] [##quiet] [##timeout=*msec*] [##unquoted#args] [##username=*username*] [##cwd=*directory*] [##verbose] <##[*argument...*]>

VBoxManage guestcontrol *<uuid | vmname>* copyfrom [##dereference] [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##no#replace] [##recursive] [##target#directory=*host#destination#dir*] [##update] [##username=*username*] [##verbose] <*guest#source0*> *guest#source1*[...] <*host#destination*>

VBoxManage guestcontrol *<uuid | vmname>* copyto [##dereference] [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##no#replace] [##recursive] [##target#directory=*guest#destination#dir*] [##update] [##username=*username*] [##verbose] <*host#source0*> *host#source1*[...]

VBoxManage guestcontrol *<uuid | vmname>* mkdir [##domain=*domainname*] [##mode=*mode*] [##parents] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*guest#directory...*>

VBoxManage guestcontrol *<uuid | vmname>* rmdir [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##recursive] [##username=*username*] [##verbose] <*guest#directory...*>

VBoxManage guestcontrol *<uuid | vmname>* rm [##domain=*domainname*] [##force] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*guest#directory...*>

VBoxManage guestcontrol *<uuid | vmname>* mv [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*source...*> <*destination#directory*>

VBoxManage guestcontrol *<uuid | vmname>* mktemp [##directory] [##domain=*domainname*] [##mode=*mode*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##secure] [##tmpdir=*directory#name*] [##username=*username*] [##verbose] <*template#name*>

VBoxManage guestcontrol *<uuid | vmname>* mount [##passwordfile=*password#file* | ##password=*password*] [##username=*username*] [##verbose]

VBoxManage guestcontrol *<uuid | vmname>* fsinfo [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##human#readable] [##quiet] [##total] [##username=*username*] [##verbose] <*path*>

VBoxManage guestcontrol *<uuid | vmname>* stat [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*filename*>

VBoxManage guestcontrol *<uuid | vmname>* list <all | files | processes | sessions> [##quiet] [##verbose]

VBoxManage guestcontrol *<uuid | vmname>* closeprocess [##session#id=*ID* | ##session#name=*name#or#pattern*] [##quiet] [##verbose] <*PID...*>

VBoxManage guestcontrol *<uuid | vmname>* closesession [##all | ##session#id=*ID* | ##session#name=*name#or#pattern*] [##quiet] [##verbose]

VBoxManage guestcontrol <*uuid* | *vmname*> updatega [##quiet] [##verbose]
[##source=*guest#additions.ISO*] [##wait#start] [##[*argument*...]]

VBoxManage guestcontrol <*uuid* | *vmname*> watch [##quiet] [##verbose]

15.24.2 Description

The **VBoxManage guestcontrol** command enables you to control a guest (VM) from the host system. See *7.10 Guest Control of Applications on page 120*.

15.24.2.1 Common Options and Operands

The following options can be used by any of the **VBoxManage guestcontrol** subcommands:

uuid | vmname

Specifies the Universally Unique Identifier (UUID) or name of the VM.

--quiet

Specifies that the command produce quieter output.

The short form of this option is -q.

--verbose

Specifies that the command produce more detailed output.

The short form of this option is -v.

Some of the **VBoxManage guestcontrol** subcommands require that you provide guest credentials for authentication. The subcommands are: **copyfrom**, **copyto**, **fsinfo**, **mkdir**, **mktemp**, **mount**, **mv**, **rmdir**, **rm**, **run**, **start**, and **stat**.

While you cannot perform anonymous executions, a user account password is optional and depends on the guest's OS security policy. If a user account does not have an associated password, specify an empty password. On OSes such as Windows, you might need to adjust the security policy to permit user accounts with an empty password. In addition, global domain rules might apply and therefore cannot be changed.

The following options are used for authentication on the guest VM:

--domain=*domainname*

Specifies the user domain for Windows guest VMs.

--password=*password*

Specifies the password for the specified user. If you do not specify a password on the command line or if the password is empty, the specified user needs to have an empty password.

--passwordfile=*filename*

Specifies the absolute path to a file on the host system that contains the password for the specified user. If the password file is empty or if you do not specify a password on the command line, the specified user needs to have an empty password.

--username=*username*

Specifies an existing user in the guest OS that runs the process. If unspecified, the name of the user on the host invoking the **VBoxManage** command will be used as the username for the guest OS login.

15.24.2.2 Guest Process Restrictions

By default, you can run up to 255 guest processes simultaneously. If attempting to start a new guest process would exceed this limit and there are inactive guest processes then the the oldest inactive guest process is discarded to run the new process. You cannot retrieve the output from a discarded guest process. If all 255 guest processes are active and running, attempting to start a new guest process fails.

15.24.2.3 Running Graphical Applications Inside a Guest

If using the **VBoxManage guestcontrol run** or **VBoxManage guestcontrol start** commands to execute a graphical application then the guest will need to be running a graphical windowing environment typically as the same user executing the GUI application. For example on Windows guests the user running the GUI application in the guest needs to be currently logged in with a running desktop session. Similarly on UNIX and UNIX-like guests a graphical windowing system such as X11 or Wayland needs to be running and the user executing the GUI application needs authorization to be able to connect to the display server.

15.24.2.4 Run a Command in the guest

VBoxManage guestcontrol <*uuid* | *vmname*> run [##arg0=*argument 0*] [##domain=*domainname*] [##dos2unix] [##exe=*filename*] [##ignore#orphaned#processes] [##no#wait#stderr | ##wait#stderr] [##no#wait#stdout | ##wait#stdout] [##passwordfile=*password#file* | ##password=*password*] [##profile] [##putenv=*var#name*=[*value*]] [##quiet] [##timeout=*msec*] [##unix2dos] [##unquoted#args] [##username=*username*] [##cwd=*directory*] [##verbose] <##[*argument*...]>

The **VBoxManage guestcontrol** *vmname* **run** command enables you to execute a program in the guest VM. Standard input, standard output, and standard error are redirected from the VM to the host system until the program completes.

--exe=*path-to-executable*

Specifies the absolute path of the executable program to run in the guest VM. For example: C:\Windows\System32\calc.exe.

--arg0=*alternate-executable-name*

Specifies an alternate name (i.e. arg0 or argv[0]) for the executable being run in the guest.

--cwd=*path-to-directory*

Specifies the absolute path of a directory in which to start the program. Optional. The directory must exist and be accessible to the guest user. For example: C:\Users\production\work_area.

The short form of this option is -C.

--timeout=*msec*

Specifies the maximum amount of time, in milliseconds, that the program can run. While the program runs, **VBoxManage** receives its output.

If you do not specify a timeout value, **VBoxManage** waits indefinitely for the process to end, or for an error to occur.

--putenv=*NAME*=[*value*]

Sets, modifies, and unsets environment variables in the guest VM environment.

When you create a guest process, it runs with the default standard guest OS environment. Use this option to modify environment variables in that default environment.

Use the --putenv=*NAME*=[*value*] option to set or modify the environment variable specified by *NAME*.

Use the --putenv=*NAME*= option to unset the environment variable specified by *NAME*.

Ensure that any environment variable name or value that includes spaces is enclosed by quotes.

Specify a --putenv option for each environment variable that you want to modify.

The short form of this option is -E.

--unquoted-args

Disables the escaped double quoting of arguments that you pass to the program. For example, \"fred\".

--ignore-orphaned-processes

Ignores orphaned processes. Not yet implemented.

--profile

Uses a shell profile to specify the environment to use. Not yet implemented.

--no-wait-stdout

Does not wait for the guest process to end or receive its exit code and any failure explanation.

--wait-stdout

Waits for the guest process to end to receive its exit code and any failure explanation. The **VBoxManage** command receives the standard output of the guest process while the process runs.

--no-wait-stderr

Does not wait for the guest process to end to receive its exit code, error messages, and flags.

--wait-stderr

Waits for the guest process to end to receive its exit code, error messages, and flags. The **VBoxManage** command receives the standard error of the guest process while the process runs.

--dos2unix

Transform DOS or Windows guest output to UNIX or Linux output. This transformation changes CR + LF line endings to LF. Not yet implemented.

--unix2dos

Transform UNIX or Linux guest output to DOS or Windows output. This transformation changes LF line endings to CR + LF.

-- [*argument...*]

Specifies one or more arguments to pass to the program being run in the guest.

Ensure that any command argument that includes spaces is enclosed by quotes.

15.24.2.5 Start a Command on the guest

VBoxManage guestcontrol <*uuid* | *vmname*> start [##arg0=*argument 0*] [##domain=*domainname*] [##exe=*filename*] [##ignore#orphaned#processes] [##passwordfile=*password#file* | ##password=*password*] [##profile] [##putenv=*var#name*=[*value*]] [##quiet] [##timeout=*msec*] [##unquoted#args] [##username=*username*] [##cwd=*directory*] [##verbose] <##[*argument...*]>

The **VBoxManage guestcontrol** *vmname* **start** command enables you to execute a guest program and returns after the command has been successfully started. The invoked command doesn't wait until all data from stdout or stderr has been read before returning.

15.24.2.6 Copy a file from the guest to the host.

VBoxManage guestcontrol <*uuid* | *vmname*> copyfrom [##dereference] [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##no#replace] [##recursive] [##target#directory=*host#destination#dir*] [##update] [##username=*username*] [##verbose] <*guest#source0*> *guest#source1*[...] <*host#destination*>

The **VBoxManage guestcontrol** *vmname* **copyfrom** command enables you to copy a file from the guest VM to the host system.

--dereference

Enables following of symbolic links on the guest file system.

--no-replace

Only copies a file if it does not exist on the host yet.

The short form of this option is -n.

--recursive

Recursively copies files and directories from the specified guest directory to the host.

The short form of this option is -R.

--target-directory=*host-dst-dir*

Specifies the absolute path of the destination directory on the host system. For example, C:\Temp.

--update

Only copies a file if the guest file is newer than on the host.

The short form of this option is -u.

***guest-source0* [*guest-source1* [...]]**

Specifies the absolute path of one or more files to copy from the guest VM. For example, C:\Windows\System32\calc.exe. You can use wildcards to specify multiple files. For example, C:\Windows\System**.dll.

15.24.2.7 Copy a file from the host to the guest.

VBoxManage guestcontrol <*uuid* | *vmname*> copyto [##dereference] [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##no#replace] [##recursive] [##target#directory=*guest#destination#dir*] [##update] [##username=*username*] [##verbose] <*host#source0*> *host#source1*[...]

The **VBoxManage guestcontrol** *vmname* **copyto** command enables you to copy a file from the host system to the guest VM.

--dereference

Enables following of symbolic links on the host system.

--no-replace

Only copies a file if it does not exist on the guest yet.

The short form of this option is -n.

--recursive

Recursively copies files and directories from the specified host directory to the guest.

The short form of this option is -R.

--target-directory=*guest-dst-dir*

Specifies the absolute path of the destination directory on the guest. For example, /home/myuser/fromhost.

--update

Only copies a file if the host file is newer than on the guest.

The short form of this option is -u.

***host-source0* [*host-source1* [...]]**

Specifies the absolute path of a file to copy from the host system. For example, C:\Windows\System32\calc.exe. You can use wildcards to specify multiple files. For example, C:\Windows\System**.dll.

15.24.2.8 Show guest filesystem information.

VBoxManage guestcontrol <*uuid* | *vmname*> fsinfo [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##human#readable] [##quiet] [##total] [##username=*username*] [##verbose] <*path*>

The **VBoxManage guestcontrol** *vmname* **fsinfo** command enables you to show filesystem information of the guest VM.

An alternate form of this subcommand is **df**.

--human-readable

Shows the disk sizes in a human readable form.

--total

Produces a grand total of all disk sizes.

***guest-path* [*guest-path*...]**

Specifies an absolute path to show guest filesystem information for.

15.24.2.9 Create a directory on the guest.

VBoxManage guestcontrol <*uuid* | *vmname*> mkdir [##domain=*domainname*] [##mode=*mode*] [##parents] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*guest#directory*...>

The **VBoxManage guestcontrol** *vmname* **mkdir** command enables you to create one or more directories on the guest VM.

Alternate forms of this subcommand are **md**, **createdir**, and **createdirectory**.

--parents

Creates any of the missing parent directories of the specified directory.

For example, if you attempt to create the D:\Foo\Bar directory and the D:\Foo directory does not exist, using the --parents creates the missing D:\Foo directory. However, if you attempt to create the D:\Foo\Bar and do not specify the --parents option, the command fails.

--mode=*mode*

Specifies the permission mode to use for the specified directory. If you specify the --parents option, the mode is used for the associated parent directories, as well. *mode* is a four-digit octal mode such as 0755.

***guest-dir* [*guest-dir*...]**

Specifies an absolute path of one or more directories to create on the guest VM. For example, D:\Foo\Bar.

If all of the associated parent directories do not exist on the guest VM, you must specify the --parents option.

You must have sufficient rights on the guest VM to create the specified directory and its parent directories.

15.24.2.10 Remove a directory from the guest.

VBoxManage guestcontrol <*uuid* | *vmname*> rmdir [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##recursive] [##username=*username*] [##verbose] <*guest#directory*...>

The **VBoxManage guestcontrol** *vmname* **rmdir** command enables you to delete the specified directory from the guest VM.

Alternate forms of this subcommand are **removedir** and **removedirectory**.

--recursive

Recursively removes directories from the specified from the guest VM.

The short form of this option is -R.

***guest-dir* [*guest-dir*...]**

Specifies an absolute path of one or more directories to remove from the guest VM. You can use wildcards to specify the directory names. For example, D:\Foo*Bar.

You must have sufficient rights on the guest VM to remove the specified directory and its parent directories.

15.24.2.11 Remove a file from the guest.

VBoxManage guestcontrol <*uuid* | *vmname*> rm [##domain=*domainname*] [##force] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*guest#directory*...>

The **VBoxManage guestcontrol** *vmname* **rm** command enables you to delete the specified files from the guest VM.

The alternate form of this subcommand is **removefile**.

--force

Forces the operation and overrides any confirmation requests.

The short form of this option is -f.

***guest-file* [*guest-file*...]**

Specifies an absolute path of one or more files to remove from the guest VM. You can use wildcards to specify the file names. For example, D:\Foo\Bar\text*.txt.

You must have sufficient rights on the guest VM to remove the specified file.

15.24.2.12 Rename a file or Directory on the guest

VBoxManage guestcontrol <*uuid* | *vmname*> mv [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*source*...> <*destination#directory*>

The **VBoxManage guestcontrol** *vmname* **mv** command enables you to rename files and directories on the guest VM.

Alternate forms of this subcommand are **move**, **ren**, and **rename**.

***guest-source* [*guest-source*...]**

Specifies an absolute path of a file or a single directory to move or rename on the guest VM. You can use wildcards to specify the file names.

You must have sufficient rights on the guest VM to access the specified file or directory.

dest

Specifies the absolute path of the renamed file or directory, or the destination directory to which to move the files. If you move only one file, *dest* can be a file or a directory, otherwise *dest* must be a directory.

You must have sufficient rights on the guest VM to access the destination file or directory.

15.24.2.13 Create a Temporary File or Directory on the guest

VBoxManage guestcontrol <*uuid* | *vmname*> mktemp [##directory] [##domain=*domainname*] [##mode=*mode*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##secure] [##tmpdir=*directory#name*] [##username=*username*] [##verbose] <*template#name*>

The **VBoxManage guestcontrol** *vmname* **mktemp** command enables you to create a temporary file or temporary directory on the guest VM. You can use this command to assist with the subsequent copying of files from the host system to the guest VM. By default, this command creates the file or directory in the guest VM's platform-specific temp directory.

Alternate forms of this subcommand are **createtemp** and **createtemporary**.

--directory

Creates a temporary directory that is specified by the *template* operand.

--secure

Enforces secure file and directory creation by setting the permission mode to 0755. Any operation that cannot be performed securely fails.

--mode=*mode*

Specifies the permission mode to use for the specified directory. *mode* is a four-digit octal mode such as 0755.

--tmpdir=*directory*

Specifies the absolute path of the directory on the guest VM in which to create the specified file or directory. If unspecified, *directory* is the platform-specific temp directory.

template

Specifies a template file name for the temporary file, without a directory path. The template file name must contain at least one sequence of three consecutive X characters, or must end in X.

15.24.2.14 Shows mount points on the guest

VBoxManage guestcontrol <*uuid* | *vmname*> mount [##passwordfile=*password#file* | ##password=*password*] [##username=*username*] [##verbose]

The **VBoxManage guestcontrol** *vmname* **mount** command enables you to the current mount points on the guest VM. For Windows guests this shows the mapped drives.

15.24.2.15 Show a file or File System Status on the guest

VBoxManage guestcontrol <*uuid* | *vmname*> stat [##domain=*domainname*] [##passwordfile=*password#file* | ##password=*password*] [##quiet] [##username=*username*] [##verbose] <*filename*>

The **VBoxManage guestcontrol** *vmname* **stat** command enables you to show the status of files or file systems on the guest VM.

***file* [*file* ...]**

Specifies an absolute path of a file or file system on the guest VM. For example, /home/foo/a.out.

You must have sufficient rights on the guest VM to access the specified files or file systems.

15.24.2.16 List the Configuration and Status Information for a Guest Virtual Machine

VBoxManage guestcontrol <*uuid* | *vmname*> list <all | files | processes | sessions> [##quiet] [##verbose]

The **VBoxManage guestcontrol** *vmname* **list** command enables you to list guest control configuration and status information. For example, the output shows open guest sessions, guest processes, and files.

all|sessions|processes|files

Indicates the type of information to show. all shows all available data, sessions shows guest sessions, processes shows processes, and files shows files.

15.24.2.17 Terminate a Process in a guest Session

VBoxManage guestcontrol <*uuid* | *vmname*> closeprocess [##session#id=*ID* | ##session#name=*name#or#pattern*] [##quiet] [##verbose] <*PID*...>

The **VBoxManage guestcontrol** *vmname* **closeprocess** command enables you to terminate a guest process that runs in a guest session. Specify the process by using a process identifier (PID) and the session by using the session ID or name.

--session-id=*ID*

Specifies the ID of the guest session.

--session-name=*name*|*pattern*

Specifies the name of the guest session. Use a pattern that contains wildcards to specify multiple sessions.

***PID* [*PID* ...]**

Specifies the list of PIDs of guest processes to terminate.

15.24.2.18 Close a guest Session

VBoxManage guestcontrol <*uuid* | *vmname*> closesession [##all | ##session#id=*ID* | ##session#name=*name#or#pattern*] [##quiet] [##verbose]

The **VBoxManage guestcontrol** *vmname* **closesession** command enables you to close a guest session. Specify the guest session either by session ID or by name.

--session-id=*ID*

Specifies the ID of the guest session.

--session-name=*name*|*pattern*

Specifies the name of the guest session. Use a pattern that contains wildcards to specify multiple sessions.

--all

Closes all guest sessions.

15.24.2.19 Update the Guest Additions Software on the guest

VBoxManage guestcontrol <*uuid* | *vmname*> updatega [##quiet] [##verbose]
[##source=*guest#additions.ISO*] [##wait#start] [##[*argument*...]]

The **VBoxManage guestcontrol** *vmname* **updatega** command enables you to update the Guest Additions software installed in the specified guest VM.

Alternate forms of this subcommand are **updateadditions** and **updateguestadditions**.

--source=*new-iso-path*

Specifies the absolute path of the Guest Additions update .ISO file on the guest VM.

--reboot

Automatically reboots the guest after a successful Guest Additions update.

--timeout=*ms*

Sets the timeout (in ms) to wait for the overall Guest Additions update to complete. By default no timeout is being used.

--verify

Verifies whether the Guest Additions were updated successfully after a successful installation. A guest reboot is mandatory.

--wait-ready

Waits for the current Guest Additions being ready to handle the Guest Additions update.

--wait-start

Starts the **VBoxManage** update process on the guest VM and then waits for the Guest Additions update to begin before terminating the **VBoxManage** process.

By default, the **VBoxManage** command waits for the Guest Additions update to complete before it terminates. Use this option when a running **VBoxManage** process affects the interaction between the installer and the guest OS.

-- *argument* [*argument* ...]

Specifies optional command-line arguments to pass to the Guest Additions updater. You might use the -- option to pass the appropriate updater arguments to retrofit features that are not yet installed.

Ensure that any command argument that includes spaces is enclosed by quotes.

15.24.2.20 Wait for a guest run level

The **VBoxManage guestcontrol** *vmname* **waitrunlevel** command enables you to wait for a guest run level being reached.

--timeout=*ms*

Sets the timeout (in ms) to wait for reaching the run level. By default no timeout is being used.

system*|*userland*|*desktop

Specifies the run level to wait for.

15.24.2.21 Show Current Guest Control Activity

VBoxManage guestcontrol <*uuid* | *vmname*> watch [##quiet] [##verbose]

The **VBoxManage guestcontrol** *vmname* **watch** command enables you to show current guest control activity.

15.24.3 Examples

The following **VBoxManage guestcontrol run** command executes the **ls -l /usr** command on the My OL VM Oracle Linux VM as the user1 user.

```
$ VBoxManage --nologo guestcontrol "My OL VM" run --exe "/bin/ls" \
--username user1 --passwordfile pw.txt --wait-stdout -- -l /usr
```

The --exe option specifies the absolute path of the command to run in the guest VM, /bin/ls. Use the -- option to pass any arguments that follow it to the **ls** command.

Use the --username option to specify the user name, user1 and use the --passwordfile option to specify the name of a file that includes the password for the user1 user, pw.txt.

The --wait-stdout option waits for the **ls** guest process to complete before providing the exit code and the command output. The --nologo option suppresses the output of the logo information.

The following **VBoxManage guestcontrol run** command executes the **ipconfig** command on the My Win VM Windows VM as the user1 user. Standard input, standard output, and standard error are redirected from the VM to the host system until the program completes.

```
$ VBoxManage --nologo guestcontrol "My Win VM" run \
--exe "c:\\windows\\system32\\ipconfig.exe" \
--username user1 --passwordfile pw.txt --wait-stdout
```

The --exe specifies the absolute path of command to run in the guest VM, c:\windows \system32\ipconfig.exe. The double backslashes shown in this example are required only on UNIX host systems.

Use the --username option to specify the user name, user1 and use the --passwordfile option to specify the name of a file that includes the password for the user1 user, pw.txt.

The --wait-stdout option waits for the **ls** guest process to complete before providing the exit code and the command output. The --nologo option to suppress the output of the logo information.

The following **VBoxManage guestcontrol start** command executes the **ls -l /usr** command on the My OL VM Oracle Linux VM until the program completes.

```
$ VBoxManage --nologo guestcontrol "My Win VM" start \
--exe "c:\\windows\\system32\\ipconfig.exe" \
--username user1 --passwordfile pw.txt
```

The following **VBoxManage guestcontrol run** command executes a **/usr/bin/busybox -l /usr** command on the My OL VM Oracle Linux VM as the user1 user, explicitly using ls as argument 0.

```
$ VBoxManage --nologo guestcontrol "My OL VM" run --exe "/usr/bin/busybox" \
--username user1 --passwordfile pw.txt --wait-stdout --arg0 ls -- -l /usr
```

The --exe option specifies the absolute path of the command to run in the guest VM, /usr/bin/ busybox. Use the -- option to pass any arguments that follow it to the **busybox** command.

Use the --username option to specify the user name, user1 and use the --passwordfile option to specify the name of a file that includes the password for the user1 user, pw.txt.

The --wait-stdout option waits for the **ls** guest process to complete before providing the exit code and the command output. The --nologo option suppresses the output of the logo information.

The --arg0 option explicitly specifies the argument 0 to use for the command to execute.

The default value of argument 0 (i.e. arg0 or argv[0]) is the value from the --exe option unless the --arg0 option has been supplied.

15.25 VBoxManage guestproperty

Manage virtual machine guest properties

15.25.1 Synopsis

VBoxManage guestproperty get <*uuid* | *vmname*> <*property#name*> [##verbose]

VBoxManage guestproperty enumerate <*uuid* | *vmname*> [##no#timestamp] [##no#flags] [##relative] [##old#format] [*patterns*...]

VBoxManage guestproperty set <*uuid* | *vmname*> <*property#name*> [*property#value* [##flags=*flags*]]

VBoxManage guestproperty unset <*uuid* | *vmname*> <*property#name*>

VBoxManage guestproperty wait <*uuid* | *vmname*> <*patterns*> [##timeout=*msec*] [##fail#on#timeout]

15.25.2 Description

The **VBoxManage guestproperty** command enables you to set or retrieve the properties of a running virtual machine (VM). See *7.8 Guest Properties on page 118*. Guest properties are arbitrary name-value string pairs that can be written to and read from by either the guest or the host. As a result, these properties can be used as a low-overhead communication channel for strings provided that a guest is running and has the Guest Additions installed. In addition, the Guest Additions automatically set and maintain values whose keywords begin with /VirtualBox/.

15.25.2.1 General Command Operand

uuid | vmname

Specifies the Universally Unique Identifier (UUID) or name of the VM.

15.25.2.2 List All Properties for a Virtual Machine

VBoxManage guestproperty enumerate <*uuid* | *vmname*> [##no#timestamp] [##no#flags] [##relative] [##old#format] [*patterns*...]

The **VBoxManage guestproperty enumerate** command lists each guest property and value for the specified VM. Note that the output is limited if the guest's property store is not being updated, for example because the VM is not running or because the Oracle VirtualBox Guest Additions are not installed.

--relative

Display the timestamp relative to current time.

--no-timestamp

Do not display the timestamp of the last update.

--no-flags

Do not display the flags.

--old-format

Use the output format from VirtualBox 6.1 and earlier.

pattern

Filters the list of properties based on the specified pattern, which can contain the following wildcard characters:

* **(asterisk)**

Represents any number of characters. For example, the /VirtualBox* pattern matches all properties that begin with /VirtualBox.

? **(question mark)**

Represents a single arbitrary character. For example, the fo? pattern matches both foo and for.

| **(pipe)**

Specifies multiple alternative patterns. For example, the s*|t* pattern matches any property that begins with s or t.

15.25.2.3 Retrieve a Property Value for a Virtual Machine

VBoxManage guestproperty get <*uuid* | *vmname*> <*property#name*> [##verbose]

The **VBoxManage guestproperty get** command retrieves the value of the specified property. If the property cannot be found, for example because the guest is not running, the command issues the following message:

```
No value set!
```

property-name

Specifies the name of the property.

--verbose

Provides the property value, timestamp, and any specified value attributes.

15.25.2.4 Set a Property Value for a Virtual Machine

VBoxManage guestproperty set <*uuid* | *vmname*> <*property#name*> [*property#value* [##flags=*flags*]]

The **VBoxManage guestproperty set** command enables you to set a guest property by specifying the property and its value. If you omit the value, the property is deleted.

property-name

Specifies the name of the property.

property-value

Specifies the value of the property. If no value is specified, any existing value is removed.

--flags=*flags*

Specify the additional attributes of the value. The following attributes can be specified as a comma-separated list:

TRANSIENT

Removes the value with the VM data when the VM exits.

TRANSRESET

Removes the value when the VM restarts or exits.

RDONLYGUEST

Specifies that the value can be changed only by the host and that the guest can read the value.

RDONLYHOST

Specifies that the value can be changed only by the guest and that the host can read the value.

READONLY

Specifies that the value cannot be changed.

15.25.2.5 Wait for a Property Value to Be Created, Deleted, or Changed

VBoxManage guestproperty wait <*uuid* | *vmname*> <*patterns*> [##timeout=*msec*] [##fail#on#timeout]

The **VBoxManage guestproperty wait** command waits for a particular value that is described by the pattern string to change, to be deleted, or to be created.

patterns

Specifies a pattern that matches the properties on which you want to wait. For information about the pattern wildcards, see the description of the --patterns option.

--timeout*msec*

Specifies the number of microseconds to wait.

--fail-on-timeout

Specifies that the command fails if the timeout is reached.

15.25.2.6 Unset a Virtual Machine Property Value

VBoxManage guestproperty unset <*uuid* | *vmname*> <*property#name*>

The **VBoxManage guestproperty unset** command unsets the value of a guest property.

The alternate form of this subcommand is **delete**.

property-name

Specifies the name of the property.

15.25.3 Examples

The following command lists the guest properties and their values for the win8 VM.

```
$ VBoxManage guestproperty enumerate win8
```

The following command creates a guest property called region for the win8 VM. The value of the property is set to west.

```
$ VBoxManage guestproperty set win8 region west
```

15.26 VBoxManage hostonlyif

Manage host-only network interfaces

15.26.1 Synopsis

VBoxManage hostonlyif ipconfig <*ifname*> [##dhcp | ##ip=*IPv4#address* ##netmask=*IPv4#netmask* | ##ipv6=*IPv6#address* ##netmasklengthv6=*length*]

VBoxManage hostonlyif create

VBoxManage hostonlyif remove <*ifname*>

15.26.2 Description

The **VBoxManage hostonlyif** command enables you to change the IP configuration of a host-only network interface. For a description of host-only networking, see *9.9 Host-Only Networking on page 154*. Each host-only network interface is identified by a name and can either use the internal DHCP server or a manual IP configuration, both IPv4 and IPv6.

15.26.2.1 Configure a Host-Only Interface

VBoxManage hostonlyif ipconfig <*ifname*> [##dhcp | ##ip=*IPv4#address* ##netmask=*IPv4#netmask* | ##ipv6=*IPv6#address* ##netmasklengthv6=*length*]

The **VBoxManage hostonlyif ipconfig** command configures a host-only interface.

ifname

Specifies the name of the network interface. The name is of the form vboxnet*N* where *N* is the interface instance.

--dhcp

Uses DHCP for the network interface.

You cannot use this option with the --ip, --ipv6, --netmask, or --netmasklengthv6 options.

--ip=*IPv4-address*

Specifies the IPv4 IP address for the network interface.

You cannot use this option with the --dhcp, --ipv6, or --netmasklengthv6 options.

--netmask=*IPv4-netmask*

Specifies the IPv4 netmask of the network interface. The default value is 255.255.255.0.

You can only use this option with the --ip option.

--ipv6=*IPv6-address*

Specifies the IPv6 IP address for the network interface.

You cannot use this option with the --dhcp, --ip, or --netmask options.

--netmasklengthv6=*length*

Specifies the length of the IPv6 network interface. The default value is 64.

You can only use this option with the --ipv6 option.

15.26.2.2 Create a Network Interface on the Host System

VBoxManage hostonlyif create

The **VBoxManage hostonlyif create** command creates a new host-only network interface on the host operating system (OS). The network interface name is of the form vboxnet*N* where *N* is the interface instance. You must run this command before you can attach virtual machines (VMs) to the host-only network.

This command is currently unavailable on Solaris hosts but the equivalent functionality is to run **ifconfig vboxnet0 plumb** as root or with sufficient privileges.

15.26.2.3 Remove a Network Interface From the Host System

VBoxManage hostonlyif remove <*ifname*>

The **VBoxManage hostonlyif remove** command removes the specified host-only network interface from the host OS.

This command is currently unavailable on Solaris hosts but the equivalent functionality is to run **ifconfig vboxnet0 unplumb** as root or with sufficient privileges.

ifname

Specifies the name of the network interface. The name is of the form vboxnet*N* where *N* is the interface instance.

15.26.3 Examples

The following command creates a new host-only network interface.

```
$ VBoxManage hostonlyif create
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
Interface 'vboxnet2' was successfully created
```

The following command configures the IPv4 address for the vboxnet2 host-only network interface.

```
$ VBoxManage hostonlyif ipconfig vboxnet2 --ip 10.0.2.18
```

15.27 VBoxManage hostonlynet

Host Only Network management

15.27.1 Synopsis

VBoxManage hostonlynet add <##name=*netname*> [##id=*netid*] <##netmask=*mask*>
<##lower#ip=*address*> <##upper#ip=*address*> [##enable | ##disable]

VBoxManage hostonlynet modify <##name=*netname* | ##id=*netid*> [##lower#ip=*address*]
[##upper#ip=*address*] [##netmask=*mask*] [##enable | ##disable]

VBoxManage hostonlynet remove <##name=*netname* | ##id=*netid*>

15.27.2 Description

The **hostonlynet** commands enable you to control host-only networks.

15.27.2.1 Common options

The subcommands of **hostonlynet** all operate on an host-only network that can be identified via its name or uuid:

--name=*netname*

The host-only network name. You see it as VBoxNetworkName in the output from **VBoxManage list hostonlynets**.

--id=*netid*

The host-only network uuid. If not specified when adding a new network, one will be generated automatically.

15.27.2.2 hostonlynet add

VBoxManage hostonlynet add <##name=*netname*> [##id=*netid*] <##netmask=*mask*> <##lower#ip=*address*> <##upper#ip=*address*> [##enable | ##disable]

Adds a new host-only network.

Options configuring the host-only network:

--netmask=*mask*

The network mask. Typically 255.255.255.0.

--lower-ip=*address*, --upper-ip=*address*

The IP address range for handing out via DHCP. The upper boundrary is inclusive while the lower one is not, so the upper address will be handed out to a client, while the lower address will be used by the host itself.

--enable, --disable

Whether to enable the host-only network or disable it. If not specified, the network will be created in enabled state.

15.27.2.3 hostonlynet modify

VBoxManage hostonlynet modify <##name=*netname* | ##id=*netid*> [##lower#ip=*address*] [##upper#ip=*address*] [##netmask=*mask*] [##enable | ##disable]

This modifies an existing host-only network configuration. It takes the same options as the **add** command.

15.27.2.4 hostonlynet remove

VBoxManage hostonlynet remove <##name=*netname* | ##id=*netid*>

Removes the specified host-only network.

15.28 VBoxManage import

Import a virtual appliance in OVF format or from a cloud service and create virtual machines

15.28.1 Synopsis

VBoxManage import <*ovfname* | *ovaname*> [##dry#run] [##options=keepallmacs | keepnatmacs | importtovdi | keepextradata] [##vsys=*n*] [##ostype=*ostype*] [##vmname=*name*] [##settingsfile=*filename*] [##basefolder=*folder*] [##group=*group*] [##memory=*MB*] [##cpus=*n*] [##description=*text*] [##eula=show | accept] [##unit=*n*] [##ignore] [##scsitype=BusLogic | LsiLogic] [##disk=*path*] [##controller=*index*] [##port=*n*]

VBoxManage import OCI:// ##cloud [##ostype=*ostype*] [##vmname=*name*] [##basefolder=*folder*] [##memory=*MB*] [##cpus=*n*] [##description=*text*] <##cloudprofile=*profile*> <##cloudinstanceid=*id*> [##cloudbucket=*bucket*]

15.28.2 Description

The **VBoxManage import** command imports a virtual appliance either in OVF format or from a cloud service such as Oracle Cloud Infrastructure (OCI). The import is performed by copying virtual disk images (by default using the VMDK image format) and by creating virtual machines (VMs) in Oracle VirtualBox. See *5.3 Importing and Exporting Virtual Machines on page 60*.

You must specify the path name of an OVF file or OVA archive to use as input, or a placeholder for the cloud case. For OVF appliances ensure that any disk images are in the same directory as the OVF file.

Note that any options you specify to control the imported virtual appliance or to modify the import parameters rely on the contents of the OVF file or the information from the cloud service.

Before you use the import operation to create the VM, perform a dry run to verify the correctness of your configuration. This is more useful with an OVF or OVA appliance, because with a cloud service even a dry run needs to perform most of the time consuming steps.

The import from a cloud service downloads a temporary file containing both the boot image and some metadata describing the details of the VM instance. The temporary file is deleted after successful import.

15.28.2.1 Common Options

ovfname* | *ovaname

Specifies the name of the OVF file or OVA archive that describes the appliance. In the cloud case this is usually a fixed string such as OCI://.

--dry-run

Performs a dry run of the **VBoxManage import** command instead of performing the actual import operation. A dry run operation does the following:

- Outputs a description of the appliance's contents based on the specified OVF or OVA file.
- Shows how the appliance would be imported into Oracle VirtualBox. In addition, the output shows any options that you can use to change the import behavior.

The shortened form of this option is -n.

--options=keepallmacs | keepnatmacs | importtovdi | keepextradata

Enables you to fine-tune the import operation.

Valid arguments are as follows:

- keepallmacs: Specifies that the MAC addresses of every virtual network card are left unchanged.
- keepnatmacs: Specifies that the MAC addresses of every virtual network card are left unchanged if the network type is NAT.
- importtovdi: Specifies that all new disk images are to be created using the VDI file format.
- keepextradata: Specifies whether extra data settings that may be present in the .ovf file are imported.

--ostype=*ostype*

Specifies the guest operating system (OS) information for the VM. Use the **VBoxManage list ostypes** command to view the OS type identifiers.

--vmname=*name*

Specifies the name for the imported VM to be used by Oracle VirtualBox.

--basefolder=*folder*

Specifies the folder where the files of the imported VM are stored.

--memory=*MB*

Specifies the memory size in Megabytes for the imported VM.

--cpus=*n*

Specifies the number of CPUs for the imported VM.

--description=*text*

Specifies the description text visible in the GUI and CLI when checking the VM details.

15.28.2.2 OVF / OVA Import Options

The following options are specific to importing a virtual appliance in OVF or OVA format. Such an appliance can contain one or more VMs, which requires specifying which VM configuration should be adjusted in case you want to change it. See *5.3.2 Importing an Appliance in OVF Format on page 61*.

VBoxManage import <*ovfname* | *ovaname*> [##dry#run] [##options=keepallmacs | keepnatmacs | importtovdi | keepextradata] [##vsys=*n*] [##ostype=*ostype*] [##vmname=*name*] [##settingsfile=*filename*] [##basefolder=*folder*] [##group=*group*] [##memory=*MB*] [##cpus=*n*] [##description=*text*] [##eula=show | accept] [##unit=*n*] [##ignore] [##scsitype=BusLogic | LsiLogic] [##disk=*path*] [##controller=*index*] [##port=*n*]

--vsys=*n*

Specifies the index selecting a specific VM within the appliance. Affects the following options.

--unit=*n*

Specifies the index selecting a specific unit of a VM within the appliance. Affects the following options.

--settingsfile=*filename*

Specifies the filename (as a relative or absolute path) of the VM config file which will be created as part of the import. The preferred way to rename the settings file is to override the VM name using the --vmname option and if necessary specify the folder in which to create the VM with --basefolder.

--group=*group*

Specifies the primary group of the imported VM.

--eula=show | accept

Enables you to show or accept the license conditions of a VM within the appliance,

Valid arguments are as follows:

- show: Shows the EULA of a VM.
- accepts: Accepts the EULA of a VM. Any VMs in an appliance which have an EULA require accepting it, otherwise the import will fail.

--ignore

Ignores the hardware associated with the VM specified with the --unit option when importing the VM, effectively removing all of its associated hardware.

--scsitype=BusLogic | LsiLogic

Enables you to select the type of the SCSI controller for the current unit of an imported VM.

Valid arguments are as follows:

- BusLogic: Uses the (very old) BusLogic SCSI controller type.
- LsiLogic: Uses the (more modern) LsiLogic SCSI controller type.

15.28.2.3 Cloud Import Options

The following options are specific to importing a VM instance from a cloud service provider. It always deals with a single VM. See *6.9 Importing an Instance from Oracle Cloud Infrastructure on page 99*.

VBoxManage import OCI:// ##cloud [##ostype=*ostype*] [##vmname=*name*] [##basefolder=*folder*] [##memory=*MB*] [##cpus=*n*] [##description=*text*] <##cloudprofile=*profile*> <##cloudinstanceid=*id*> [##cloudbucket=*bucket*]

--cloud

Specifies that the import should be from the cloud.

--cloudprofile=*profile*

Specifies the cloud profile which is used to connect to the cloud service provider. The cloud profile contains your Oracle Cloud Infrastructure account details, such as your user OCID and the fingerprint for your public key. To use a cloud profile, you must have the required permissions on Oracle Cloud Infrastructure.

--cloudinstanceid=*id*

Specifies the ID of an existing instance in the cloud.

--cloudbucket=*bucket*

Specifies the bucket name in which to store the object created from the instance. In Oracle Cloud Infrastructure, a bucket is a logical container for storing objects. By default the first bucket available with the cloud profile is used.

15.28.3 Examples

The following example performs the dry run of an OVF import operation for a sample appliance that contains a Windows 10 guest:

```
$ VBoxManage import Windows10.ovf --dry-run
Interpreting Windows10.ovf...
OK.
Virtual system 0:
 0: Suggested OS type: "Windows10_64"
    (change with "--vsys 0 --ostype <type>"; use "list ostypes" to list all)
 1: Suggested VM name "win10-appliance"
    (change with "--vsys 0 --vmname <name>")
 2: Suggested VM group "/"
    (change with "--vsys 0 --group <group>")
 3: Suggested VM settings file name "/home/user1/VirtualBox VMs/win10-appliance/win10-
appliance.vbox"
    (change with "--vsys 0 --settingsfile <filename>")
 4: Suggested VM base folder "/home/user1/VirtualBox VMs"
    (change with "--vsys 0 --basefolder <path>")
 5: End-user license agreement
    (display with "--vsys 0 --eula show";
    accept with "--vsys 0 --eula accept")
 6: Number of CPUs: 1
    (change with "--vsys 0 --cpus <n>")
 7: Guest memory: 2048 MB (change with "--vsys 0 --memory <MB>")
 8: Sound card (appliance expects "ensoniq1371", can change on import)
    (disable with "--vsys 0 --unit 8 --ignore")
 9: USB controller
    (disable with "--vsys 0 --unit 9 --ignore")
10: Network adapter: orig bridged, config 2, extra type=bridged
11: Floppy
    (disable with "--vsys 0 --unit 11 --ignore")
12: SCSI controller, type BusLogic
    (change with "--vsys 0 --unit 12 --scsitype {BusLogic|LsiLogic}";
    disable with "--vsys 0 --unit 12 --ignore")
13: IDE controller, type PIIX4
    (disable with "--vsys 0 --unit 13 --ignore")
14: Hard disk image: source image=Windows10.vmdk,
      target path=/home/user1/disks/Windows10.vmdk, controller=12;channel=0
```

```
  (change target path with "--vsys 0 --unit 14 --disk <path>";
  change controller with "--vsys 0 --unit 14 --controller <index>";
  change controller port with "--vsys 0 --unit 14 --port <n>";
  disable with "--vsys 0 --unit 14 --ignore")
```

The dry run output lists and numbers the individual configuration items that are described in the Windows10.ovf file. Some of the items include information about how to disable or change the configuration of the item.

You can disable many of the items by using the --vsys *X* --unit *Y* --ignore options. *X* is the number of the virtual system. The value is 0 unless the appliance includes several virtual system descriptions. *Y* is the configuration item number.

Item 1 in the example command output specifies the name of the target machine. Items 12 and 13 specify the IDE and SCSI hard disk controllers, respectively.

Item 14 indicates the hard disk image and the --disk option specifies the target path where the image will be stored, the --controller option specifies which controller the disk will be attached to, and the --port option specifies which port on the controller the disk will be attached to. The default values are specified in the OVF file.

You can combine several items for the same virtual system by specifying the same value for the --vsys option. For example use the following command to import a machine as described in the OVF, exclude the sound card and USB controller and specify that the disk image is stored with a different name.

```
$ VBoxManage import Windows10.ovf --vsys 0 --unit 8 --ignore \
  --unit 9 --ignore --unit 14 --disk Windows10_disk0.vmdk
```

The following example illustrates how to import a VM from Oracle Cloud Infrastructure. To find the Oracle Cloud Infrastructure VM instances and its ID you can list all available instances with:

```
$ VBoxManage cloud --provider=OCI --profile=cloud-profile-name list instances
```

Once you know the ID the following command imports the instance from Oracle Cloud Infrastructure:

```
$ VBoxManage import OCI:// --cloud --vmname OCI_FreeBSD_VM --memory 4000 \
  --cpus 3 --ostype FreeBSD_64 --cloudprofile "standard user" \
  --cloudinstanceid ocid1.instance.oc1.iad.abuwc... --cloudbucket myBucket
```

15.29 VBoxManage list

View system information and VM configuration details

15.29.1 Synopsis

VBoxManage list [##long] [##platform#arch=x86 | arm] [##sorted] [bridgedifs | cloudnets | cloudprofiles | cloudproviders | cpu#profiles | dhcpservers | dvds | extpacks | floppies | groups | hddbackends | hdds | hostcpuids | hostdrives | hostdvds | hostfloppies | hostinfo | hostonlyifs | hostonlynets | intnets | natnets | ostypes | ossubtypes | runningvms | screenshotformats | systemproperties | usbfilters | usbhost | vms | webcams]

15.29.2 Description

The **VBoxManage list** subcommands enable you to obtain information about the Oracle VirtualBox software, the VMs and associated services that you create.

15.29.2.1 Common Options

--long

Shows detailed information about each information entry if available. The short form of this option is -l.

--platform-arch

Filters the output by the given platform architecture (if available, otherwise ignored). The short form of this option is -p.

--sorted

Sorts the list of information entries alphabetically. The short form of this option is -s.

15.29.2.2 List the Bridged Network Interfaces on the Host System

VBoxManage list bridgedifs

The **VBoxManage list bridgedifs** command lists the bridged network interfaces that are currently available on the host system. The output shows detailed configuration information about each interface. See *9 Virtual Networking on page 143*.

15.29.2.3 List the Cloud Network Interfaces

VBoxManage list cloudnets

The **VBoxManage list cloudnets** command lists the cloud network interfaces that have been configured. A cloud network interface provides connectivity between local VMs and a cloud network.

15.29.2.4 List the Cloud Profiles

VBoxManage list cloudprofiles

The **VBoxManage list cloudprofiles** command lists the cloud profiles that have been configured. A cloud profile contains settings for a cloud service account.

15.29.2.5 List the Cloud Providers

VBoxManage list cloudproviders

The **VBoxManage list cloudproviders** command lists the cloud providers that are supported by Oracle VirtualBox. Oracle Cloud Infrastructure is an example of a cloud provider.

15.29.2.6 List the known CPU Profiles

VBoxManage list cpu#profiles

The **VBoxManage list cpu-profiles** command lists the CPU profiles that are known by Oracle VirtualBox.

15.29.2.7 List the DHCP Servers on the Host System

VBoxManage list dhcpservers

The **VBoxManage list dhcpservers** command lists the DHCP servers that are currently available on the host system. The output shows detailed configuration information about each DHCP server. See *9 Virtual Networking on page 143*.

15.29.2.8 List the DVD Virtual Disk Images

VBoxManage list dvds

The **VBoxManage list dvds** command shows information about the DVD virtual disk images that are currently in use by the Oracle VirtualBox software. For each image, the output shows all the settings, the UUIDs associated with the image by Oracle VirtualBox, and all files associated with the image.

This command performs the same function as the Virtual Media Manager. See *8.3 The Virtual Media Manager on page 128*.

15.29.2.9 List the Installed Oracle VirtualBox Extension Packs

VBoxManage list extpacks

The **VBoxManage list extpacks** command shows all Oracle VirtualBox extension packs that are currently installed. See *3.1.1 Install the Oracle VirtualBox Extension Pack on page 43* and *15.22 VBoxManage extpack on page 358*.

15.29.2.10 List the Floppy Disk Virtual Disk Images

VBoxManage list floppies

The **VBoxManage list floppies** command shows information about the floppy disk images that are currently in use by the Oracle VirtualBox software. For each image, the output shows all the settings, the UUIDs associated with the image by Oracle VirtualBox, and all files associated with the image.

This command performs the same function as the Virtual Media Manager. See *8.3 The Virtual Media Manager on page 128*.

15.29.2.11 List the Virtual Machine Groups

VBoxManage list groups

The **VBoxManage list groups** command shows all VM groups. See *5.6.2 Using VM Groups on page 65*.

15.29.2.12 List the Virtual Disk Backends

VBoxManage list hddbackends

The **VBoxManage list hddbackends** command lists all known virtual disk backends of the Oracle VirtualBox software. For each such format, such as VDI, VMDK, or RAW, this command lists the backend's capabilities and configuration.

15.29.2.13 List the Hard Disk Virtual Disk Images

VBoxManage list hdds

The **VBoxManage list hdds** command shows information about the hard disk virtual disk images that are currently in use by the Oracle VirtualBox software. For each image, the output shows all the settings, the UUIDs associated with the image by Oracle VirtualBox, and all files associated with the image.

This command performs the same function as the Virtual Media Manager. See *8.3 The Virtual Media Manager on page 128*.

15.29.2.14 List the CPUID Information for the Host System CPUs

VBoxManage list hostcpuids

The **VBoxManage list hostcpuids** command lists CPUID information for each CPU on the host system. Use this information to perform a more fine grained analyis of the host system's virtualization capabilities.

15.29.2.15 List the Storage Drives on the Host System

VBoxManage list hostdrives

The **VBoxManage list hostdrives** command lists the disk drives on the host system potentially useful for creating a VMDK raw disk image. Each entry includes the name used to reference them from within Oracle VirtualBox.

15.29.2.16 List the DVD Drives on the Host System

VBoxManage list hostdvds

The **VBoxManage list hostdvds** command lists the DVD drives on the host system. Each DVD entry includes the name used to access them from within Oracle VirtualBox.

15.29.2.17 List the Floppy Disk Drives on the Host System

VBoxManage list hostfloppies

The **VBoxManage list hostfloppies** command lists the floppy disk drives on the host system. Each floppy disk entry includes the name used to access them from within Oracle VirtualBox.

15.29.2.18 List Information About the Host System

VBoxManage list hostinfo

The **VBoxManage list hostinfo** command shows information about the host system. The output includes information about the CPUs, memory, and the OS version.

15.29.2.19 List the Host-Only Network Interfaces on the Host System

VBoxManage list hostonlyifs

The **VBoxManage list hostonlyifs** command lists the host-only network interfaces that are currently available on the host system. The output shows detailed configuration information about each interface. See *9 Virtual Networking on page 143*.

15.29.2.20 List Host-Only Networks

VBoxManage list hostonlynets

The **VBoxManage list hostonlynets** command lists the host-only networks that have been configured. A host-only network provides connectivity between the host and local VMs. See *9 Virtual Networking on page 143*.

15.29.2.21 List Internal Networks

VBoxManage list intnets

The **VBoxManage list intnets** command shows information about the internal networks. See *9 Virtual Networking on page 143*.

15.29.2.22 List the NAT Network Interfaces on the Host System

VBoxManage list natnets

The **VBoxManage list natnets** command lists the NAT network interfaces that are currently available on the host system. See *9 Virtual Networking on page 143*.

15.29.2.23 List the Guest Operating Systems

VBoxManage list ostypes

The **VBoxManage list ostypes** command lists all guest operating systems (OSes) that are known to Oracle VirtualBox. Each OS entry includes an identifier, a description, a family identifier, a family description, and whether the OS has 64-bit support.

You can use these identifiers with the **VBoxManage modifyvm** command.

15.29.2.24 List the Guest Operating System Subtypes

VBoxManage list ossubtypes

The **VBoxManage list ossubtypes** command lists all guest operating system (OS) subtypes along with the associated guest OS descriptions that are known to Oracle VirtualBox. Each list entry includes a guest OS family identifier, the guest OS subtypes associated with that OS family (if any), and a description the guest OSes associated with that OS subtype.

15.29.2.25 List the Running Virtual Machines

VBoxManage list runningvms

The **VBoxManage list runningvms** command lists all virtual machines (VMs) that are currently running. By default this displays a compact list that shows the name and UUID of each VM.

15.29.2.26 List the Available Screen Shot Formats

VBoxManage list screenshotformats

The **VBoxManage list screenshotformats** command shows the list of available screen shot formats.

15.29.2.27 List System Properties

VBoxManage list systemproperties

The **VBoxManage list systemproperties** command shows a large collection of global Oracle VirtualBox settings and limits, such as minimum and maximum guest RAM, virtual hard disk size, folder settings, and the current authentication library in use.

15.29.2.28 List the Registered Global USB Filters

VBoxManage list usbfilters

The **VBoxManage list usbfilters** command lists all global USB filters registered with Oracle VirtualBox and displays the filter parameters. Global USB filters are for devices which are accessible to all virtual machines.

15.29.2.29 List the USB Devices on the Host System

VBoxManage list usbhost

The **VBoxManage list usbhost** command shows information about the USB devices that are attached to the host system. The output includes information that you can use to construct USB filters and indicates whether the device is currently in use by the host system.

15.29.2.30 List Virtual Machines

VBoxManage list vms

The **VBoxManage list vms** command lists all virtual machines (VMs) that are currently registered with Oracle VirtualBox. By default this command displays a compact list that shows the name and UUID of each VM.

15.29.2.31 List the Webcams Attached to a Running Virtual Machine

VBoxManage list webcams

The **VBoxManage list webcams** command shows the list of webcams that are attached to the running VM.

The output is a list of absolute paths or aliases that are used to attach the webcams to the VM by using the **VBoxManage webcam attach** command.

15.29.3 Examples

The following command lists the VM groups configured for Oracle VirtualBox.

```
$ VBoxManage list groups
"/Linux-VMs"
"/Windows-VMs"
```

The following command lists the VMs that are currently running.

```
$ VBoxManage list runningvms
"ol7" {ol7-UUID}
"win8" {win8-UUID}
```

15.30 VBoxManage mediumio

Medium content access

15.30.1 Synopsis

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] formatfat [##quick]

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] cat [##hex] [##offset=*byte#offset*] [##size=*bytes*] [##output=*#*|*filename*]

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] stream [##format=*image#format*] [##variant=*image#variant*] [##output=*#*|*filename*]

15.30.2 Description

15.30.2.1 Common options

The subcommands of **mediumio** all operate on a medium which must be specified using one of the following options along with an optional encryption password. The following common options can be placed before or after the sub-command:

--disk=*uuid*|*filename*

Either the UUID or filename of a harddisk image, e.g. VDI, VMDK, VHD, ++.

--dvd=*uuid*|*filename*

Either the UUID or filename of a DVD image, e.g. ISO, DMG, CUE.

--floppy=*uuid*|*filename*

Either the UUID or filename of a floppy image, e.g. IMG.

--password-file=-|*filename*

The name of a file containing the medium encryption password. If - is specified, the password will be read from stdin.

15.30.2.2 mediumio formatfat

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] formatfat [##quick]

Formats a medium with the FAT file system. This will erase the contents of the medium.

--quick

Quickformat the medium.

15.30.2.3 mediumio cat

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] cat [##hex] [##offset=*byte#offset*] [##size=*bytes*] [##output=*#*|*filename*]

Dumps the contents of the medium to stdout or the specified file.

--hex

Dump as hex bytes.

--offset

The byte offset in the medium to start.

--size

The number of bytes to dump.

--output

The output filename. As usual - is take to mean stdout.

15.30.2.4 mediumio stream

VBoxManage mediumio <##disk=*uuid*|*filename* | ##dvd=*uuid*|*filename* | ##floppy=*uuid*|*filename*> [##password#file=*#*|*filename*] stream [##format=*image#format*] [##variant=*image#variant*] [##output=*#*|*filename*]

Converts the medium to a streamable format and dumps it to the given output.

--format

The format of the destination image.

--variant

The medium variant for the destination.

--output

The output filename. As usual - is take to mean stdout.

15.31 VBoxManage mediumproperty

Manage medium properties

15.31.1 Synopsis

VBoxManage mediumproperty [disk | dvd | floppy] set <*uuid* | *filename*> <*property#name*> <*property#value*>

VBoxManage mediumproperty [disk | dvd | floppy] get <*uuid* | *filename*> <*property#name*>

VBoxManage mediumproperty [disk | dvd | floppy] delete <*uuid* | *filename*> <*property#name*>

15.31.2 Description

The **VBoxManage mediumproperty** command enables you to set, retrieve, or delete a medium property.

15.31.2.1 Set a Medium Property

VBoxManage mediumproperty [disk | dvd | floppy] set <*uuid* | *filename*> <*property#name*> <*property#value*>

The **VBoxManage mediumproperty set** command enables you to set a medium property.

disk | dvd | floppy

Specifies the type of medium. Valid values are disk (hard drive), dvd, or floppy.

uuid | filename

Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

property-name

Specifies the name of the property.

property-value

Specifies the value of the specified property.

15.31.2.2 Retrieve a Medium Property Value

VBoxManage mediumproperty [disk | dvd | floppy] get <*uuid* | *filename*> <*property#name*>

The **VBoxManage mediumproperty get** command enables you to retrieve the value of a medium property.

disk | dvd | floppy

Specifies the type of medium. Valid values are disk (hard drive), dvd, or floppy.

uuid | filename

Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

property-name

Specifies the name of the property.

15.31.2.3 Delete a Medium Property

VBoxManage mediumproperty [disk | dvd | floppy] delete <*uuid* | *filename*> <*property#name*>

The **VBoxManage mediumproperty delete** command enables you to delete a medium property.

disk | dvd | floppy

Specifies the type of medium. Valid values are disk (hard drive), dvd, or floppy.

uuid | filename

Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

property-name

Specifies the name of the property.

15.31.3 Examples

The following command sets the property called prop1 to val1 for the ol7.vdi disk image.

```
$ VBoxManage mediumproperty disk set ol7.vdi prop1 val1
```

The following command gets the value of the property called prop1 for the ol7.vdi disk image.

```
$ VBoxManage mediumproperty disk get ol7.vdi prop1
```

15.32 VBoxManage metrics

Monitor system resource usage

15.32.1 Synopsis

VBoxManage metrics collect [##detach] [##list] [##period=*seconds*] [##samples=*count*] [* | host | *vmname metric#list*]

VBoxManage metrics disable [##list] [* | host | *vmname metric#list*]

VBoxManage metrics enable [##list] [* | host | *vmname metric#list*]

VBoxManage metrics list [* | host | *vmname metric#list*]

VBoxManage metrics query [* | host | *vmname metric#list*]

VBoxManage metrics setup [##list] [##periods*eseconds*] [##samples*count*] [* | host | *vmname* *metric#list*]

15.32.2 Description

The **VBoxManage metrics** command enables you to monitor system resource usage for the host system and for virtual machines (VMs). For example, you can monitor particular metrics, such as the percentage of time CPUs spend executing in user mode (CPU/Load/User), over a specified sampling period.

Use the **VBoxManage metrics query** command to retrieve data at any time.

By default, metrics are not collected unless you run the **VBoxManage metrics setup** command to specify a sampling interval in seconds and the number of metrics to save.

Note that you can enable metric collection only for running VMs. Collected data and collection settings for a VM are discarded when the VM shuts down.

15.32.2.1 Metrics

The host and VMs have different sets of associated metrics which you can view by running the **VBoxManage metrics list** command.

Each metric is represented as a string that is composed of a category and a metric. Optionally, the metric string can include any of the following: a submetric, a sub-submetric, and an aggregate. The metric string has the following format:

category/*metric*[/*submetric*[/*sub-submetric*]][:*aggregate*]

- *category* is the resource type, such as CPU, RAM, FS, Net.
- *metric* is a measurement type that is associated with the resource category. For example, the Load and MHz metrics are associated with the CPU resource category.
- *submetric* is an optional measurement type that is associated with the metric. For example, the User, Kernel, and Idle submetrics are associated with the Load metric.
- *sub-submetric* is an optional measurement type that is associated with the submetric. For example, the Rx and Tx sub-submetrics are associated with the Rate submetric of the Net resource category. The associated metric is the network interface.
- *aggregate* is an optional function to provide minimum, maximum, and average measurements for a resource category. For example, the RAM/Usage/Free:min metric represents the minimum amount of available memory found in all saved data on the host system.

By default, the **VBoxManage metrics** commands operate on the host system and all VMs, and report on all metrics. You can optionally limit these commands to operate on the host system or on a particular VM, and report on a list of one or more metrics.

15.32.2.2 Common Options

*** | host | *vmname***

Specifies the component on which to operate. By default, this command operates on the host system and all running VMs.

If you specify host, the **VBoxManage metrics** command operates on the host system only. If you specify an asterisk (*), the command operates on all VMs. If you specify the name of a VM, the **VBoxManage metrics** command operates on that VM.

metric-list

Specifies a comma-separated list of one or more metrics.

The form of the metric must include the *category* and *metric* part of the metric string separated by a slash.

Note that the **VBoxManage metrics enable** and **VBoxManage metrics disable** commands require that you specify metrics as parameters. The metrics must include only the resource category and metric part, such as CPU/Load and RAM/Usage.

15.32.2.3 Collect Data Metrics

VBoxManage metrics collect [##detach] [##list] [##period=*seconds*] [##samples=*count*] [* | host | *vmname metric#list*]

The **VBoxManage metrics collect** command collects and outputs data periodically until you stop the process by pressing Ctrl+C.

--detach

Disables the collection of metric data, so no data is output. Using this option is the same as running the **VBoxManage metrics setup** command.

--list

Shows which metrics match the specified filter.

--period=*seconds*

Specifies the number of seconds to wait between collecting metric data samples. The default value is 1.

--samples=*count*

Specifies the number of metric data samples to save. To view the saved data, use the **VBoxManage metrics query** command. The default value is 1.

15.32.2.4 Disable Metric Data Collection

VBoxManage metrics disable [##list] [* | host | *vmname metric#list*]

The **VBoxManage metrics disable** command suspends data collection. This action does not affect the data collection properties or the collected data. Note that specifying a submetric in the metric list does not disable its underlying metrics.

Note that the **VBoxManage metrics disable** command requires that you specify metrics as parameters. The metrics must include only the resource category and metric part, such as CPU/Load and RAM/Usage.

--list

Shows whether the command succeeded as expected.

15.32.2.5 Enable Metric Data Collection

VBoxManage metrics enable [##list] [* | host | *vmname metric#list*]

The **VBoxManage metrics enable** command resumes data collection after it has been suspended by using the **VBoxManage metrics disable** command. Note that specifying a submetric in the metric list does not enable its underlying metrics.

Unlike the **VBoxManage metrics setup** command, the **VBoxManage metrics enable** command does not discard previously collected samples for the specified set of objects and metrics.

Note that the **VBoxManage metrics enable** command requires that you specify metrics as parameters. The metrics must include only the resource category and metric part, such as CPU/Load and RAM/Usage.

--list

Shows whether the command succeeded as expected.

15.32.2.6 List Metric Values

VBoxManage metrics list [* | host | *vmname* *metric#list*]

The **VBoxManage metrics list** command shows the metrics that are currently available. Note that VM-specific metrics are shown only when that VM is running.

15.32.2.7 List Saved Metric Data

VBoxManage metrics query [* | host | *vmname* *metric#list*]

The **VBoxManage metrics query** command retrieves and shows the saved metric data.

Note that the **VBoxManage metrics query** command does not remove or flush saved data but older samples are replaced by newer samples over time.

15.32.2.8 Configure Metric-Gathering Properties

VBoxManage metrics setup [##list] [##period*seconds*] [##samples*count*] [* | host | *vmname* *metric#list*]

The **VBoxManage metrics setup** command configures metric-gathering properties.

Note that this command discards any previously collected samples for the specified set of objects and metrics. To enable or disable metrics collection without discarding the data, use the **VBoxManage metrics enable** command or the **VBoxManage metrics disable** command, respectively.

--list

Shows which metrics have been modified as a result of the command execution.

--period=*seconds*

Specifies the number of seconds to wait between collecting metric data samples. The default value is 1.

--samples=*count*

Specifies the number of metric data samples to save. To view the saved data, use the **VBoxManage metrics query** command. The default value is 1.

15.32.3 Examples

The following example command enables the collection of host processor and memory usage metrics every second. The --samples option saves the five latest samples.

```
$ VBoxManage metrics setup --period 1 --samples 5 host CPU/Load,RAM/Usage
```

The following command lists the metrics that are available to the host system and VMs:

```
$ VBoxManage metrics list
```

Note that the host system and VMs have different sets of metrics.

The following example shows how to query metric data about the CPU time spent in user and kernel modes for the test VM:

```
$ VBoxManage metrics query test CPU/Load/User,CPU/Load/Kernel
```

15.33 VBoxManage modifymedium

Change the characteristics of an existing disk image

15.33.1 Synopsis

VBoxManage modifymedium [disk | dvd | floppy] <*uuid* | *filename*> [##autoreset=on | off] [##compact] [##description=*description*] [##move=*pathname*] [##property=*name*=[*value*]] [##resize=*megabytes* | ##resizebyte=*bytes*] [##setlocation=*pathname*] [##type=normal | writethrough | immutable | shareable | readonly | multiattach]

15.33.2 Description

The **VBoxManage modifymedium** command enables you to change the characteristics of an existing disk image.

Note:

For compatibility with earlier versions of Oracle VirtualBox, you can use the **modifyvdi** and **modifyhd** commands.

disk | dvd | floppy

Specifies the media type of the image.

filename

Specifies the Universally Unique Identifier (UUID) or path name of the disk image on the host file system. You can specify the UUID only if the medium is registered. Use the **VBoxManage list hdds** command to list the registered images. You can specify an absolute or relative path to the medium.

--autoreset=on | off

Specifies whether to automatically reset an immutable hard disk on every virtual machine (VM) startup. This option is only for immutable hard disks and the default value is on. See *8.4 Special Image Write Modes on page 132*.

--compact

Compresses disk images by removing blocks that contain only zeroes. This option shrinks a dynamically allocated image and reduces the *physical* size of the image without affecting the logical size of the virtual disk.

You can use this option for base images and for differencing images that are created as part of a snapshot.

> **Note:**
>
> Before you compress the image, you must use a suitable software tool to zero out free space in the guest system. For example:
>
> - *Windows guests.* Run the **sdelete -z** command.
> - *Linux guests.* Use the **zerofree** utility, which supports ext2 and ext3 file systems.
> - *Mac OS X guests.* Use the **diskutil secureErase freespace 0 /** command.

Note that you can only use this option to compress VDI images. To compress non-VID images, you can zero out free blocks and then clone the disk to any other dynamically allocated format.

--description=*description*

Specifies a text description of the medium.

--move=*pathname*

Specifies a relative or absolute path to a medium on the host system. Use this option to relocate a medium to a different location on the host system.

--property=*name*=*value*

Specifies a property name and value for the medium.

--resize=*size*

Specifies the new capacity of an existing image in MB. You can use this option only to expand the capacity of an image. You can cannot shrink the capacity of an image.

Note that you can only resize dynamically allocated disk images that use the VDI and VHD formats. This option adjusts the *logical* size of a virtual disk and has only a minor affect on the physical size.

For example, if your dynamically allocated 10 GB disk is full, you can use the --resize 15360 option to increase the capacity of the existing disk to 15 GB (15,360 MB). This operation enables you to avoid having to create a new image and copy all data from within a VM.

Note that using this option only changes the capacity of the drive. So, you might need to subsequently use a partition management tool in the guest to adjust the main partition to fill the drive.

--resizebyte=*size*

Specifies the new capacity of an existing image in bytes. This option is similar to the --resize option, but you specify the size in bytes instead of megabytes.

--setlocation=*pathname*

Specifies the new location of the medium on the host system after the medium has been moved. The path name can be relative to the current directory or be absolute to the root.

Note that the **VBoxManage modifymedium** command does not perform any sanity checks on the path name you specify. Ensure that the path name is valid.

--type

Specifies the new mode type of an existing image. Valid values are normal, immutable, writethrough, multiattach, shareable, and readonly. For descriptions of these mode types, see *8.4 Special Image Write Modes on page 132*.

15.33.3 Examples

The following command modifies the description for the disk image file called disk01.vdi.

```
$ VBoxManage modifymedium disk disk01.vdi --description "Oracle Linux 7 image"
```

The following command modifies the write mode for the disk image file called disk01.vdi.

```
$ VBoxManage modifymedium disk disk01.vdi --type writethrough
```

15.33.4 See Also

15.29 VBoxManage list on page 384

15.34 VBoxManage modifynvram

List and modify the NVRAM content of a virtual machine

15.34.1 Synopsis

VBoxManage modifynvram <*uuid* | *vmname*> inituefivarstore

VBoxManage modifynvram <*uuid* | *vmname*> enrollmssignatures

VBoxManage modifynvram <*uuid* | *vmname*> enrollorclpk

VBoxManage modifynvram <*uuid* | *vmname*> enrollpk [##platform#key=*filename*] [##owner#uuid=*uuid*]

VBoxManage modifynvram <*uuid* | *vmname*> enrollmok [##mok=*filename*] [##owner#uuid=*uuid*]

VBoxManage modifynvram <*uuid* | *vmname*> secureboot <##enable | ##disable>

VBoxManage modifynvram <*uuid* | *vmname*> listvars

VBoxManage modifynvram <*uuid* | *vmname*> queryvar [##name=*name*] [##filename=*filename*]

VBoxManage modifynvram <*uuid* | *vmname*> deletevar [##name=*name*] [##owner#uuid=*uuid*]

VBoxManage modifynvram <*uuid* | *vmname*> changevar [##name=*name*] [##filename=*filename*]

15.34.2 Description

The "modifynvram" commands are for experts who want to inspect and modify the UEFI variable store of a virtual machine. Any mistakes made here can result in a non-bootable virtual machine.

15.34.2.1 Common options

The subcommands of **modifynvram** all operate on a running virtual machine:

uuid | vmname

Either the UUID or the name (case sensitive) of a VM.

15.34.2.2 modifynvram inituefivarstore

VBoxManage modifynvram <*uuid* | *vmname*> inituefivarstore

Initalizes the UEFI variable store to a default state. Any previous existing variable store is deleted. Use with extreme caution!

15.34.2.3 modifynvram enrollmssignatures

VBoxManage modifynvram <*uuid* | *vmname*> enrollmssignatures

Enrolls the default Microsoft KEK and DB signatures required for UEFI secure boot.

15.34.2.4 modifynvram enrollorclpk

VBoxManage modifynvram <*uuid* | *vmname*> enrollorclpk

Enrolls the default platform key provided by Oracle required for UEFI secure boot.

15.34.2.5 modifynvram enrollpk

VBoxManage modifynvram <*uuid* | *vmname*> enrollpk [##platform#key=*filename*] [##owner#uuid=*uuid*]

Enrolls a custom platform key provided by the user required for UEFI secure boot. The following commands use openssl to generate a new platform key:

```
$ openssl req -new -x509 -newkey rsa:2048 -keyout PK.key -out PK.crt
```

```
$ openssl x509 -in PK.crt -out PK.cer -outform DER
```

--platform-key=*filename*

The platform key provided as a DER encoded X.509 signature.

--owner-uuid=*uuid*

The UUID identifying the owner of the platform key.

15.34.2.6 modifynvram secureboot

VBoxManage modifynvram <*uuid* | *vmname*> secureboot <##enable | ##disable>

Enables or disables UEFI secure boot.

--enable

Enables UEFI secure boot if the state of the key enrolment permits.

--disable

Disables UEFI secure boot.

15.34.2.7 modifynvram listvars

VBoxManage modifynvram <*uuid* | *vmname*> listvars

Lists all UEFI variables in the virtual machine's store along with their owner UUID.

15.34.2.8 modifynvram queryvar

VBoxManage modifynvram <*uuid* | *vmname*> queryvar [##name=*name*] [##filename=*filename*]

Queries the content of a given UEFI variable identified by its name.

--name=*name*

UEFI variable name to query.

--filename=*filename*

Where to store the content of the variable upon success. This is optional, if omitted the content will be dumped to the terminal as a hex dump.

15.34.2.9 modifynvram deletevar

VBoxManage modifynvram <*uuid* | *vmname*> deletevar [##name=*name*] [##owner#uuid=*uuid*]

Deletes the given variable identified by its name and owner UUID.

--name=*name*

UEFI variable name to delete.

--owner-uuid=*uuid*

The UUID identifying the owner of the variable to delete.

15.34.2.10 modifynvram changevar

VBoxManage modifynvram <*uuid* | *vmname*> changevar [##name=*name*] [##filename=*filename*]

Changes the UEFI variable content to the one form the given file.

--name=*name*

UEFI variable name to change the data for.

--filename=*filename*

The file to read the data from.

15.35 VBoxManage modifyvm

Change settings for a virtual machine that is stopped

15.35.1 Synopsis

VBoxManage modifyvm <*uuid* | *vmname*> [##name=*name*] [##groups=*group* [,*group*...]] [##description=*description*] [##os#type=*OS#type*] [##icon#file=*filename*] [##memory=*size#in#MB*] [##page#fusion=on | off] [##vram=*size#in#MB*] [##acpi=on | off] [##ioapic=on | off] [##hardware#uuid=*UUID*] [##cpus=*CPU#count*] [##cpu#hotplug=on | off] [##plug#cpu=*CPU#ID*] [##unplug#cpu=*CPU#ID*] [##cpu#execution#cap=*number*] [##x86#pae=on | off] [##x86#long#mode=on | off] [##ibpb#on#vm#exit=on | off] [##ibpb#on#vm#entry=on | off] [##spec#ctrl=on | off] [##l1d#flush#on#sched=on | off] [##l1d#flush#on#vm#entry=on | off] [##mds#clear#on#sched=on | off] [##mds#clear#on#vm#entry=on | off] [##cpu#profile=host | Intel 8086 | Intel 80286 | Intel 80386] [##x86#hpet=on | off] [##hwvirtex=on | off] [##triple#fault#reset=on | off] [##apic=on | off] [##x86#x2apic=on | off] [##arm#gic#its=on | off] [##paravirt#provider=none | default | legacy | minimal | hyperv | kvm] [##paravirt#debug=*key*=*value*[,*key*=*value*...]] [##nested#paging=on | off] [##large#pages=on | off] [##x86#vtx#vpid=on | off] [##x86#vtx#ux=on | off] [##nested#hw#virt=on | off] [##virt#vmsave#vmload=on | off] [##accelerate#3d=on | off] [##chipset=ich9 | piix3 | armv8virtual] [##iommu=none | automatic | amd | intel] [##tpm#type=none | 1.2 | 2.0 | host | swtpm] [##tpm#location=*location*] [##firmware#logo#fade#in=on | off] [##firmware#logo#fade#out=on | off] [##firmware#logo#display#time=*msec*] [##firmware#logo#image#path=*pathname*] [##firmware#boot#menu=disabled | menuonly | messageandmenu] [##firmware#apic=disabled | apic | x2apic] [##firmware#system#time#offset=*msec*] [##firmware#pxe#debug=on | off] [##system#uuid#le=on | off] [##boot*X*= none | floppy | dvd | disk | net] [##rtc#use#utc=on | off] [##graphicscontroller=none | vboxvga | vmsvga | vboxsvga | qemuramfb] [##snapshot#folder=default | *pathname*] [##firmware=bios | efi | efi32 | efi64] [##guest#memory#balloon=*size#in#MB*] [##default#frontend=default | *name*] [##vm#process#priority=default | flat | low | normal | high] [##vm#execution#engine=default | hm | hwvirt | nem | native#api | interpreter | recompiler]

VBoxManage modifyvm <*uuid* | *vmname*> [##nic*N*= none | null | nat | bridged | intnet | hostonly | hostonlynet | generic | natnetwork | cloud] [##nic#type*N*= Am79C970A | Am79C973 | 82540EM | 82543GC | 82545EM | virtio | usbnet] [##cable#connected*N*= on | off] [##nic#trace*N*= on | off] [##nic#trace#file*N*=*filename*] [##nic#property*N*=*name*= [*value*]] [##nic#speed*N*=*kbps*] [##nic#boot#prio*N*=*priority*] [##nic#promisc*N*= deny | allow#vms | allow#all] [##nic#bandwidth#group*N*= none | *name*] [##bridge#adapter*N*= none | *device#name*] [##cloud#network*N*=*network#name*] [##host#only#adapter*N*= none | *device#name*] [##host#only#net*N*=*network#name*] [##intnet*N*=*network#name*] [##nat#network*N*=*network#name*] [##nic#generic#drv*N*=*driver#name*] [##mac#address*N*= auto | *MAC#address*]

VBoxManage modifyvm <*uuid* | *vmname*> [##nat#net*N*= *network* | default] [##nat#pf*N*= [*rule#name*],tcp | udp,[*host#IP*],*hostport*,[*guest#IP*],*guestport*] [##nat#pf*N*=delete=*rule#name*] [##nat#tftp#prefix*N*=*prefix*] [##nat#tftp#file*N*=*filename*] [##nat#tftp#server*N*=*IP#address*] [##nat#bind#ip*N*=*IP#address*] [##nat#dns#pass#domain*N*= on | off] [##nat#localhostreachable*N*= on | off] [##nat#settings*N*=[*mtu*]] [##nat#forward#broadcast*N*= on | off] [##nat#enable#tftp*N*= on | off]

VBoxManage modifyvm <*uuid* | *vmname*> [##mouse=ps2 | usb | usbtablet | usbmultitouch | usbmtscreenpluspad] [##keyboard=ps2 | usb] [##uart*N*= off | *IO#base IRQ*] [##uart#mode*N*= disconnected | server*pipe* | client*pipe* | tcpserver*port* | tcpclient*hostname*:*port* | file*filename* | *device#name*] [##uart#type*N*= 16450 | 16550A | 16750] [##lpt#mode*N*=*device#name*] [##lpt*N*= off | *IO#base IRQ*] [##audio#controller=ac97 | hda | sb16] [##audio#codec=stac9700 | ad1980 | stac9221 | sb16] [##audio#driver=none | default | null | dsound | was | oss | alsa | pulse | coreaudio] [##audio#enabled=on | off] [##audio#in=on | off] [##audio#out=on | off] [##clipboard#mode=disabled | hosttoguest | guesttohost | bidirectional] [##clipboard#file#transfers=enabled | disabled] [##drag#and#drop=disabled | hosttoguest | guesttohost | bidirectional] [##monitor#count=*number*] [##usb#ehci=on | off] [##usb#ohci=on | off] [##usb#xhci=on | off] [##usb#rename=*old#name new#name*]

VBoxManage modifyvm <*uuid* | *vmname*> [##recording=on | off] [##recording#screens=all | none | *screen#ID*[,*screen#ID*...]] [##recording#file=*filename*] [##recording#max#size=*MB*] [##recording#max#time=*seconds*] [##recording#opts= *key*=*value*[,*key*=*value*...]] [##recording#video#fps=*fps*] [##recording#video#rate=*rate*] [##recording#video#res=*width*x*height*]

VBoxManage modifyvm <*uuid* | *vmname*> [##vrde=on | off] [##vrde#property=*property#name*=[*property#value*]] [##vrde#extpack=default | *name*] [##vrde#port=*port*] [##vrde#address=*hostip*] [##vrde#auth#type=null | external | guest] [##vrde#auth#library=default | *name*] [##vrde#multi#con=on | off] [##vrde#reuse#con=on | off] [##vrde#video#channel=on | off] [##vrde#video#channel#quality=*percent*]

VBoxManage modifyvm <*uuid* | *vmname*> [##teleporter=on | off] [##teleporter#port=*port*] [##teleporter#address=*address* | empty] [##teleporter#password=*password*] [##teleporter#password#file=*filename* | stdin] [##cpuid#portability#level=*level*] [##cpuid#set=*leaf* [:*subleaf*] *eax ebx ecx edx*] [##cpuid#remove=*leaf* [:*subleaf*]] [##cpuid#remove#all]

VBoxManage modifyvm <*uuid* | *vmname*> [##tracing#enabled=on | off] [##tracing#config=*string*] [##tracing#allow#vm#access=on | off]

VBoxManage modifyvm <*uuid* | *vmname*> [##usb#card#reader=on | off]

VBoxManage modifyvm <*uuid* | *vmname*> [##autostart#enabled=on | off] [##autostart#delay=*seconds*]

VBoxManage modifyvm <*uuid* | *vmname*> [##guest#debug#provider=none | native | gdb | kd] [##guest#debug#io#provider=none | tcp | udp | ipc] [##guest#debug#address=*IP#Address* | *path*] [##guest#debug#port=*port*]

VBoxManage modifyvm <*uuid* | *vmname*> [##pci#attach=*host#PCI#address* [*@guest#PCI#bus#address*]] [##pci#detach=*host#PCI#address*]

VBoxManage modifyvm <*uuid* | *vmname*> [##testing#enabled=on | off] [##testing#mmio=on | off] [##testing#cfg#dword*idx*=*value*]

15.35.2 Description

The **VBoxManage modifyvm** command enables you to change the properties of a registered virtual machine (VM) that is not running.

Most of these properties correspond to the VM settings that are shown in each VM's *Settings* dialog in the VirtualBox Manager. See *5 Working with Virtual Machines on page 51*. However, some settings can only be viewed and managed with the **VBoxManage** command.

You can use the **VBoxManage modifyvm** command to change VM settings only when the VM is powered off. The VM cannot be running or in saved state when you use this command.

You can use the **VBoxManage controlvm** command to dynamically change some VM machine settings while the VM is running. See *15.12 VBoxManage controlvm on page 309*.

15.35.2.1 General Settings

VBoxManage modifyvm <*uuid* | *vmname*> [##name=*name*] [##groups=*group* [,*group*...]] [##description=*description*] [##os#type=*OS#type*] [##icon#file=*filename*] [##memory=*size#in#MB*] [##page#fusion=on | off] [##vram=*size#in#MB*] [##acpi=on | off] [##ioapic=on | off] [##hardware#uuid=*UUID*] [##cpus=*CPU#count*] [##cpu#hotplug=on | off] [##plug#cpu=*CPU#ID*] [##unplug#cpu=*CPU#ID*] [##cpu#execution#cap=*number*] [##x86#pae=on | off] [##x86#long#mode=on | off] [##ibpb#on#vm#exit=on | off] [##ibpb#on#vm#entry=on | off] [##spec#ctrl=on | off] [##l1d#flush#on#sched=on | off] [##l1d#flush#on#vm#entry=on | off] [##mds#clear#on#sched=on | off] [##mds#clear#on#vm#entry=on | off] [##cpu#profile=host | Intel 8086 | Intel 80286 | Intel 80386] [##x86#hpet=on | off] [##hwvirtex=on | off] [##triple#fault#reset=on | off] [##apic=on | off] [##x86#x2apic=on | off] [##arm#gic#its=on | off] [##paravirt#provider=none | default | legacy | minimal | hyperv | kvm] [##paravirt#debug=*key*=*value*[,*key*=*value*...]] [##nested#paging=on | off] [##large#pages=on | off] [##x86#vtx#vpid=on | off] [##x86#vtx#ux=on | off] [##nested#hw#virt=on | off] [##virt#vmsave#vmload=on | off] [##accelerate#3d=on | off] [##chipset=ich9 | piix3 | armv8virtual] [##iommu=none | automatic | amd | intel] [##tpm#type=none | 1.2 | 2.0 | host | swtpm] [##tpm#location=*location*] [##firmware#logo#fade#in=on | off] [##firmware#logo#fade#out=on | off] [##firmware#logo#display#time=*msec*] [##firmware#logo#image#path=*pathname*] [##firmware#boot#menu=disabled | menuonly | messageandmenu] [##firmware#apic=disabled | apic | x2apic] [##firmware#system#time#offset=*msec*] [##firmware#pxe#debug=on | off] [##system#uuid#le=on | off] [##boot*X*= none | floppy | dvd | disk | net] [##rtc#use#utc=on | off] [##graphicscontroller=none | vboxvga | vmsvga | vboxsvga | qemuramfb] [##snapshot#folder=default | *pathname*] [##firmware=bios | efi | efi32 | efi64] [##guest#memory#balloon=*size#in#MB*] [##default#frontend=default | *name*] [##vm#process#priority=default | flat | low | normal | high] [##vm#execution#engine=default | hm | hwvirt | nem | native#api | interpreter | recompiler]

The following options enable you to modify general information about your VM.

The **VBoxManage modifyvm** command supports the following options:

--name=*vmname*

Changes the name of the VM and its related internal VM files. See *15.15 VBoxManage createvm on page 330*.

--groups=*group*

Changes the group membership of a VM. Group names always begin with a slash character (/) and can be nested. By default, VMs are members of the / group. A VM can be member of multiple groups, but its primary group determines the directory structure where the internal VM files are placed by default.

--description=*desc*

Changes the optional VM description. Use a description to record details about the VM in a meaningful way. The GUI interprets HTML markup while the **VBoxManage modifyvm** command enables you include arbitrary strings that can contain multiple lines.

--os-type=*OS-type*

Specifies the guest operating system (OS) information for the VM. Use the **VBoxManage list ostypes** command to view the OS type identifiers.

--icon-file=*filename*

Specifies the path to the VM icon file in PNG format on the host system. The icon is shown in the VM manager UI and when running the VM with UI.

--memory=*size*

Specifies the amount of host system RAM to allocate to the VM. The size is in MB. See *4 Creating a New Virtual Machine on page 47*.

--page-fusion=on | off

Enables or disables the Page Fusion feature, which is disabled by default. Use the Page Fusion feature to minimize the memory duplication between VMs that have similar configurations and that run on the same host system. See *7.11.2 Page Fusion on page 122*.

--vram=*size*

Specifies the amount of RAM to allocate to the virtual graphics card. See *5.14 Display Settings on page 75*.

--acpi=on | off

Determines whether the VM has ACPI support. See *5.13.1 Motherboard Tab on page 72*.

--ioapic=on | off

Determines whether the VM has I/O APIC support. See *5.13.1 Motherboard Tab on page 72*.

--hardware-uuid=*uuid*

Specifies the Universally Unique Identifier (UUID) to present to the guest VM in memory tables (DMI/SMBIOS), hardware, and VM properties. By default this hardware UUID is the same as the VM UUID. Cloning a VM and the teleporting feature automatically preserve the hardware UUID value. Likewise for Virtual Appliance export and import, but only if both operations are done by Oracle VirtualBox.

--cpus=*CPU-count*

Specifies the number of virtual CPUs to assign to the VM. See *5.13.2 Processor Tab on page 74*.

If CPU hot-plugging is enabled, this option specifies the maximum number of virtual CPUs that can be plugged into the VMs.

--cpu-hotplug=on | off

Enables or disables CPU hot-plugging. When enabled, you can dynamically add virtual CPUs to a VM or remove virtual CPUs from a VM. See *11.2 CPU Hot-Plugging on page 179*.

--plug-cpu=*CPU-ID*

Adds a virtual CPU to the VM. *CPU-ID* is the index of the virtual CPU to add. A valid index value is a number from 0 to the maximum number of CPUs that you configured by using the --cpus option.

Only use this option if CPU hot-plugging is enabled.

--unplug-cpu=*CPU-ID*

Removes a virtual CPU from the VM. *CPU-ID* is the index of the virtual CPU to remove. A valid index value is a number from 1 to the maximum number of CPUs that you configured by using the --cpus option.

Only use this option if CPU hot-plugging is enabled.

Note that you cannot remove CPU 0.

--cpuexectioncap=*percentage*

Specifies how much CPU time a virtual CPU can use. A valid value is from 1 to 100. A value of 50 indicates that a single virtual CPU can use up to 50% of a single host CPU.

Use this feature with caution, it can have unexpected results including timekeeping problems and lower performance than specified. If you want to limit the resource usage of a VM it is more reliable to pick an appropriate number of VCPUs.

--x86-pae=on | off

Enables or disables physical address extension (PAE). See *5.13.2 Processor Tab on page 74*.

--x86-long-mode=on | off

Enables or disables long mode. See *5.13.2 Processor Tab on page 74*.

--ibpb-on-vm-exit=on | off

Enables use of Indirect Branch Prediction Barrier (IBPB) on every VM exit.

--ibpb-on-vm-entry=on | off

Enables use of Indirect Branch Prediction Barrier (IBPB) on every VM entry.

--spec-ctrl=on | off

Enables or disables the exposure of speculation control interfaces to the guest VM. These interfaces must be available on the host system.

Depending on the host CPU and the workload, enabling speculation control might significantly reduce performance.

--l1d-flush-on-sched=on | off

Enables or disables level 1 data cache flushing when a thread is scheduled to execute guest code. See *14.4.1 CVE-2018-3646 on page 267*.

--l1d-flush-on-vm-entry=on | off

Enables or disables level 1 data cache flushing on every VM entry. See *14.4.1 CVE-2018-3646 on page 267*.

--mds-clear-on-sched=on | off

Enables CPU buffer clearing when a thread is scheduled to execute guest code. See *14.4.2 CVE-2018-12126, CVE-2018-12127, CVE-2018-12130, CVE-2019-11091 on page 268*.

--mds-clear-on-vm-entry=on | off

Enables CPU buffer clearing on every VM entry. See *14.4.2 CVE-2018-12126, CVE-2018-12127, CVE-2018-12130, CVE-2019-11091 on page 268*.

--cpu-profile=host | Intel 8086 | Intel 80286 | Intel 80386

Specifies the profile to use for guest CPU emulation. Specify a value that is based on the host system CPU (host) or one of the following older Intel micro-architectures: 8086, 80286, or 80386.

--x86-hpet=on | off

Enables or disables a High Precision Event Timer (HPET) that can replace a legacy system timer. This feature is disabled by default. Note HPET is supported on Windows versions starting with Vista.

--hwvirtex=on | off

Enables or disables the use of hardware virtualization extensions in the processor of the host system. Such extensions are Intel VT-x or AMD-V.

--triple-fault-reset=on | off

Enables or disables the resetting of the guest VM instead of triggering a Guru Meditation. Some guest VMs raise a triple fault to reset the CPU, so sometimes resetting the guest VM is the best outcome. This option only applies to guests that do not use symmetric multiprocessing (SMP).

--apic=on | off

Enables or disables APIC. With APIC, OSes can use more than 16 interrupt requests (IRQs) to avoid IRQ sharing and to improve reliability. APIC is enabled by default. See *5.13.1 Motherboard Tab on page 72*.

--x86-x2apic=on | off

Enables or disables the CPU x2APIC feature. CPU x2APIC enables an OS to run more efficiently on high core count configurations and to optimize interrupt distribution in virtualized environments. This feature is enabled by default.

Disable this feature when the OS that runs on a host system or a guest VM is incompatible with CPU x2APIC.

--arm-gic-its=on | off

Enables or disables the ITS (Interrupt Translation Service) component of the GIC (Generic Interrupt Controller). This feature is disabled by default.

--paravirt-provider=none | default | legacy | minimal | hyperv | kvm

Specifies one of the following paravirtualization interfaces to provide to the guest OS:

- none does not expose any paravirtualization interface.
- default selects the appropriate interface based on the guest OS type when starting the VM. This is the default value used when creating new VMs.
- legacy selects a paravirtual interface for VMs that were created by older Oracle VirtualBox versions.
- minimal is required for Mac OS X guest VMs.
- kvm is recommended for Linux guest VMs. See *5.9 Paravirtualization Providers on page 69*.
- hyperv is recommended for Windows guest VMs. See *5.9 Paravirtualization Providers on page 69*.

--paravirt-debug=*property*=*value*

Specifies debugging properties that are specific to the paravirtualization provider configured for the specified VM. See *11.28 Paravirtualized Debugging on page 221*.

--nested-paging=on | off

Enables or disables the nested paging feature in the processor of the host system. This option is available only when hardware virtualization is enabled. See *14.4.1 CVE-2018-3646 on page 267*.

--large-pages=on | off

Enables or disables the hypervisor's use of large pages, which can improve performance by up to 5%. The use of large pages reduces TLB use and overhead. This option is available only when both hardware virtualization and nested paging are enabled.

--x86-vtx-vpid=on | off

Enables or disables the use of the tagged TLB (VPID) feature in the processor of your host system. This option is available only when hardware virtualization is enabled on Intel VT-x.

--x86-vtx-ux=on | off

Enables or disables the use of unrestricted guest mode for executing the guest VM. This option is available only when hardware virtualization is enabled on Intel VT-x.

--nested-hw-virt=on | off

Enables or disables nested virtualization. Enabling makes hardware virtualization features available to the VM. See *11.31 Nested Virtualization on page 225*.

--virt-vmsave-vmload=on | off

If hardware virtualization is enabled and the host has an AMD CPU, this setting enables or disables the use of the virtualized vmsave/vmload host feature while executing the VM. It is enabled by default. It is recommended to leave it enabled as it has a drastic impact on performance while executing nested VMs when using the nested hardware virtualization feature. *11.31 Nested Virtualization on page 225*.

--accelerate-3d=on | off

Enables or disables hardware 3D acceleration for the graphics adapter variants which support it. This option has an effect only when the Guest Additions are installed. See *7.6 Hardware-Accelerated Graphics on page 116*.

--chipset=piix3 | ich9 | armv8virtual

Specify the Intel chipset for Oracle VirtualBox to emulate. For the x86 platform, the default value is the Intel PIIX3 chipset. (piix3). For the ARM platform, the default value is the ARMv8Virtual chipset. (armv8virtual).

Change this value only if you need to relax some of the chipset constraints. See *5.13.1 Motherboard Tab on page 72*.

--iommu=none | automatic | amd | intel

Specifies the IOMMU type for Oracle VirtualBox to emulate. Both Intel and AMD IOMMU emulation currently require the use of the Intel ICH9 chipset (see --chipset option).

Valid values are as follows:

- none – No IOMMU is present and is the default value.
- automatic – An IOMMU is present but its type is automatically chosen to match the host CPU vendor when the VM is powered on.
- amd – An AMD IOMMU is present.
- intel – An Intel IOMMU is present.

--tpm-type=none | 1.2 | 2.0 | host | swtpm

Specifies the TPM type for Oracle VirtualBox to emulate.

Valid values are as follows:

- none – No TPM is present and is the default value.
- 1.2 – A TPM conforming to the TCG specification version 1.2 is present.
- 2.0 – A TPM conforming to the TCG specification version 2.0 is present.
- host – The host TPM is passed through to the guest. May not be available on all supported host platforms.
- swtpm – The VM connects to an external TPM emulation compliant to swtpm. Requires to set the TPM location to connect to (see --tpm-location option).

--firmware-logo-fade-in=on | off

Specifies whether the BIOS logo fades in on VM startup. By default, an Oracle VirtualBox logo is shown.

--firmware-logo-fade-out=on | off

Specifies whether the BIOS logo fades out on VM startup.

--firmware-logo-display-time=*msec*

Specifies the amount of time in milliseconds that the BIOS logo is visible.

--firmware-logo-image-path=*pathname*

Replaces the existing BIOS logo with a different image. The replacement image must be an uncompressed 16, 256 or 16M color bitmap file (BMP) that does not contain color space information (Windows 3.0 format). Also ensure that the image is no larger than 640 X 480 pixels.

--firmware-boot-menu=disabled | menuonly | messageandmenu

Specifies whether the BIOS permits you to select a temporary boot device. Valid values are:

- disabled outputs the alternate boot device message and permits you to select a temporary boot device by pressing F12.
- menuonly suppresses the alternate boot device message, but permits you to select a temporary boot device by pressing F12.
- messageandmenu suppresses the alternate boot device message and prevents you from selecting a temporary boot device by pressing F12.

--firmware-apic=x2apic | apic | disabled

Specifies the APIC level of the firmware. Valid values are: x2apic, apic, and disabled. When the value is disabled, neither the apic nor the x2apic version of the firmware is used.

Note that if you specify the x2apic value and x2APIC is unsupported by the virtual CPU, the APIC level downgrades to apic, if supported. Otherwise, the APIC level downgrades to disabled. Similarly, if you specify the apic value and APIC is unsupported by the virtual CPU, the APIC level downgrades to disabled.

--firmware-system-time-offset=*msec*

Specifies the time offset in milliseconds of the guest VM relative to the time on the host system. If the offset value is positive, the guest VM time runs ahead of the time on the host system.

--firmware-pxe-debug=on | off

Enables or disables additional debugging output when using the Intel PXE boot ROM. The debug output is written to the release log file. See *13.5 Collecting Debugging Information on page 242*.

--system-uuid-le=on | off

Enables or disables representing the system UUID in little endian form. The default value is on for new VMs. For old VMs the setting is off to keep the content of the DMI/SMBIOS table unchanged, which can be important for Windows license activation.

--boot*N*=none | floppy | dvd | disk | net

Enables you to specify the boot device order for the VM by assigning one of the device types to each of the four boot device slots that are represented by *N* in the option name.

A value of 1 for *N* represents the first boot device slot, and so on.

The device types are floppy for floppy disks, dvd for DVDs or CDs, disk for hard disks, and net for a network device. A value of none indicates that no boot device is associated with the specified slot.

--rtc-use-utc=on | off

Specifies whether the real-time clock (RTC) uses coordinated universal time (UTC). See *5.13.1 Motherboard Tab on page 72*.

--graphicscontroller=none | vboxvga | vmsvga | vboxsvga

Specifies the graphics controller type to use. See *5.14.1 Screen Tab on page 75*.

--snapshot-folder=default | *pathname*

Specifies the name of the VM's snapshot storage folder. If you specify default, the folder name is Snapshots/ in the machine folder.

--firmware=bios | efi | efi32 | efi64

Specifies the firmware used to boot the VM. Valid values are: bios, efi, efi32, or efi64. Use EFI values with care.

By default, BIOS firmware is used.

--guest-memory-balloon=*size*

Specifies the size of the guest memory balloon. The guest memory balloon is the memory allocated by the Guest Additions from the guest OS and returned to the hypervisor for use by other VMs. Specify *size* in megabytes. The default value is 0 megabytes. See *7.11.1 Memory Ballooning on page 121*.

--default-frontend=default | *name*

Specifies the default frontend to use when starting the specified VM. If you specify default, the VM is shown in a window on the user's desktop. See *15.47 VBoxManage startvm on page 446*.

--vm-process-priority=default | flat | low | normal | high

Specifies the priority scheme of the VM process to use when starting the specified VM and while the VM runs.

The following valid values are:

- default – Default process priority determined by the OS.
- flat – Assumes a scheduling policy which puts the process at the default priority and with all threads at the same priority.
- low – Assumes a scheduling policy which puts the process mostly below the default priority of the host OS.
- normal – Assume a scheduling policy which shares the CPU resources fairly with other processes running with the default priority of the host OS.
- high – Assumes a scheduling policy which puts the task above the default priority of the host OS. This policy might easily cause other tasks in the system to starve.

15.35.2.2 Networking Settings

VBoxManage modifyvm *<uuid | vmname>* [##nic*N*= none | null | nat | bridged | intnet | hostonly | hostonlynet | generic | natnetwork | cloud] [##nic#type*N*= Am79C970A | Am79C973 | 82540EM | 82543GC | 82545EM | virtio | usbnet] [##cable#connected*N*= on | off] [##nic#trace*N*= on | off] [##nic#trace#file*N*=*filename*] [##nic#property*N*=*name*= [*value*]] [##nic#speed*N*=*kbps*] [##nic#boot#prio*N*=*priority*] [##nic#promisc*N*= deny | allow#vms | allow#all] [##nic#bandwidth#group*N*= none | *name*] [##bridge#adapter*N*= none | *device#name*] [##cloud#network*N*=*network#name*] [##host#only#adapter*N*= none | *device#name*] [##host#only#net*N*=*network#name*] [##intnet*N*=*network#name*] [##nat#network*N*=*network#name*] [##nic#generic#drv*N*=*driver#name*] [##mac#address*N*= auto | *MAC#address*]

The following options enable you to modify networking on your VM. With all these options, *N* is an integer greater than zero that represents the particular virtual network adapter to configure.

--nic*N*=none | null | nat | natnetwork | bridged | intnet | hostonly | generic

Configures the network type used by each virtual network card in the VM.

The following valid values correspond to the modes described in *9.3 Introduction to Networking Modes on page 145*:

- none – No networking present
- null – Not connected to the host system
- nat – Use network address translation (NAT)
- natnetwork – Use a NAT network
- bridged – Use bridged networking
- intnet – Use internal networking
- hostonly – Use host-only networking
- generic – Access rarely used sub-modes

--nic-type*N*=Am79C970A | Am79C973 | 82540EM | 82543GC | 82545EM | virtio | usbnet

Identifies the type of networking hardware that Oracle VirtualBox presents to the guest VM for the specified virtual network card. See *9.2 Virtual Networking Hardware on page 144*.

Valid values are as follows:

- Am79C970A represents the AMD PCNet PCI II.
- Am79C973 represents the AMD PCNet FAST III, which is the default value.
- 82540EM represents the Intel PRO/1000 MT Desktop.
- 82543GC represents the Intel PRO/1000 T Server.
- 82545EM represents the Intel PRO/1000 MT Server.
- virtio represents a paravirtualized network adapter.
- usbnet represents an Ethernet over USB network adapter.

--cable-connected*N*=on | off

Temporarily disconnects a virtual network interface, as if you pull a network cable from a physical network card. You might use this option to reset certain software components in the VM.

--nic-trace*N*=on | off

Enables or disables network tracing for the specified virtual network card.

--nic-trace-file*N*=*filename*

Specifies the absolute path of the file in which to write trace log information. Use this option if network tracing is enabled.

--nic-property*N*=*name*=*value*

Enables you to set property values and pass them to rarely used network backends. To use this option, you must also use the --nic-generic-drv option.

These properties are specific to the backend engine and differ between the UDP Tunnel and the VDE backend drivers. For property examples, see *9.10 UDP Tunnel Networking on page 156*.

--nic-speed*N*=*kbps*

Specifies the throughput rate in kilobits per second for rarely used networking sub-modes such as VDE network and UDP Tunnel. Use this option only if you used the --nic option to enable generic networking for the specified virtual network card.

--nic-boot-prio*N*=*priority*

Assigns a priority to each NIC that determines the order in which that NIC is used to perform a PXE network boot. The priority value is an integer in the range from 0 to 4. Priority 0, which is the default value, is the lowest priority. Priority 1 is the highest priority, and priorities 3 and 4 are lower.

This option has an effect only when using the Intel PXE boot ROM.

--nic-promisc*N*=deny | allow-vms | allow-all

Enables you to specify whether to deny or allow promiscuous mode for the specified VM virtual network card. This option is relevant only for bridged networking. Valid values are as follows:

- deny hides any traffic that is not intended for the VM. This is the default value.
- allow-vms hides all host traffic from the VM, but allows the VM to see traffic to and from other VMs.
- allow-all allows the VM to see all traffic.

--nic-bandwidth-group*N*=none | *name*

Adds or removes a bandwidth group assignment to the specified virtual network interface. Valid values are as follows:

- none removes any current bandwidth group assignment from the specified virtual network interface.
- *name* adds a bandwidth group assignment to the specified virtual network interface.

See *9.13 Limiting Bandwidth for Network Input/Output on page 158*.

--bridge-adapter*N*=none | *device-name*

Specifies the host interface to use for the specified virtual network interface. See *9.7 Bridged Networking on page 152*. Use this option only if you used the --nic option to enable bridged networking for the specified virtual network card.

--host-only-adapter*N*=none | *device-name*

Specifies which host-only networking interface to use for the specified virtual network interface. See *9.9 Host-Only Networking on page 154*. Use this option only if you used the --nic option to enable host-only networking for the specified virtual network card.

--intnet*N*=*network-name*

Specifies the name of the internal network. See *9.8 Internal Networking on page 153*. Use this option only if you used the --nic option to enable internal networking for the specified virtual network card.

--nat-network*N*=*network-name*

Specifies the name of the NAT network to which this adapter is connected. Use this option only if the networking type is natnetwork, not nat.

--nic-generic-drv*N*=*backend-driver*

Enables you to access rarely used networking sub-modes, such as VDE networks and UDP Tunnel. Use this option only if you used the --nic option to enable generic networking for a virtual network card.

--mac-address*N*=auto | *MAC-address*

Specifies the MAC address of the specified network adapter on the VM. By default, Oracle VirtualBox assigns a random MAC address to each network adapter at VM creation.

15.35.2.3 NAT Networking Settings

VBoxManage modifyvm <*uuid* | *vmname*> [##nat#net*N*= *network* | default] [##nat#pf*N*= [*rule#name*],tcp | udp,[*host#IP*],*hostport*,[*guest#IP*],*guestport*] [##nat#pf*N*=delete=*rule#name*] [##nat#tftp#prefix*N*=*prefix*] [##nat#tftp#file*N*=*filename*] [##nat#tftp#server*N*=*IP#address*] [##nat#bind#ip*N*=*IP#address*] [##nat#dns#pass#domain*N*= on | off] [##nat#localhostreachable*N*= on | off] [##nat#settings*N*=[*mtu*]] [##nat#forward#broadcast*N*= on | off] [##nat#enable#tftp*N*= on | off]

The following options use *N* to specify the particular virtual network adapter to modify.

--nat-net*N*=default | *network*

Specifies the IP address range to use for this network. See *9.6 Fine Tuning the Oracle VirtualBox NAT Engine on page 150*. Use this option only if the networking type is nat, not natnetwork.

--nat-pf*N*=[*name*],tcp | udp,[*host-IP*],*hostport*,[*guest-IP*],*guestport*

Specifies the NAT port-forwarding rule to use. See *9.4.1 Configuring Port Forwarding with NAT on page 147*.

--nat-pf*N*=delete *name*

Specifies the NAT port-forwarding rule to delete. See *9.4.1 Configuring Port Forwarding with NAT on page 147*.

--nat-tftp-prefix*N*=*prefix*

Specifies a prefix to use for the built-in TFTP server. For example, you might use a prefix to indicate where the boot file is located. See *9.4.2 PXE Booting with NAT on page 148* and *9.6.2 Configuring the Boot Server (Next Server) of a NAT Network Interface on page 150*.

--nat-tftp-file*N*=*boot-file*

Specifies the name of the TFT boot file. See *9.6.2 Configuring the Boot Server (Next Server) of a NAT Network Interface on page 150*.

--nat-tftp-server*N*=*tftp-server*

Specifies the address of the TFTP server from which to boot. See *9.6.2 Configuring the Boot Server (Next Server) of a NAT Network Interface on page 150*.

--nat-bind-ip*N*=*IP-address*

Specifies an alternate IP address to which the NAT engine binds. See *9.6 Fine Tuning the Oracle VirtualBox NAT Engine on page 150*. By default, Oracle VirtualBox's NAT engine routes TCP/IP packets through the default interface assigned by the host's TCP/IP stack.

--nat-dns-pass-domain*N*=on | off

Specifies whether the built-in DHCP server passes the domain name for network name resolution.

--nat-localhostreachable*N*=on | off

Specifies whether the NAT engine allows traffic from the guest directed to 10.0.2.2 to pass to the host's loopback interface, i.e. localhost or 127.0.0.1.

--nat-settings*N*=[*mtu*]

Specifies values for tuning NAT performance. See *9.6 Fine Tuning the Oracle VirtualBox NAT Engine on page 150*.

15.35.2.4 Other Hardware Settings

VBoxManage modifyvm <*uuid* | *vmname*> [##mouse=ps2 | usb | usbtablet | usbmultitouch | usbmtscreenpluspad] [##keyboard=ps2 | usb] [##uart*N*= off | *IO#base IRQ*] [##uart#mode*N*= disconnected | server*pipe* | client*pipe* | tcpserver*port* | tcpclient*hostname*:*port* | file*filename* | *device#name*] [##uart#type*N*= 16450 | 16550A | 16750] [##lpt#mode*N*=*device#name*] [##lpt*N*= off | *IO#base IRQ*] [##audio#controller=ac97 | hda | sb16] [##audio#codec=stac9700 | ad1980 | stac9221 | sb16] [##audio#driver=none | default | null | dsound | was | oss | alsa | pulse | coreaudio] [##audio#enabled=on | off] [##audio#in=on | off] [##audio#out=on | off] [##clipboard#mode=disabled | hosttoguest | guesttohost | bidirectional] [##clipboard#file#transfers=enabled | disabled] [##drag#and#drop=disabled | hosttoguest | guesttohost | bidirectional] [##monitor#count=*number*] [##usb#ehci=on | off] [##usb#ohci=on | off] [##usb#xhci=on | off] [##usb#rename=*old#name new#name*]

The following options enable you to configure other hardware, such as the serial port, monitor, audio device, USB ports, and the clipboard, and drag-and-drop features.

--mouse=ps2 | usb | usbtablet | usbmultitouch | usbmtscreenpluspad

Specifies the mode of the mouse to use in the VM. Valid values are: ps2, usb, usbtablet, usbmultitouch and usbmtscreenpluspad.

--keyboard=ps2 | usb

Specifies the mode of the keyboard to use in the VM. Valid values are: ps2 and usb.

--uart*N*=off | *I/O-base IRQ*

Configures virtual serial ports for the VM. *N* represents the serial port to modify. Valid values are off to disable the port or an I/O base address and IRQ. For information about the traditional COM port I/O base address and IRQ values, see *5.18 Serial Ports on page 79*.

--uart-mode*N*=*mode*

Specifies how Oracle VirtualBox connects the specified virtual serial port to the host system that runs the VM. See *5.18 Serial Ports on page 79*.

Ensure that you first configure the virtual serial port by using the --uart*N* option.

Specify one of the following connection modes for each port:

- disconnected indicates that even though the serial port is shown to the guest VM, it is not connected. This state is like a physical COM port without a cable attached.
- server *pipe-name* creates the specified named pipe or local domain socket on the host system and connects the virtual serial device to it.

  On a Windows host system, *pipe-name* is a named pipe that has a name that uses the following form: \\.\pipe*pipe-name*.

  On a Linux host system, *pipe-name* is a local domain socket.
- client *pipe-name* connects the virtual serial device to the specified named pipe or local domain socket.

  Note that the named pipe or local domain socket must already exist.
- tcpserver *port* creates a TCP socket with the specified TCP port on the host system and connects the virtual serial device to it.

  For UNIX-like systems, use ports over 1024 for non-root users.
- tcpclient *hostname*:*port* connects the virtual serial device to the TCP socket.

  Note that the TCP socket must already exist.
- file *filename* redirects the serial port output to the specified raw file. Ensure that *filename* is the absolute path of the file on the host system.
- *device-name*: specifies the device name of a physical hardware serial port on the specified host system to which the virtual serial port connects.

  Use this mode to connect a physical serial port to a VM.

  On a Windows host system, the device name is a COM port such as COM1. On a Linux host system, the device name is similar to /dev/ttyS0.

--uart-type*N*=*UART-type*

Configures the UART type for the specified virtual serial port (*N*). Valid values are 16450, 16550A, and 16750. The default value is 16550A.

--lpt-mode*N*=*device-name*

Specifies the device name of the parallel port to use.

For a Windows host system, use a device name such as **lpt1**. For a Linux host system, use a device name such as /dev/lp0.

--lpt*N*=*I/O-base IRQ*

Specifies the I/O base address and IRQ of the parallel port.

You can view the I/O base address and IRQ that the VM uses for the parallel port in the Device Manager.

--audio-controller=*controller-type*

Specifies the audio controller to be used with the VM. Valid audio controller type values are: ac97, hda, and sb16.

--audio-codec=*codec-type*

Specifies the audio codec to be used with the VM. Valid audio codec type values are: stac9700, ad1980, stac9221, and sb16.

--audio-driver=*type*

Specifies whether which audio driver (backend) to use. none, default, null, dsound, was, oss, alsa, pulse, and coreaudio.

Note that the audio driver are dependent on the host operating system. Use the **VBoxManage modifyvm** command usage output to determine the supported audio types for your host system.

For maximum interoperability between hosts, the default audio driver can be used. The VM will then automatically select the most appropriate audio driver for the current host available.

--audio-enabled=on|off

Specifies whether to enable or disable audio for the VM.

This option has precedence over the --audio-on and --audio-off options, i.e. turning off audio via this option will turn off both, input and output, audio.

--audio-in=on|off

Specifies whether to enable or disable audio capture from the host system.

--audio-out=on|off

Specifies whether to enable or disable audio playback from the guest VM.

--clipboard-mode=*value*

Specifies how to share the guest VM or host system OS's clipboard with the host system or guest VM, respectively. Valid values are: disabled, hosttoguest, guesttohost, and bidirectional. See *5.12 General Settings on page 70*.

The clipboard feature is available only if you have the Guest Additions be installed in the VM.

--clipboard-file-transfers=*value*

Specifies whether file transfers via clipboard between the guest VM and the host are enabled or not. Valid values are: disabled, enabled. Depends on the current clipboard mode being set.

This clipboard file transfer feature is available only if you have the Guest Additions be installed in the VM.

--drag-and-drop=*value*

Specifies how to use the drag and drop feature between the host system and the VM. Valid values are: disabled, hosttoguest, guesttohost, and bidirectional. See *7.5 Drag and Drop on page 115*.

The drag and drop feature is available only if you have the Guest Additions be installed in the VM.

--monitor-count=*count*

Enables you to configure multiple monitors. See *5.14 Display Settings on page 75*.

--usb-ohci=on | off

Enables or disables the VM's virtual USB 1.1 controller. See *5.19.1 USB Settings on page 81*.

--usb-ehci=on | off

Enables or disables the VM's virtual USB 2.0 controller. See *5.19.1 USB Settings on page 81*.

--usb-xhci=on | off

Enables or disables the VM's virtual USB 3.0 controller. This is the most efficient option if the VM supports it. See *5.19.1 USB Settings on page 81*.

--usb-rename=*old-name new-name*

Rename's the VM's virtual USB controller from *old-name* to *new-name*.

15.35.2.5 Recording Settings

VBoxManage modifyvm <*uuid* | *vmname*> [##recording=on | off] [##recording#screens=all | none | *screen#ID*[,*screen#ID*...]] [##recording#file=*filename*] [##recording#max#size=*MB*] [##recording#max#time=*seconds*] [##recording#opts= *key*=*value*[,*key*=*value*...]] [##recording#video#fps=*fps*] [##recording#video#rate=*rate*] [##recording#video#res=*width*x*height*]

The following options enable you to modify settings for video recording, audio recording, or both.

--recording=on | off

Enables or disables the recording of a VM session into a WebM or VP8 file. When set to on, recording begins when the VM session starts.

--recording-screens=all | none | *screen-ID*[,*screen-ID*...

Enables you to specify the VM screens to record. The recording for each screen is output to its own file. Valid values are: all, which records all screens, none, which records no screens, or one or more specified screens.

--recording-file=*filename*

Specifies the name of the file in which to save the recording.

--recording-max-size=*MB*

Specifies the maximum size of the recorded video file in megabytes. When the file reaches the specified size, recording stops. If the value is 0, recording continues until you manually stop recording.

--recording-max-time=*seconds*

Specifies the maximum amount of time to record in seconds. When the specified time elapses, recording stops. If the value is 0, recording continues until you manually stop recording.

--recording-opts=*keyword=value*

Specifies additional video-recording properties as a comma-separated property keyword-value list. For example, foo=bar,a=b.

Only use this option if you are an advanced user. For information about keywords, see the *Oracle VirtualBox Programming Guide and Reference*.

--recording-video-fps=*fps*

Specifies the maximum number of video frames per second (FPS) to record. The recording ignores any frames that have a higher frequency. When you increase the FPS, fewer frames are ignored but the recording and the size of the recording file increases.

--recording-video-rate=*bit-rate*

Specifies the bit rate of the video in kilobits per second. When you increase the bit rate, the recording appearance improves and the size of the recording file increases.

--recording-video-res=*widthxheight*

Specifies the video resolution (width and height) of the recorded video in pixels.

15.35.2.6 Remote Machine Settings

VBoxManage modifyvm <*uuid* | *vmname*> [##vrde=on | off] [##vrde#property=*property#name*=[*property#value*]] [##vrde#extpack=default | *name*] [##vrde#port=*port*] [##vrde#address=*hostip*] [##vrde#auth#type=null | external | guest] [##vrde#auth#library=default | *name*] [##vrde#multi#con=on | off] [##vrde#reuse#con=on | off] [##vrde#video#channel=on | off] [##vrde#video#channel#quality=*percent*]

The following options enable you to modify the VirtualBox Remote Desktop Extension (VRDE) behavior.

--vrde=on | off

Enables or disables the VRDE server.

--vrde-property=TCP/Ports=*port*

port is the port or port range to which the VRDE server binds. The default or 0 value uses port 3389, which is the standard RDP port.

See also the --vrde-port option description.

--vrde-property=TCP/Address=*IP-address*

IP-address is the IP address of the host network interface to which the VRDE server binds. When specified, the server accepts connections only on the host network interface at that IP address.

See also the --vrde-address option description.

--vrde-property=VideoChannel/Enabled=*value*

Specifies whether the VRDP video channel is on or off. 1 means on and 0 means off. See *10.1.10 VRDP Video Redirection on page 169*.

--vrde-property=Quality=*value*

Specifies a value between 10% and 100%, inclusive, that represents the JPEG compression level on the VRDE server video channel. A lower value produces lower JPEG quality but higher compression. See *10.1.10 VRDP Video Redirection on page 169*.

--vrde-property=DownscaleProtection=*value*

Enables or disables the video downscale protection feature. Valid values are 1 to enable the feature and 0 to disable the feature.

When this feature is enabled, Oracle VirtualBox determines whether to display the video:

- When the video size equals the size of the shadow buffer, the video is considered to be full screen and is displayed.
- When the video size is between full screen and the downscale threshold, the video is not displayed. Such a video might be an application window, which is unreadable when downscaled.

When this feature is disabled, an attempt is always made to display a video.

--vrde-property=Client/DisableDisplay=1

Disables the display VRDE server feature.

To re-enable a feature, assign an empty value. For example, to re-enable the display feature, specify the **VBoxManage modifyvm --vrde-property=Client/DisableDisplay=** command. See *10.1.11 VRDP Customization on page 169*.

--vrde-property=DisableInput=1

Disables the input VRDE server feature.

--vrde-property=DisableAudio=1

Disables the audio VRDE server feature.

--vrde-property=DisableUSB=1

Disables the USB VRDE server feature.

--vrde-property=Client/DisableClipboard=1

Disables the clipboard VRDE server feature. To re-enable the feature, assign an empty value. See *10.1.11 VRDP Customization on page 169*.

--vrde-property=DisableUpstreamAudio=1

Disables the upstream audio VRDE server feature. To re-enable the feature, assign an empty value. See *10.1.11 VRDP Customization on page 169*.

--vrde-property=Client/DisableRDPDR=1

Disables the RDP device redirection for smart cards VRDE server feature. To re-enable this feature, assign an empty value.

--vrde-property=H3DRedirect/Enabled=1

Enables the 3D redirection VRDE server feature. To disable this feature, assign an empty value.

--vrde-property=Security/Method=*value*

Specifies the following information that is required for a connection:

- Negotiate indicates that both Enhanced (TLS) and Standard RDP Security connections are permitted. The security method is negotiated with the client. This is the default value.
- RDP indicates that only Standard RDP Security is accepted.
- TLS indicates that only Enhanced RDP Security is accepted. The client must support TLS.

See *10.1.7 RDP Encryption on page 167*.

--vrde-property=ServerCertificate=*value*

Specifies the absolute path to the server certificate. See *10.1.7 RDP Encryption on page 167*.

--vrde-property=ServerPrivateKey=*value*

Specifies the absolute path to the server private key. See *10.1.7 RDP Encryption on page 167*.

--vrde-property=CACertificate=*value*

Specifies the absolute path to the CA self-signed certificate. See *10.1.7 RDP Encryption on page 167*.

--vrde-property Audio/RateCorrectionMode=*value*

Specifies the audio connection mode or the path to the audio log file. Valid values are as follows:

- VRDP_AUDIO_MODE_VOID is no mode. Use this value to unset any set audio mode.
- VRDP_AUDIO_MODE_RC is the rate correction mode.
- VRDP_AUDIO_MODE_LPF is the low pass filter mode.
- VRDP_AUDIO_MODE_CS is the client sync sync mode to prevent an underflow or overflow of the client queue.

--vrde-property=LogPath=*value*

Specifies the absolute path to the audio log file.

--vrde-extpack=default | *name*

Specifies the library to use to access the VM remotely. The default value uses the RDP code that is part of the Oracle VirtualBox Extension Pack.

To use the VRDE module in VNC, specify VNC. See *11.18 Other Extension Packs on page 212*.

--vrde-port=default | *port*

port is the port or port range to which the VRDE server binds. The default or 0 value uses port 3389, which is the standard RDP port.

You can specify a comma-separated list of ports or port ranges of ports. Use a dash between two port numbers to specify a port range. The VRDE server binds to only one of the available ports from the list. Only one machine can use a given port at a time. For example, the --vrde-port=5000,5010-5012 option specifies that server can bind to one of following ports: 5000, 5010, 5011, or 5012.

--vrde-address=*IP-address*

Specifies the IP address of the host network interface to which the VRDE server binds. If you specify an IP address, the server accepts connections only on the specified host network interface.

Use this option to specify whether the VRDP server should accept IPv4, IPv6, or both type of connections:

- *Only IPv4:* Use the --vrde-address="0.0.0.0" option.
- *Only IPv6:* Use the --vrde-address="::" option.
- *Both IPv6 and IPv4:* Use the --vrde-address="" option. This is the default value.

--vrde-auth-type=null | external | guest

Specify whether to use authorization and how to perform authorization. See *10.1.6 RDP Authentication on page 166*. Valid values are as follows:

- null provides no authentication.
- external provides external authentication through an authentication library.
- guest performs authentication by using guest user accounts. This unsupported method requires that you install the Guest Additions on the VM.

--vrde-auth-library=default | *name*

Specifies the library to use for RDP authentication. The default library for external authentication is VBoxAuth. See *10.1.6 RDP Authentication on page 166*.

--vrde-multi-con=on | off

Enables or disables the multiple connections VRDE server feature, if supported. See *10.1.8 Multiple Connections to the VRDP Server on page 168*.

--vrde-reuse-con=on | off

Specifies how the VRDE server behaves when multiple connections are disabled. When the value is on, the server permits a new client to connect and drops the existing connection. When the value is off, a new connection is not accepted if a client is already connected to the server. This is the default value.

--vrde-video-channel=on | off

Enables video redirection if supported by the VRDE server. See *10.1.10 VRDP Video Redirection on page 169*.

--vrde-video-channel-quality=*percent*

Specifies the image quality for video redirection as a value from 10 to 100 percent. The percentage represents the JPEG compression level where a lower number diminishes quality and provides higher compression. See *10.1.10 VRDP Video Redirection on page 169*.

15.35.2.7 Teleporting Settings

VBoxManage modifyvm <*uuid* | *vmname*> [##teleporter=on | off] [##teleporter#port=*port*] [##teleporter#address=*address* | empty] [##teleporter#password=*password*] [##teleporter#password#file=*filename* | stdin] [##cpuid#portability#level=*level*] [##cpuid#set=*leaf* [:*subleaf*] *eax ebx ecx edx*] [##cpuid#remove=*leaf* [:*subleaf*]] [##cpuid#remove#all]

The following options enable you to configure a machine as a teleporting target. See *10.2 Teleporting on page 169* and the teleporting related entries in *14.3.4 Potentially Insecure Operations on page 266*.

--teleporter=on | off

Enables or disables the teleporter. When enabled, a machine starts up and waits to receive a teleporting request from the network instead of booting normally.

Teleporting requests are received on the port and address specified using the following parameters.

--teleporter-port=*port*

Specifies the port on which the VM listens to receive a teleporting request from another VM. *port* is any free TCP/IP port number, such as 6000. You must also specify the --teleporter option.

--teleporter-address=*IP-address*

Specifies the IP address on which the VM listens to receive a teleporting request from another VM. *IP-address* is any IP address or host name and specifies the TCP/IP socket on which to bind. The default IP address is 0.0.0.0, which represents any IP address. You must also specify the --teleporter option.

--teleporter-password=*password*

Specifies the password to use for authentication. When specified, the teleporting request only succeeds if the password on the source machine is the same password as the one you specify.

--teleporter-password-file=*filename*

Specifies a file that contains the password to use for authentication. When specified, the teleporting request only succeeds if the password on the source machine is the same password as the one you specify in the password file. A value of stdin reads the password from standard input.

--cpuid-portability-level=*level*

Restricts the virtual CPU capabilities that Oracle VirtualBox presents to the guest OS by using portability rules. Higher integer values designate more restrictive behavior. The default level of 0 indicates that all virtualized features supported by the host are made available to the guest. The value 3 suppresses most features. Values of 1 and 2 represent restrictions in between. The behavior may change depending on the product version.

--cpuid-set=*leaf*[:*subleaf*] *eax ebx ecx edx*

Advanced users can use this setting before a teleporting operation (in fact before starting the VM) to restrict the virtual CPU capabilities that Oracle VirtualBox presents to the guest operating system. This must be run on both the source and the target machines involved in teleporting and will then modify what the guest sees when it executes the CPUID machine instruction. This might help with misbehaving applications that wrongly assume that certain CPU capabilities are present. The meaning of the parameters is hardware dependent. Refer to the AMD or Intel processor documentation.

The values of *leaf*, *subleaf* (optional), *eax*, *ebx*, *ecx* and *edx* are integers given in hexadecimal format, i.e. using a radix (base) of 16 without requiring any prefix.

--cpuid-remove=*leaf*[:*subleaf*]

Removes an adjustment established with --cpuid-set.

--cpuid-remove-all

Removes all adjustments established with --cpuid-set.

15.35.2.8 Debugging Settings

VBoxManage modifyvm <*uuid* | *vmname*> [##tracing#enabled=on | off] [##tracing#config=*string*] [##tracing#allow#vm#access=on | off]

Only use the following options to perform low-level VM debugging. These options are for advanced users only.

--tracing-enabled=on | off

Enables or disables the trace buffer. Note that when specified, the trace buffer consumes some memory and adds overhead.

--tracing-config=*config-string*

Enables a tracing configuration that defines which group of trace points are enabled.

--tracing-allow-vm-access=on | off

Enables or disables VM access to the trace buffer. The default value is off, which disables access.

15.35.2.9 USB Card Reader Settings

VBoxManage modifyvm <*uuid* | *vmname*> [##usb#card#reader=on | off]

The following options specify the access to a USB Card Reader by the guest environment. A USB card reader can access data on memory cards, such as CompactFlash (CF), Secure Digital (SD), and MultiMediaCard (MMC).

--usb-card-reader=on | off

Enables or disables the USB card reader interface.

15.35.2.10 Autostarting VMs During Host System Boot

The following options enable you to configure the VM autostart feature, which automatically starts the VM at host system boot-up. You must do some host system configuration before you can use this feature. See *11.19 Starting Virtual Machines During System Boot on page 213*.

VBoxManage modifyvm <*uuid* | *vmname*> [##autostart#enabled=on | off] [##autostart#delay=*seconds*]

--autostart-enabled=on | off

Enables or disables VM autostart at host system boot-up for the specified users.

--autostart-delay=*seconds*

Specifies the number of seconds after host system boot-up to autostart the VM.

15.35.2.11 Guest Debugging

These options are for configuring the VMM for guest debugging.

VBoxManage modifyvm <*uuid* | *vmname*> [##guest#debug#provider=none | native | gdb | kd] [##guest#debug#io#provider=none | tcp | udp | ipc] [##guest#debug#address=*IP#Address* | *path*] [##guest#debug#port=*port*]

--guest-debug-provider=none | native | gdb | kd

Selects the given debug stub provider.

--guest-debug-io-provider=none | tcp | udp | ipc

Selects the given I/O transport backend for the selected provider.

--guest-debug-address=*IP-Address* | *path*

Sets the path the debugger is accessible under, depends on the selected I/O transport.

--guest-debug-port=*port*

Sets the port the debugger is accessible under, depends on the selected I/O transport.

15.35.2.12 PCI Passthrough Settings

The following options enable you to configure the PCI passthrough feature, which currently is not available in Oracle VirtualBox. It is planned to bring this functionality back in the future.

VBoxManage modifyvm <*uuid* | *vmname*> [##pci#attach=*host#PCI#address* [*@guest#PCI#bus#address*]] [##pci#detach=*host#PCI#address*]

--pci-attach=*host-PCI-address*[*@guest-PCI-bus-address*]

Attaches the specified PCI network controller on the host to the guest VM. You can optionally specify the PCI bus on the guest VM on which to attach the controller.

--pci-detach=*host-PCI-address*

Detaches the specified PCI network controller from the attached PCI bus on the guest VM.

15.35.2.13 Testing (ValidationKit / Bootsector)

These options are for configuring the testing functionality of the VMM device and almost exclusively used by the bootsector testcases in the ValidationKit.

VBoxManage modifyvm <*uuid* | *vmname*> [##testing#enabled=on | off] [##testing#mmio=on | off] [##testing#cfg#dword*idx*=*value*]

--testing-enabled=on | off

Enabled the testing functionality of the VMMDev. See VMMDevTesting.h for details.

--testing-mmio=on | off

Enabled the MMIO region of the VMMDev testing feature.

--testing-cfg-dword*idx*=*value*

This sets one of the 10 dword configuration values. The *idx* must be in the range 0 through 9. The *value* is limited to 32 bits (dword).

15.35.3 Examples

The following command changes the description for the ol7 VM.

```
$ VBoxManage modifyvm ol7 --description "Oracle Linux 7 with UEK4"
```

The following command enables VirtualBox Remote Display Protocol (VRDP) support for the ol7 VM.

```
$ VBoxManage modifyvm ol7 --vrde on
```

15.35.4 See Also

15.44 VBoxManage showvminfo on page 439, *15.12 VBoxManage controlvm on page 309*, *15.15 VBoxManage createvm on page 330*, *15.47 VBoxManage startvm on page 446* *15.29 VBoxManage list on page 384*

15.36 VBoxManage movevm

Move a virtual machine to a new location on the host system

15.36.1 Synopsis

VBoxManage movevm <*uuid* | *vmname*> [##type=basic] [##folder=*folder#name*]

15.36.2 Description

The **VBoxManage movevm** command moves a virtual machine (VM) to a new location on the host system.

When moved, all of the files that are associated with the VM, such as settings files and disk image files, are moved to the new location. The Oracle VirtualBox configuration is updated automatically.

uuid | vmname

Specifies the Universally Unique Identifier (UUID) or name of the VM to move.

--type=basic

Specifies the type of the move operation. So far basic is the only recognized value and also the default if not specified.

--folder=*folder-name*

Specifies a full path name or relative path name of the new location on the host file system. Not specifying the option or specifying the current location is allowed, and moves disk images and other parts of the VM to this location if they are currently in other locations.

15.36.3 Examples

The following command moves the ol7 VM to a new location on the host system.

```
$ VBoxManage movevm ol7 --folder "/home/testuser/vms" --type basic
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
Machine has been successfully moved into /home/testuser/vms
```

15.37 VBoxManage natnetwork

Create, modify, and manage a NAT network

15.37.1 Synopsis

VBoxManage natnetwork add [##disable | ##enable] <##netname=*name*> <##network=*network*>
[##dhcp=on|off] [##ipv6=on|off] [##loopback#4=*rule*] [##loopback#6=*rule*]
[##port#forward#4=*rule*] [##port#forward#6=*rule*]

VBoxManage natnetwork list [*filter#pattern*]

VBoxManage natnetwork modify [##dhcp=on|off] [##disable | ##enable] <##netname=*name*>
<##network=*network*> [##ipv6=on|off] [##loopback#4=*rule*] [##loopback#6=*rule*]
[##port#forward#4=*rule*] [##port#forward#6=*rule*]

VBoxManage natnetwork remove <##netname=*name*>

VBoxManage natnetwork start <##netname=*name*>

VBoxManage natnetwork stop <##netname=*name*>

15.37.2 Description

The **VBoxManage natnetwork** command enables you to create, modify, and manage a NAT network.

NAT networks use the Network Address Translation (NAT) service. The service groups systems into a network and prevents external systems from directly accessing the systems in the network. The service also enables the systems in the network to communicate with each other and with external systems by means of TCP and UDP over IPv4 and IPv6.

A NAT service is attached to an internal network. For a VM to use the NAT service, you must attach the VM to the internal network. Specify the name of the internal network when you create the NAT service. Note that the internal network is created if it does not already exist.

15.37.2.1 Add a NAT Network Service

VBoxManage natnetwork add [##disable | ##enable] <##netname=*name*> <##network=*network*> [##dhcp=on|off] [##ipv6=on|off] [##loopback#4=*rule*] [##loopback#6=*rule*] [##port#forward#4=*rule*] [##port#forward#6=*rule*]

The **VBoxManage natnetwork add** command creates a new internal network interface and adds a NAT network service. You must use this command before you can attach the VM to the NAT network.

--disable

Disables the NAT network service.

--enable

Enables the NAT network service.

--netname=*name*

Specifies the name of the new internal network interface on the host OS.

--network

Specifies the static or DHCP network address and mask of the NAT service interface. By default, this value specifies the static network address.

--dhcp

Enables or disables the DHCP server specified with the --netname option.

--ipv6

Enables or disables IPv6. By default, IPv6 is disabled and IPv4 is enabled.

--loopback-4=*rule*

Enables an IPv4 loopback interface using the specified rule.

--loopback-6=*rule*

Enables an IPv6 loopback interface using the specified rule.

--port-forward-4=*rule*

Enables IPv4 port forwarding using the specified rule.

--port-forward-6=*rule*

Enables IPv6 port forwarding using the specified rule.

15.37.2.2 Remove a NAT Network Service

VBoxManage natnetwork remove <##netname=*name*>

The **VBoxManage natnetwork remove** command removes the specified NAT network service.

--netname=*name*

Specifies the name of the NAT network service to remove.

15.37.2.3 Start a NAT Network Service

VBoxManage natnetwork start <##netname=*name*>

The **VBoxManage natnetwork start** command starts a NAT network service and any associated DHCP server.

--netname=*name*

Specifies the name of the NAT network service to start.

15.37.2.4 Stop a NAT Network Service

VBoxManage natnetwork stop <##netname=*name*>

The **VBoxManage natnetwork stop** command stops a NAT network service and any associated DHCP server.

--netname=*name*

Specifies the name of the NAT network service to stop.

15.37.2.5 List All NAT Network Services

VBoxManage natnetwork list [*filter#pattern*]

The **VBoxManage natnetwork list** command lists all NAT network services. You can use a pattern to show a subset of the NAT network services.

filter-pattern

Specifies an optional filtering pattern.

15.37.2.6 Modify the Settings of a NAT Network Service

VBoxManage natnetwork modify [##dhcp=on|off] [##disable | ##enable] <##netname=*name*>
<##network=*network*> [##ipv6=on|off] [##loopback#4=*rule*] [##loopback#6=*rule*]
[##port#forward#4=*rule*] [##port#forward#6=*rule*]

The **VBoxManage natnetwork modify** command modifies the settings of an existing internal network interface.

--disable

Disables the NAT network service.

--enable

Enables the NAT network service.

--netname=*name*

Specifies the name of the new internal network interface on the host OS.

--network

Specifies the static or DHCP network address and mask of the NAT service interface. By default, this value specifies the static network address.

--dhcp

Enables or disables the DHCP server specified with the --netname option.

--ipv6

Enables or disables IPv6. By default, IPv6 is disabled and IPv4 is enabled.

--loopback-4=*rule*

Enables an IPv4 loopback interface using the specified rule.

--loopback-6=*rule*

Enables an IPv6 loopback interface using the specified rule.

--port-forward-4=*rule*

Enables IPv4 port forwarding using the specified rule.

--port-forward-6=*rule*

Enables IPv6 port forwarding using the specified rule.

15.37.3 Examples

The following command shows how to create a NAT network for the natnet1 internal network that uses the 192.168.15.0/24 network address and mask of the NAT service interface. In this static configuration, the gateway is assigned the 192.168.15.1 IP address by default. Note that this IP address is the next address after the network address that you specify with the --network option.

```
$ VBoxManage natnetwork add --netname natnet1 --network "192.168.15.0/24" --enable
```

The following command shows how to add a DHCP server to the natnet1 NAT network after creation:

```
$ VBoxManage natnetwork modify --netname natnet1 --dhcp on
```

15.38 VBoxManage objtracker

Manage the tracked objects

15.38.1 Synopsis

VBoxManage objtracker ifaces

VBoxManage objtracker objlist <##ifacename=*VirtualBox interface name*>

VBoxManage objtracker objinfo <##ifacename=*VirtualBox interface name*> <##id=*Unique object Id*>

15.38.2 Description

15.38.2.1 objtracker ifaces

VBoxManage objtracker ifaces

Shows the actual list of VirtualBox interfaces supported for tracking

15.38.2.2 objtracker objlist

VBoxManage objtracker objlist <##ifacename=*VirtualBox interface name*>

Shows the list of the unique identifiers of the tracked objects existing at moment for a specified interface

--ifacename=*vbox interface name*

The name which fully identifies VitualBox interface aka IProgress, ISession, IMachine.

15.38.2.3 objtracker objinfo

VBoxManage objtracker objinfo <##ifacename=*VirtualBox interface name*> <##id=*Unique object Id*>

Shows the information about the tracked object

--ifacename=*vbox interface name*

The name which fully identifies VitualBox interface aka IProgress, ISession, IMachine.

--id=*unique object id*

The unique identifer assigned to a tracked object by VirtualBox

15.39 VBoxManage registervm

Register a virtual machine

15.39.1 Synopsis

VBoxManage registervm <*filename*> ##password*file*

15.39.2 Description

The **VBoxManage registervm** command enables you to create a virtual machine (VM) by importing an XML machine configuration file into Oracle VirtualBox. The VM cannot have the same UUID as a VM that is already registered in Oracle VirtualBox. Ensure that the XML machine configuration file is in the machines folder prior to registration.

Note:

When you use the **VBoxManage createvm** command to create a VM, you can specify the --register option to register the VM.

filename

Specifies the XML machine configuration file. This file has the .vbox file extension.

--password

Use the --password to supply the encryption password of the VM. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password on the command line.

15.39.3 Examples

The following command registers a VM called vm2. The XML machine configuration file for the VM is located in the default machines folder.

```
$ VBoxManage registervm "/home/user/VirtualBox VMs/vm2/vm2.vbox"
```

15.39.4 See Also

15.15 VBoxManage createvm on page 330, *15.51 VBoxManage unregistervm on page 458*

15.40 VBoxManage setextradata

Set a keyword value that is associated with a virtual machine or configuration

15.40.1 Synopsis

VBoxManage setextradata <global | *uuid* | *vmname*> <*keyword*> [*value*]

15.40.2 Description

The **VBoxManage setextradata** command enables you to set a keyword value that is associated with a virtual machine (VM) or with an Oracle VirtualBox configuration.

global

Sets information about the configuration rather than a VM.

uuid | vmname

Specifies the Universally Unique Identifier (UUID) or name of the VM.

keyword

Specifies the keyword for which to set its value.

value

Specifies the keyword value. Specifying no value removes the keyword.

15.40.3 Examples

The following command sets the installdate keyword value for the Fedora5 VM to 2019.01.01:

```
$ VBoxManage setextradata Fedora5 installdate 2019.01.01
```

The following command unsets the value of the installdate keyword for the Fedora5 VM:

```
$ VBoxManage setextradata Fedora5 installdate
```

15.40.4 See Also

15.23 VBoxManage getextradata on page 359

15.41 VBoxManage setproperty

Change global settings

15.41.1 Synopsis

VBoxManage setproperty <*property#name*> <*property#value*>

15.41.2 Description

The **VBoxManage setproperty** command enables you to change global settings that affect the entire Oracle VirtualBox installation. Some of these settings correspond to the settings in the *Preferences* dialog in the VirtualBox Manager.

The following properties are available:

autostartdbpath

Specifies the path to the autostart database. Valid values are null, which disables the autostart database, or the name of the folder that contains the database. See *11.19 Starting Virtual Machines During System Boot on page 213*.

defaultfrontend

Specifies the global default VM frontend. Valid values are default, which specifies the default frontend, or the name of the frontend to use.

hwvirtexclusive

Specifies whether Oracle VirtualBox makes exclusive use of the Intel VT-x or AMD-V hardware virtualization extensions of the host system's processor.

Valid values are as follows:

- on enables Oracle VirtualBox to make exclusive use of these extensions. This is the default value.
- off shares these extensions with other hypervisors that run simultaneously. Note that sharing these extensions has negative performance implications.

language

Specifies the user language used to translate API messages. Valid values are C, which means no translation or a language code in the form of either ll or ll_CC, where ll is an ISO 639 two-letter language code and CC an ISO 3166 two-letter country code. For example, for Greek in Greece, ll is el, and CC is GR.

logginglevel

Specifies the VBoxSVC release logging details. See *www.virtualbox.org/wiki/VBoxLogging*.

loghistorycount

Specifies the number of rotated VM logs to retain.

machinefolder

Specifies the default folder in which virtual machine (VM) definitions are stored. Valid values are default, which specifies the default storage folder, or the name of the folder to use. See *13.1 Where Oracle VirtualBox Stores its Files on page 237*.

proxymode

Configures the mode for an HTTP proxy server. Valid values are as follows:

manual

Configure the URL of a HTTP proxy server manually, using the proxyurl property value.

noproxy

Do not use an HTTP proxy server. A direct connection to the Internet is used.

system

Detect the proxy settings automatically for the host network. This is the default value.

proxyurl

Specifies the URL for an HTTP proxy server when you specify a manual proxy by setting the proxymode property to manual.

vrdeauthlibrary

Specifies which library to use when external authentication has been configured for a particular VM. Valid values are default, which specifies the default library, or the name of the library to use. See *10.1.6 RDP Authentication on page 166*.

vrdeextpack

Specifies the library that implements the VirtualBox Remote Desktop Extension (RDE). Valid values are null, which disables the RDE, or the name of the library to use.

websrvauthlibrary

Specifies which library the web service uses to authenticate users. Valid values are default, which specifies the default library, null, which disables authentication, or the name of the library to use. For information about the Oracle VirtualBox web service, see *12.1 Oracle VirtualBox Programming Interfaces on page 235*.

15.41.3 Examples

The following command configures Oracle VirtualBox to use the specified HTTP proxy server.

```
$ VBoxManage setproperty proxymode manual
$ VBoxManage setproperty proxyurl "http://myproxy.com:8080"
```

15.41.4 See Also

15.47 VBoxManage startvm on page 446

15.42 VBoxManage sharedfolder

Add and remove shared folders, configure security policy for shared folders

15.42.1 Synopsis

VBoxManage sharedfolder add <global | *uuid* | *vmname*> <##name=*share#name*> <##hostpath=*hostpath*> [##readonly] [##transient] [##automount] [##auto#mount#point=*path*]

VBoxManage sharedfolder remove <global | *uuid* | *vmname*> <##name=*share#name*> [##transient]

VBoxManage sharedfolder modify <*uuid* | *vmname*> <##name=*share#name*> <##readonly= true | false > <##automount= true | false > <##auto#mount#point=*path*> <##symlink#policy= forbidden | subtree | relative | any>

15.42.2 Description

Shared folders enable you to share data between the host system and guest VMs. To use shared folders you must first install the Oracle VirtualBox Guest Additions software in the guest VM.

The shared folder is associated with a share name and the full path name of the folder or directory on the host system. The share name is a unique name within the namespace of the host OS.

15.42.2.1 Add a Shared Folder

VBoxManage sharedfolder add <global | *uuid* | *vmname*> <##name=*share#name*> <##hostpath=*hostpath*> [##readonly] [##transient] [##automount] [##auto#mount#point=*path*]

The **VBoxManage sharedfolder add** command creates a shared folder. The folder you specify is on the host computer. Once created the contents of the folder on the host system can be accessed from within the guest OS.

global

Specifies that the share is global which means that it is available to all virtual machines.

uuid | vmname

Specifies the name or UUID of the guest VM that shares a folder with the host system.

--name=*share-name*

Specifies the name of the share, which is a unique name within the namespace of the host OS.

--hostpath=*hostpath*

Specifies the absolute path of the folder or directory on the host OS to share with the guest OS.

--readonly

Specifies that the share has only read-only access to files at the host path.

By default, shared folders have read-write access to the files mounted from the host. However on Solaris and Linux distributions shared folders are mounted with 770 file permissions with the files owned by the root user and the vboxsf group which means the files are restricted to members of the vboxsf group and the root user. If the --readonly option is specified the file permissions become 700 and the files are accessible only to the root user.

--transient

Specifies that the share is transient which means that it is added and removed to a running VM and does not persist after the VM stops.

--automount

Specifies that the share is automatically mounted.

--auto-mount-point=*path*

Specifies the mount point of the share. This is guest OS specific.

For Windows and OS/2 guests this must be an unused drive letter. If left blank (or if the drive letter is already in use), the last unused drive letter is used instead (i.e. searching from Z: through A:).

For Linux, Solaris and other Unix guests, it must be an absolute path such as /mnt/mysharedfolder. If left empty the default location is /media/sf_*sharename*.

15.42.2.2 Remove a Shared Folder

VBoxManage sharedfolder remove <global | *uuid* | *vmname*> <##name=*share#name*> [##transient]

The **VBoxManage sharedfolder remove** command removes a shared folder.

global

Specifies that the share is global which means that it is accessible from all applicable guest VMs.

uuid | vmname

Specifies the name or UUID of the guest VM that shares a folder with the host system.

--name=*share-name*

Specifies the name of the share to remove.

--transient

Specifies that the share is transient which means that it is added and removed to a running VM and does not persist after the VM stops.

15.42.2.3 Modify a Shared Folder's Configuration

VBoxManage sharedfolder modify <*uuid* | *vmname*> <##name=*share#name*> <##readonly= true | false > <##automount= true | false > <##auto#mount#point=*path*> <##symlink#policy= forbidden | subtree | relative | any>

The **VBoxManage sharedfolder modify** command modifies the configuration of a Shared Folder.

uuid | vmname

Specifies the name or UUID of the guest VM that shares a folder with the host system.

--name=*share-name*

Specifies the name of the shared folder to modify.

--readonly=*true | false*

Specifies whether the shared folder is to be mounted as read-only.

--automount=*true | false*

Specifies whether the shared folder is to be mounted automatically when the VM boots.

--auto-mount-point=*path*

Specifies where to mount the shared folder if it is configured to be be mounted automatically when the VM boots.

--symlink-policy=*policy-name*

Specifies the symbolic link security policy of the shared folder. Valid symlink security policies are: forbidden, subtree, relative, and any.

15.42.3 Examples

The following command creates a shared folder named o7share for the ol7 VM and configures the share to be mounted automatically when the VM is started.

```
$ VBoxManage sharedfolder add ol7 --name ol7share --hostpath "/home/user/ol7share" --automount
```

The following command removes the shared folder named o7share from the ol7 VM.

```
$ VBoxManage sharedfolder remove ol7 --name ol7share
```

15.43 VBoxManage showmediuminfo

Show information about a medium

15.43.1 Synopsis

VBoxManage showmediuminfo [disk | dvd | floppy] <*uuid* | *filename*>

15.43.2 Description

The **VBoxManage showmediuminfo** command shows the following information about a medium:

- Size
- Size on disk
- Type
- In use by virtual machines (VMs)

The medium must be specified by either its UUID, if the medium is registered, or by its filename. Registered images can be listed using **VBoxManage list hdds**, **VBoxManage list dvds**, or **VBoxManage list floppies**, as appropriate.

For backward compatibility, you can also use the **showvdiinfo** command to obtain information about the medium.

disk | **dvd** | **floppy**

Specifies the type of medium. Valid values are disk (hard drive), dvd, or floppy.

uuid | filename

Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

If the medium is registered, you can specify the UUID. You can also list registered images by using the **VBoxManage list hdds**, **VBoxManage list dvds**, or **VBoxManage list floppies** command.

15.43.3 Examples

The following command shows information about the disk01.vdi disk image:

```
$ VBoxManage showmediuminfo disk01.vdi
```

The following command shows information about the floppy01.img floppy disk image.

```
$ VBoxManage showmediuminfo floppy floppy01.img
```

15.43.4 See Also

15.29 VBoxManage list on page 384

15.44 VBoxManage showvminfo

Show configuration information or log file contents for a virtual machine

15.44.1 Synopsis

VBoxManage showvminfo <*uuid* | *vmname*> [##details] [##machinereadable] [##password#id] [##password]

VBoxManage showvminfo <*uuid* | *vmname*> <##log=*index*> [##password#id*id*] [##password*file*|#]

15.44.2 Description

The **VBoxManage showvminfo** command outputs configuration information or log file contents for a specified virtual machine (VM).

15.44.2.1 Viewing Virtual Machine Information

VBoxManage showvminfo <*uuid* | *vmname*> [##details] [##machinereadable] [##password#id] [##password]

The **VBoxManage showvminfo** command outputs information about the specified VM in a detailed format or in a machine-readable format.

The **VBoxManage showvminfo** command shows the same information for the specified VM in the same format as the **VBoxManage list vms --long** command.

--details

Includes detailed information about the VM.

--machinereadable

Specifies that the VM information be in a machine-readable format.

--password-id *id*

Specifies password id of the VM if it is encrypted.

--password *file*|-

Specifies password of the VM if it is encrypted. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password.

15.44.2.2 Viewing Virtual Machine Log Contents

VBoxManage showvminfo <*uuid* | *vmname*> <##log=*index*> [##password#id*id*] [##password*file*|#]

The **VBoxManage showvminfo --log** command outputs the contents of one of the specified VM's log files.

--log=*index*

Specifies a numerical index that identifies the log file.

The index value starts at 0, which indicates the VBox.log file. An index value of 1 indicates the VBoxHardening.log file. Index values starting at 2 indicate other log files, such as the VBox.log.1 file.

--password-id *id*

Specifies password id of the VM if it is encrypted.

--password *file*|-

Specifies password of the VM if it is encrypted. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password.

15.44.3 Examples

The following example shows typical output for this command:

```
$ VBoxManage showvminfo "Windows 10"
Name:            Windows 10
Groups:          /
Guest OS:        Windows 10 (64-bit)
UUID:            1bf3464d-57c6-4d49-92a9-a5cc3816b7e7
Config file:     /home/username/VirtualBox VMs/Windows 10/Windows 10.vbox
Snapshot folder: /home/username/VirtualBox VMs/Windows 10/Snapshots
Log folder:      /home/username/VirtualBox VMs/Windows 10/Logs
Hardware UUID:   1bf3464d-57c6-4d49-92a9-a5cc3816b7e7
Memory size:     2048MB
Page Fusion:     off
VRAM size:       12MB
CPU exec cap:    100%
...
```

The following example shows the information output in a machine-readable format, which shows the entries as a *property=value* string:

```
$ VBoxManage showvminfo "Windows 10" --machinereadable
...
groups="/"
ostype="Windows 10 (64-bit)"
UUID="1bf3464d-57c6-4d49-92a9-a5cc3816b7e7"
...
```

The following example shows the contents of the VBox.log log file:

```
$ VBoxManage showvminfo "Windows 10" --log 0
00:00:02.895106 VirtualBox VM 6.0.0_RC1 r127378 linux.amd64 (Dec 10 2018 17:16:06) release log
00:00:02.895109 Log opened 2018-12-14T14:31:44.088259000Z
00:00:02.895111 Build Type: release
00:00:02.895115 OS Product: Linux
00:00:02.895117 OS Release: 4.1.12-61.1.22.el7uek.x86_64
00:00:02.895119 OS Version: #2 SMP Fri Dec 2 09:28:44 PST 2016
...
```

15.44.4 See Also

15.29 VBoxManage list on page 384

15.45 VBoxManage signova

Digitally sign an OVA

15.45.1 Synopsis

VBoxManage signova <*ova*> <##certificate=*file*> <##private#key=*file*>
[##private#key#password#file=*password#file* | ##private#key#password=*password*]
[##digest#type=*type*] [##pkcs7 | ##no#pkcs7] [##intermediate#cert=*file*] [##force] [##verbose]
[##quiet] [##dry#run]

15.45.2 Description

The **VBoxManage signova** command adds a digital signature to an OVA file.

ova

The OVA file to sign.

--certificate=*file*

File containing the certificate that the OVA should be signed with. This can be in either PEM format (base64) or DER (binary).

--private-key=*file*

The file containing the private key. This can be in either PEM (base64) or DER (binary) format.

--private-key-password-file=*password-file*

File containing the private key password.

--private-key-password=*password*

The private key password.

--digest-type=*type*

Select the cryptographic digest algorithm to use for signing the OVA file. The possible values are : SHA-256 (default), SHA-512 and SHA-1.

Some older versions of VMware's OVF Tool command line utility and other VMware products may require the --digest-type=sha-1 option.

--pkcs7, --no-pkcs7

Enables or disables the creation of an additional PKCS#7/CMS signature. This is enabled by default.

--intermediate-cert=*file*

File containing an intermediary certificate that should be included in the optional PKCS#7/CMS signature. The file can be in either PEM format (base64) or DER (binary). This option can be repeated to add multiple intermediate certificates. This option implies the --pkcs7 option.

--force

Overwrite existing signature if present. The default behaviour is to fail if the OVA is already signed.

--dry-run

Do not actually modify the OVA, just test-run the signing operation.

-v, --verbose, -q, --quiet

Controls the verbosity of the command execution. The --verbose option can be specified multiple times to get more output.

15.46 VBoxManage snapshot

Manage virtual machine snapshots

15.46.1 Synopsis

VBoxManage snapshot <*uuid* | *vmname*>

VBoxManage snapshot <*uuid* | *vmname*> take <*snapshot#name*> [##description=*description*] [##live] [##uniquename Number,Timestamp,Space,Force]

VBoxManage snapshot <*uuid* | *vmname*> delete <*snapshot#name*>

VBoxManage snapshot <*uuid* | *vmname*> restore <*snapshot#name*>

VBoxManage snapshot <*uuid* | *vmname*> restorecurrent

VBoxManage snapshot <*uuid* | *vmname*> edit <*snapshot#name* | ##current> [##description=*description*] [##name=*new#name*]

VBoxManage snapshot <*uuid* | *vmname*> list [##details | ##machinereadable]

VBoxManage snapshot <*uuid* | *vmname*> showvminfo <*snapshot#name*>

15.46.2 Description

The **VBoxManage snapshot** command manages snapshots.

Oracle VirtualBox uses snapshots to capture the state of a virtual machine (VM). You can later use the snapshot to revert to the state described by the snapshot.

A snapshot is a complete copy of a VM's settings. If you take a snapshot while the VM is running, the snapshot also includes the VM's current running state.

After you take a snapshot, Oracle VirtualBox creates a *differencing hard disk* for each normal hard disk that is associated with the host machine. When you restore a snapshot, Oracle VirtualBox uses these differencing files to quickly restore the contents of the VM's virtual hard disks.

For each **VBoxManage snapshot** command, you must specify the name or the universal unique identifier (UUID) of the VM for which you want to take a snapshot.

15.46.2.1 General Command Operand

uuid | vmname

Specifies the UUID or name of the VM.

15.46.2.2 Take a Snapshot of a Virtual Machine

VBoxManage snapshot <*uuid* | *vmname*> take <*snapshot#name*> [##description=*description*] [##live] [##uniquename Number,Timestamp,Space,Force]

The **VBoxManage snapshot take** command takes a snapshot of the current state of the VM. You must supply a name for the snapshot and can optionally supply a description. The new snapshot is inserted into the snapshots tree as a child of the current snapshot (if the VM has any snapshots) and then becomes the new current snapshot.

--description=*description*

Specifies a description of the snapshot.

--live

Specifies that the VM is not stopped while you create the snapshot. This operation is know as live snapshotting.

--uniquename Number,Timestamp,Space,Force

TBD.

snapshot-name

Specifies the name of the snapshot to create.

15.46.2.3 Delete a Snapshot

VBoxManage snapshot <*uuid* | *vmname*> delete <*snapshot#name*>

The **VBoxManage snapshot delete** command removes the specified snapshot.

The delete operation may take some time to finish. This is because the differencing images that are associated with the snapshot may need to be merged with their child differencing images.

snapshot-name

Specifies the UUID or name of the snapshot.

15.46.2.4 Restore a Snapshot

VBoxManage snapshot <*uuid* | *vmname*> restore <*snapshot#name*>

The **VBoxManage snapshot restore** command restores the specified snapshot. This operation resets the VM's settings and current state to that of the snapshot. The state of the VM on which you restore a snapshot is lost. When restored, the specified snapshot becomes the new current snapshot and subsequent snapshots become children of that snapshot.

snapshot-name

Specifies the UUID or name of the snapshot.

15.46.2.5 Restore the Current Snapshot

VBoxManage snapshot <*uuid* | *vmname*> restorecurrent

The **VBoxManage snapshot restorecurrent** command restores the current snapshot. The current snapshot is the one from which the current state is derived. This command is equivalent to using the **VBoxManage snapshot restore** command and specifying the name or UUID of the current snapshot.

15.46.2.6 Change the Name or Description of an Existing Snapshot

VBoxManage snapshot <*uuid* | *vmname*> edit <*snapshot#name* | ##current> [##description=*description*] [##name=*new#name*]

The **VBoxManage snapshot edit** command enables you to change the name or the description of a specified snapshot.

snapshot-name

Specifies the UUID or name of the snapshot to edit.

This option is mutually exclusive with the --current option.

--current

Specifies that you update the current version of the snapshot.

This option is mutually exclusive with a specific snapshot name or its UUID.

--description=*description*

Specifies a new description for the snapshot.

--name=*new-name*

Specifies a new name for the snapshot.

15.46.2.7 List the Snapshots

VBoxManage snapshot <*uuid* | *vmname*> list [##details | ##machinereadable]

The **VBoxManage snapshot list** command lists all the snapshots for a VM.

--details

Specifies that the output shows detailed information about the snapshot.

This option is mutually exclusive with the --machinereadable option.

--machinereadable

Specifies that the output is shown in a machine-readable format.

This option is mutually exclusive with the --details option.

15.46.2.8 Show Information About a Snapshot's Settings

VBoxManage snapshot <*uuid* | *vmname*> showvminfo <*snapshot#name*>

The **VBoxManage snapshot showvminfo** command enables you to view the VM settings that are part of an existing snapshot.

snapshot-name

Specifies the UUID or name of the snapshot.

15.46.3 Examples

The following command creates a snapshot of the ol7u4 VM. The snapshot is called ol7u4-snap-001. The command uses the --description option to provide a description of the snapshot contents.

```
$ VBoxManage snapshot ol7u4 take ol7u4-snap-001 \
--description="Oracle Linux 7.4"
```

The following command lists the snapshots for the ol7u4 VM.

```
$ VBoxManage snapshot ol7u4 list
```

The following command changes the description for the ol7u4-snap-001 snapshot of the ol7u4 VM.

```
$ VBoxManage snapshot ol7u4 edit ol7u4-snap-001 \
--description="Oracle Linux 7.4 with UEK4 kernel"
```

The following command shows VM settings for the ol7u1-snap-001 snapshot of the ol7u4 VM.

```
$ VBoxManage snapshot ol7u4 showvminfo ol7u4-snap-001
Name:           ol7u4
Groups:         /
```

```
Guest OS:       Oracle (64-bit)
UUID:           43349d78-2ab3-4cb8-978f-0e755cd98090
Config file:    C:\Users\user1\VirtualBox VMs\ol7u4\ol7u4.vbox
...
Snapshots:

  Name: ol7u4-snap-001 (UUID: 1cffc37d-5c37-4b86-b9c5-a0f157a55f43)
  Description: Oracle Linux 7.4 with UEK4 kernel
```

15.47 VBoxManage startvm

Start a virtual machine

15.47.1 Synopsis

VBoxManage startvm [##putenv=*name*[=*value*]] [##type=<gui|headless|sdl|separate>] [##password=*file*] [##password#id=*password#identifier*] <*uuid* | *vmname*...>

15.47.2 Description

The **VBoxManage startvm** command starts an Oracle VirtualBox virtual machine (VM) that is in the Powered Off or Saved state.

uuid* | *vmname

Specifies the name or Universally Unique Identifier (UUID) of the VM.

--putenv=*name*=*value*

Assigns a value to an environment variable as a name-value pair. For example, VBOX_DISABLE_HOST_DISK_CACHE=1.

The short form of this option is -E.

--type=gui | headless | sdl | separate

Specifies the frontend used to start the VM.

You can use the **VBoxManage setproperty** command to set a global default value for the frontend. Alternatively, you can use the **VBoxManage modifyvm** command to specify a default frontend value for a specific VM. If neither a global or per-VM default value is set and you do not specify the --type option, then the VM opens in a window on the host desktop.

The --type option accepts the following values:

gui

Starts a VM in a graphical user interface (GUI) window. This is the default.

headless

Starts a VM for remote display only.

sdl

Starts a VM using the VBoxSDL frontend.

separate

Starts a VM with a detachable user interface (UI), which means that the VM runs headless with the UI in a separate process.

--password

Use the --password to supply the encryption password. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password on the command line.

--password-id

Use the --password-id option to specify the id the password is supplied for.

Note:

If a VM fails to start with a particular frontend and the error information is inconclusive, consider starting the VM directly by running the frontend. This workaround might provide additional error information.

15.47.3 Examples

The following command starts the ol7u6 VM:

```
$ VBoxManage startvm ol7u6
```

The following command starts the ol7u6-mininstall VM in headless mode.

```
$ VBoxManage startvm ol7u6-mininstall --type headless
```

15.47.4 See Also

10.1.2 VBoxHeadless, the Remote Desktop Server on page 162, *15.41 VBoxManage setproperty on page 433*, *15.35 VBoxManage modifyvm on page 402*.

15.48 VBoxManage storageattach

Attach, remove, and modify storage media used by a virtual machine

15.48.1 Synopsis

VBoxManage storageattach <*uuid* | *vmname*> <##storagectl=*name*> [##bandwidthgroup=name | none] [##comment=*text*] [##device=*number*] [##discard=on | off] [##encodedlun=*lun*] [##forceunmount] [##hotpluggable=on | off] [##initiator=*initiator*] [##intnet] [##lun=*lun*] [##medium=none | emptydrive | additions | *uuid* | *filename* | host:*drive* | iscsi] [##mtype=normal | writethrough | immutable | shareable | readonly | multiattach] [##nonrotational=on | off] [##passthrough=on | off] [##passwordfile=*file*] [##password=*password*] [##port=*number*] [##server=*name* | *ip*] [##setparentuuid=*uuid*] [##setuuid=*uuid*] [##target=*target*] [##tempeject=on | off] [##tport=*port*] [##type=dvddrive | fdd | hdd] [##username=*username*]

15.48.2 Description

The **VBoxManage storageattach** command attaches, modifies, or removes a storage medium connected to a storage controller that was previously added with the **VBoxManage storagectl** command.

uuid* | *vmname

Specifies the Universally Unique Identifier (UUID) or the name of the virtual machine (VM).

--storagectl=*name*

Specifies the name of the storage controller. Use the **VBoxManage showvminfo** command to list the storage controllers that are attached to the VM.

--port=*number*

Specifies the port number of the storage controller to modify. You must specify this option unless the storage controller has only a single port.

--device=*number*

Specifies the port's device number to modify. You must specify this option unless the storage controller has only one device per port.

--type=dvddrive | fdd | hdd

Specifies the drive type to which the medium is associated. Only omit this option if the medium type can be determined by using the --medium option or by information provided by an earlier medium attachment command.

--medium=none | emptydrive | additions | *uuid* | *filename* | host:*drive* | iscsi

Specifies one of the following values:

none

Removes any existing device from the specified slot.

emptydrive

For a virtual DVD or floppy drive only.

Makes the device slot behave like a removable drive into which no media has been inserted.

additions

For a virtual DVD drive only.

Attaches the VirtualBox Guest Additions image to the specified device slot.

uuid

Specifies the UUID of a storage medium to attach to the specified device slot. The storage medium must already be known to Oracle VirtualBox, such as a storage medium that is attached to another VM. Use the **VBoxManage list** command to list media.

filename

Specifies the full path of an existing disk image to attach to the specified device slot. The disk image can be in ISO, RAW, VDI, VMDK, or other format.

host:*drive*

For a virtual DVD or floppy drive only.

Connects the specified device slot to the specified DVD or floppy drive on the host computer.

iscsi

For virtual hard disks only.

Specifies an iSCSI target for which you must specify additional information. See *8.10 iSCSI Servers on page 138*.

For removable media such as floppies and DVDs, you can make configuration changes while a VM is running. Changes to devices or hard disk device slots require that the VM be powered off.

--mtype=normal | writethrough | immutable | shareable | readonly | multiattach

Specifies how this medium behaves with respect to snapshots and write operations. See *8.4 Special Image Write Modes on page 132*.

--comment=*text*

Specifies an optional description to store with the medium.

--setuuid=*uuid*

Modifies the UUID of a medium before attaching it to a VM.

This is an expert option. Inappropriate values might make the medium unusable or lead to broken VM configurations if another VM already refers to the same medium.

Using the --setuuid="" option assigns a new random UUID to an image, which can resolve duplicate UUID errors if you used a file copy utility to duplicate an image.

--setparentuuid=*uuid*

Modifies the parent UUID of a medium before attaching it to a VM.

This is an expert option. Inappropriate values might make the medium unusable or lead to broken VM configurations if another VM already refers to the same medium.

--passthrough=on | off

For a virtual DVD drive only.

Enables writing to a DVD. This feature is experimental, see *8.9 CD/DVD Support on page 138*.

--tempeject=on | off

For a virtual DVD drive only.

Specifies whether to permit a temporary guest-triggered medium eject operation. When set to on, you can eject a medium. The ability for a guest-triggered eject operation does not persist if the VM is powered off and restarted. So, when you set this option to on and the VM is restarted, the originally configured medium is still in the drive.

--nonrotational=on | off

Enables you to specify that the virtual hard disk is non-rotational. Some guest OSes, such as Windows 7 or later, treat such disks as solid state drives (SSDs) and do not perform disk fragmentation on them.

--discard=on | off

Specifies whether to enable the auto-discard feature for a virtual hard disk. When set to on, a VDI image is shrunk in response to a **trim** command from the guest OS.

This feature is experimental and has known bugs which can cause hangs and other instabilities of the guest OS. Do not use if you care about the integrity of data on the virtual hard disk.

The virtual hard disk must meet the following requirements:

- The disk format must be VDI.
- The size of the cleared area of the disk must be at least 1 MB.
- Ensure that the space being trimmed is at least a 1 MB contiguous block at a 1 MB boundary.

Consider running defragmentation commands as background cron jobs to save space. On Windows, run the **defrag.exe /D** command. On Linux, run the **btrfs filesystem defrag** command.

> **Note:**
>
> When you configure the guest OS to issue the **trim** command, the guest OS typically sees the disk as an SSD.
>
> Ext4 supports the -o discard mount option. Mac OS X might require additional settings. Windows 7, 8, and 10 automatically detect and support SSDs. The Linux **exFAT** driver from Samsung supports the **trim** command.

The Microsoft implementation of exFAT might not support this feature.

You can use other methods to issue trim commands. The Linux **fstrim** command is part of the util-linux package. Earlier solutions required you to zero out unused areas by using the **zerofree** or a similar command, and then to compact the disk. You can only perform these steps when the VM is offline.

--bandwidthgroup=*name*

Specifies the bandwidth group to use for the device. See *8.8 Limiting Bandwidth for Disk Images on page 137*.

--forceunmount

For a virtual DVD or floppy drive only.

Forcibly unmounts the DVD, CD, or floppy or mounts a new DVD, CD, or floppy even if the previous removable storage is locked by the guest for reading. See *8.9 CD/DVD Support on page 138*.

The following options are applicable when you specify the --medium=iscsi option:

--server=*hostname* | *IP-address*

Specifies the host name or IP address of the iSCSI target.

--target=*target*

Specifies the target name string, which is determined by the iSCSI target and is used to identify the storage resource.

--tport=*port*

Specifies the TCP/IP port number of the iSCSI service on the target.

--lun=*LUN*

Specifies the logical unit number (LUN) of the target resource. For a single disk drive, the value is zero.

--encodedlun=*LUN*

Specifies the hexadecimal-encoded of the target resource. For a single disk drive, the value is zero.

--username=*username*

Specifies the user name to use for target authentication.

> **Note:**
>
> Unless you provide a settings password, the user name is stored as clear text in the XML machine configuration file.

--password=*password*

Specifies the password used for target authentication.

> **Note:**
>
> Unless you provide a settings password, this password is stored as clear text in the XML machine configuration file. When you specify a settings password for the first time, the target authentication password is stored in encrypted form.

--passwordfile=*password-filename*

Specifies a file that contains the target authentication password as clear text.

> **Note:**
>
> Use permission and ownership settings to ensure that the contents of this file cannot be read by unauthorized users.

--initiator=*initiator*

Specifies the iSCSI initiator.

The Microsoft iSCSI Initiator is a system, such as a server, that attaches to an IP network and initiates requests and receives responses from an iSCSI target. The SAN components in the iSCSI initiator are largely analogous to Fibre Channel SAN components, and they include the following:

- *iSCSI driver*. Transports blocks of iSCSI commands over the IP network. This iSCSI driver is installed on the iSCSI host and is included with the Microsoft iSCSI Initiator.
- *Gigabit Ethernet adapter*. Connects to an iSCSI target. Use an Ethernet adapter that can transmit 1000 megabits per second (Mbps). Like standard 10/100 adapters, most gigabit adapters use a preexisting Category 5 or Category 6E cable. Each port on the adapter is identified by a unique IP address.
- *iSCSI target*. Is any device that receives iSCSI commands. The device can be an end node such as a storage device, or it can be an intermediate device such as a network bridge between IP and Fibre Channel devices. Each port on the storage array controller or network bridge is identified by one or more IP addresses.

--intnet

Specifies whether to connect to the iSCSI target that uses internal networking. This configuration requires further configuration. See *16.1.6 Access iSCSI Targets Using Internal Networking on page 472*.

15.48.3 Examples

The following command attaches the o7.vdi disk image to the specified SATA storage controller on the ol7 VM.

```
$ storageattach ol7 --storagectl "SATA Controller" --port 0 --device 0 \
--type hdd --medium /VirtualBox/ol7/ol7.vdi
```

The following command attaches the o7-r6-dvd.iso DVD image to the specified IDE storage controller on the ol7 VM.

```
$ VBoxManage storageattach ol7 --storagectl "IDE Controller" --port 0 --device 0 \
--type dvddrive --medium ol7-r6-dvd.iso
```

15.48.4 See Also

15.29 VBoxManage list on page 384, *15.44 VBoxManage showvminfo on page 439*, *15.49 VBoxManage storagectl on page 454*

15.49 VBoxManage storagectl

Manage a storage controller

15.49.1 Synopsis

VBoxManage storagectl <*uuid* | *vmname*> <##name=*controller#name*> [##add=floppy | ide | pcie | sas | sata | scsi | usb] [##controller=BusLogic | I82078 | ICH6 | IntelAhci | LSILogic | LSILogicSAS | NVMe | PIIX3 | PIIX4 | USB | VirtIO] [##bootable=on | off] [##hostiocache=on | off] [##portcount=*count*] [##remove] [##rename=*new#controller#name*]

15.49.2 Description

The **VBoxManage storagectl** command enables you to attach, modify, and remove a storage controller. After you configure the storage controller, you can use the **VBoxManage storageattach** command to attach virtual media to the controller.

uuid* | *vmname

Specifies the Universally Unique Identifier (UUID) or name of the virtual machine (VM).

--name=*controller-name*

Specifies the name of the storage controller.

--add=*system-bus-type*

Specifies the type of the system bus to which to connect the storage controller. Valid values are floppy, ide, pcie, sas, sata, scsi, and usb.

--controller=*chipset-type*

Specifies the chipset type to emulate for the specified storage controller. Valid values are BusLogic, I82078, ICH6, IntelAHCI, LSILogic, LSILogicSAS, NVMe, PIIX3, PIIX4, and USB.

The default value varies, according to the type of storage controller.

--portcount=*count*

Specifies the number of ports that the storage controller supports. Valid values depend on the type of storage controller.

--hostiocache=on|off

Specifies whether to use the host I/O cache for all disk images attached to this storage controller. Valid values are on and off. See *8.7 Host Input/Output Caching on page 136*.

--bootable=on|off

Specifies whether this controller is bootable. Valid values are on and off.

--rename=*new-controller-name*

Specifies a new name for the storage controller.

--remove

Removes a storage controller from the VM configuration.

15.49.3 Examples

The following command creates a SATA storage controller called sata01 and adds it to the ol7 VM. The storage controller emulates the IntelAHCI chipset.

```
$ VBoxManage storagectl ol7 --name "sata01" --add sata --controller IntelAHCI
```

The following command creates an IDE storage controller called ide01 and adds it to the ol7 VM.

```
$ VBoxManage storagectl ol7 --name "ide01" --add ide
```

15.49.4 See Also

15.48 VBoxManage storageattach on page 448

15.50 VBoxManage unattended

Unattended guest OS installation

15.50.1 Synopsis

VBoxManage unattended detect <##iso=*install#iso*> [##machine#readable]

VBoxManage unattended install <*uuid* | *vmname*> <##iso=*install#iso*> [##user=*login*]
[##user#password=*password*] [##user#password#file=*file*] [##admin#password=*password*]
[##admin#password#file=*file*] [##full#user#name=*name*] [##key=*product#key*]
[##install#additions] [##no#install#additions] [##additions#iso=*add#iso*] [##install#txs]
[##no#install#txs] [##validation#kit#iso=*testing#iso*] [##locale=*ll_CC*] [##country=*CC*]
[##time#zone=*tz*] [##proxy=*url*] [##hostname=*fqdn*] [##package#selection#adjustment=*keyword*]
[##dry#run] [##auxiliary#base#path=*path*] [##image#index=*number*]
[##script#template=*file*] [##post#install#template=*file*] [##post#install#command=*command*]
[##extra#install#kernel#parameters=*params*] [##language=*lang*] [##start#vm=*session#type*]

15.50.2 Description

15.50.2.1 unattended detect

VBoxManage unattended detect <##iso=*install#iso*> [##machine#readable]

Detects the guest operating system (OS) on the specified installation ISO and displays the result. This can be used as input when creating a VM for the ISO to be installed in.

--iso=*install-iso*

The installation ISO to run the detection on.

--machine-readable

Produce output that is simpler to parse from a script.

15.50.2.2 unattended install

VBoxManage unattended install <*uuid* | *vmname*> <##iso=*install#iso*> [##user=*login*] [##user#password=*password*] [##user#password#file=*file*] [##admin#password=*password*] [##admin#password#file=*file*] [##full#user#name=*name*] [##key=*product#key*] [##install#additions] [##no#install#additions] [##additions#iso=*add#iso*] [##install#txs] [##no#install#txs] [##validation#kit#iso=*testing#iso*] [##locale=*ll_CC*] [##country=*CC*] [##time#zone=*tz*] [##proxy=*url*] [##hostname=*fqdn*] [##package#selection#adjustment=*keyword*] [##dry#run] [##auxiliary#base#path=*path*] [##image#index=*number*] [##script#template=*file*] [##post#install#template=*file*] [##post#install#command=*command*] [##extra#install#kernel#parameters=*params*] [##language=*lang*] [##start#vm=*session#type*]

Reconfigures the specified VM for installation and optionally starts it up.

uuid | vmname

Either the UUID or the name (case sensitive) of a VM.

--iso=*install-iso*

The installation ISO to run the detection on.

--user=*login*

The login name. (default: vboxuser)

--user-password=*password*

The user login password. This is used for the user given by --user (default: changeme)

--user-password-file=*file*

Alternative to --user-password for providing the user password. Special filename stdin can be used to read the password from standard input.

--admin-password=*password*

The admin / root login password. If not specified, the password from --user-password will be used.

--admin-password-file=*file*

Alternative to --admin-password for providing the admin / root password. Special filename stdin can be used to read the password from standard input.

--full-user-name=*name*

The full user name. (default: --user)

--key=*product-key*

The guest OS product key. Not all guest OSes requires this.

--install-additions, --no-install-additions

Whether to install the VirtualBox guest additions. (default: --no-install-additions)

--additions-iso=*add-iso*

Path to the VirtualBox guest additions ISO. (default: installed/downloaded GAs)

--install-txs, --no-install-txs

Whether to install the Test eXecution Service (TXS) from the VirtualBox ValidationKit. This is useful when preparing VMs for testing or similar. (default: --no-install-txs)

--validation-kit-iso=*testing-iso*

Path to the VirtualBox ValidationKit ISO. This is required if --install-txs is specified.

--locale=*ll_CC*

The base locale specification for the guest, like en_US, de_CH, or nn_NO. (default: host or en_US)

--country=*CC*

The two letter country code if it differs from the specified by --location.

--time-zone=*tz*

The time zone to set up the guest OS with. (default: host time zone or UTC)

--proxy=*url*

Proxy URL to use.

--hostname=*fqdn*

The fully qualified domain name of the guest machine. (default: *vmname*.myguest.virtualbox.org)

--package-selection-adjustment=*keyword*

Adjustments to the guest OS packages/components selection. This can be specified more than once. Currently the only recognized keyword is minimal which triggers a minimal installation for some of the guest OSes.

--dry-run

Do not create any files or make any changes to the VM configuration.

--start-vm=*session-type*

Start the VM using the front end given by *session-type*. This is the same as the --type option for the startvm command, but we have add none for indicating that the VM should not be started. (default: none)

Advanced options:

--auxiliary-base-path=*path*

The path prefix to the media related files generated for the installation. (default: *vm-config-dir*/Unattended-*vm-uuid*-)

--image-index=*number*

Windows installation image index. (default: 1)

--script-template=*file*

The unattended installation script template. (default: IMachine::OSTypeId dependent)

--post-install-template=*file*

The post installation script template. (default: IMachine::OSTypeId dependent)

--post-install-command=*command*

A single command to run after the installation is completed. The exact format and exactly when this is run is guest OS installer dependent.

--extra-install-kernel-parameters=*params*

List of extra Linux kernel parameters to use during the installation. (default: IMachine::OSTypeId dependent)

--language=*lang*

Specifies the UI language for a Windows installation. The *lang* is generally of the form {ll}-{CC}. See the detectedOSLanguages results from **VBoxManage unattended detect**. (default: detectedOSLanguages[0])

15.51 VBoxManage unregistervm

Unregister a virtual machine

15.51.1 Synopsis

VBoxManage unregistervm <*uuid* | *vmname*> [##delete] [##delete#all]

15.51.2 Description

The **VBoxManage unregistervm** command unregisters a virtual machine (VM).

uuid* | *vmname

Specifies the name or Universally Unique Identifier (UUID) of the VM.

--delete

Deletes the following files related to the VM automatically:

- All hard disk image files, including differencing files.
- All saved state files that the machine created, including one for each snapshot.
- XML VM machine definition file and its backups.
- VM log files.
- The empty directory associated with the unregistered VM.

--delete-all

Deletes the files described in the --delete option, as well as all DVDs and Floppy disks located in the VM folder and attached only to this VM.

15.51.3 Examples

The following command unregisters a VM called vm2.

```
$ VBoxManage unregistervm vm2
```

The following command unregisters a VM called vm3. All files associated with the VM are deleted.

```
$ VBoxManage unregistervm vm3 --delete
%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
```

15.51.4 See Also

15.39 VBoxManage registervm on page 432

15.52 VBoxManage updatecheck

Checks for a newer version of Oracle VirtualBox

15.52.1 Synopsis

VBoxManage updatecheck perform [##machine#readable]

VBoxManage updatecheck list [##machine#readable]

VBoxManage updatecheck modify [##disable | ##enable] [##channel=*stable* | *withbetas* | *all*]
[##frequency=*days*]

15.52.2 Description

The **updatecheck** subcommand is used to check if a newer version of Oracle VirtualBox is available. The two subcommand options of **updatecheck** are used for modifying or viewing the settings associated with checking for a newer version of Oracle VirtualBox.

15.52.2.1 updatecheck perform

VBoxManage updatecheck perform [##machine#readable]

Checks if a newer version of Oracle VirtualBox is available.

--machine-readable

Machine readable output.

15.52.2.2 updatecheck list

VBoxManage updatecheck list [##machine#readable]

Displays the current settings used for specifying when to check for a newer version of Oracle VirtualBox.

--machine-readable

Machine readable output.

15.52.2.3 updatecheck modify

VBoxManage updatecheck modify [##disable | ##enable] [##channel=*stable* | *withbetas* | *all*] [##frequency=*days*]

Modifies the settings used for specifying when to check for a newer version of Oracle VirtualBox.

--enable

Enable the update check service.

--disable

Disable the update check service.

--channel=stable | withbetas | all

The preferred release type used for determining whether a newer version of Oracle VirtualBox is available. The default is 'stable'.

stable

Checks for newer stable releases (maintenance and minor releases within the same major release) of Oracle VirtualBox.

all

Checks for newer stable releases (maintenance and minor releases within the same major release) and major releases of Oracle VirtualBox.

withbetas

Checks for newer stable releases (maintenance and minor releases within the same major release), major releases, and beta releases of Oracle VirtualBox.

--frequency=days

Specifies how often in days to check for a newer version of Oracle VirtualBox.

--proxy-mode=system | manual | none

Specifies the proxy mode to use.

--proxy-url=<address>

Specifies the proxy address to use. Set to empty string to clear proxy address.

15.53 VBoxManage usbdevsource

Add and remove USB device sources

15.53.1 Synopsis

VBoxManage usbdevsource add <*source#name*> <##backend=*backend*> <##address=*address*>

VBoxManage usbdevsource remove <*source#name*>

15.53.2 Description

The **VBoxManage usbdevsource** command adds a USB device source and makes it available to VM guests on the host system. You can also use this command to remove a USB device source.

15.53.2.1 Add a USB Device Source

VBoxManage usbdevsource add <*source#name*> <##backend=*backend*> <##address=*address*>

The **VBoxManage usbdevsource add** command adds a USB device source, which is then available to all guest VMs on the host system.

source-name

Specifies a unique name for the USB device source.

--address=*address*

Specifies the address of the USB backend.

--backend=*backend*

Specifies the USB proxy service backend to use.

If specifying a remote server over the USB/IP protocol the only currently supported backend value is USBIP.

15.53.2.2 Remove a USB Device

VBoxManage usbdevsource remove <*source#name*>

The **VBoxManage usbdevsource remove** command removes a USB device.

source-name

Specifies the name of the USB device source to remove.

15.53.3 Examples

The following command adds a USB device server called hostusb01.

```
$ VBoxManage usbdevsource add hostusb01 --backend USBIP --address 10.0.1.16
```

15.54 VBoxManage usbfilter

Manage USB filters

15.54.1 Synopsis

VBoxManage usbfilter add <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>> <##name=*string*> <##action=ignore | hold> [##active=yes | no] [##vendorid=*XXXX*] [##productid=*XXXX*] [##revision=*IIFF*] [##manufacturer=*string*] [##product=*string*] [##port=*hex*] [##remote=yes | no] [##serialnumber=*string*] [##maskedinterfaces=*XXXXXXXX*]

VBoxManage usbfilter modify <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>> [##name=*string*] [##action=ignore | hold] [##active=yes | no] [##vendorid=*XXXX*| ""] [##productid=*XXXX*| ""] [##revision=*IIFF*| ""] [##manufacturer=*string*| ""] [##product=*string*| ""] [##port=*hex*] [##remote=yes | no] [##serialnumber=*string*| ""] [##maskedinterfaces=*XXXXXXXX*]

VBoxManage usbfilter remove <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>>

15.54.2 Description

The **VBoxManage usbfilter** command enables you to manage USB filters for a specific virtual machine (VM), or global USB filters that affect the entire Oracle VirtualBox configuration.

Global filters are applied before VM-specific filters. This means that you can use a global filter to prevent devices from being captured by any VM.

Global filters are applied in sequence based on where they were located in the list (see the **--index** option below for the list ordering details). Only the first filter that matches a device is applied. For example, if two global filters were created and the first filter made a specific Kingston memory stick device available while the second filter ignored all Kingston devices the result of applying these two filters would be that this specific Kingston memory stick would made available to any VM but no other Kingston USB devices would be made available.

15.54.2.1 Common Operand and Options

index,0-*N*

Specifies a single integer that indicates the position of the filter in the list. Zero (0) represents the first position in the list. If a filter already exists at the specified position, the existing filter and any existing filters that follow are moved down the list. Otherwise, the new filter is appended to the list.

--action=ignore | hold

Specifies whether to allow VMs access to devices that match a USB filter (hold) or to deny them access (ignore). This option applies only to global filters.

--active=yes | no

Specifies whether a USB filter is active or temporarily disabled. Valid values are yes, which activates the filter, and no, which disables the filter. The default value is yes.

--manufacturer=*string*

Specifies a manufacturer ID filter as a string. The default value is an empty string ("").

--maskedinterfaces=*XXXXXXXX*

Specifies a masked interface filter that is used to hide one or more USB interfaces from the guest. The value is a bit mask where the set bits correspond to the USB interfaces to hide, or mask off. This feature is supported on Linux host systems only.

--name=*filter-name*

Specifies the name of the filter.

--port=*hex*

Specifies a hub port number filter as a string. The default value is an empty string ("").

--product=*string*

Specifies a product ID filter as a string. The default value is an empty string ("").

--productid=*XXXX*

Specifies a product ID filter. The string representation for an exact match has the form *XXXX*, where *X* is a hexadecimal digit including leading zeroes. The default value is an empty string ("").

--remote=yes | no

Specifies a remote filter that indicates whether the device is physically connected to a remote VRDE client or to a local host system. This option applies to VM filters only. The default value is no.

--revision=*IIFF*

Specifies a revision ID filter. The string representation for an exact match has the form *IIFF*. *I* is a decimal digit of the integer part of the revision. *F* is a decimal digit of its fractional part that includes leading and trailing zeros. The default value is an empty string ("").

To specify a range of revision IDs, ensure that you use the hexadecimal form so that the revision is stored as a 16-bit packed BCD value. For example, the int:0x0100-0x0199 expression matches any revision from 1.0 to 1.99, inclusive.

--serialnumber=*string*

Specifies a serial number filter as a string. The default value is an empty string ("").

--target=*uuid* | *vmname* | global

Specifies the VM that the filter is attached to. You can specify the Universally Unique Identifier (UUID) or the name of the VM. To apply the filter description to all VMs, specify global.

--vendorid=*XXXX*

Specifies a vendor ID filter, which is a string representation of a four-digit hexadecimal number. *X* is the hexadecimal digit including leading zeroes. The default value is an empty string ("").

15.54.2.2 Add a USB Filter or a Global Filter

VBoxManage usbfilter add <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>> <##name=*string*> <##action=ignore | hold> [##active=yes | no] [##vendorid=*XXXX*] [##productid=*XXXX*] [##revision=*IIFF*] [##manufacturer=*string*] [##product=*string*] [##port=*hex*] [##remote=yes | no] [##serialnumber=*string*] [##maskedinterfaces=*XXXXXXXX*]

Use the **VBoxManage usbfilter add** command to create a new USB filter.

In addition, specify parameters by which to filter. You can use the **VBoxManage list usbhost** command to view the parameters of the USB devices that are attached to your system.

15.54.2.3 Modify a USB Filter or a Global Filter

VBoxManage usbfilter modify <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>> [##name=*string*] [##action=ignore | hold] [##active=yes | no] [##vendorid=*XXXX*| ""] [##productid=*XXXX*| ""] [##revision=*IIFF*| ""] [##manufacturer=*string*| ""] [##product=*string*| ""] [##port=*hex*] [##remote=yes | no] [##serialnumber=*string*| ""] [##maskedinterfaces=*XXXXXXXX*]

Use the **VBoxManage usbfilter modify** command to modify a USB filter. You can use the **VBoxManage list usbfilters** command to list global filter indexes and the **VBoxManage showvminfo** command to list indexes for a specific virtual machine.

15.54.2.4 Remove a USB Filter or a Global Filter

VBoxManage usbfilter remove <*index*,0#*N*> <##target=<*uuid* | *vmname* | global>>

Use the **VBoxManage usbfilter remove** command to remove a USB filter entry.

15.54.3 Examples

The following command lists the available USB devices on the host system.

```
$ VBoxManage list usbhost
```

The following command adds a USB filter called filter01 to the ol7 VM. The filter specifies a Kingston DataTraveler memory stick and is placed first in the list of USB filters for the VM.

```
$ VBoxManage usbfilter add 0 --target ol7 --name filter01 --vendorid 0x0930 --productid 0x6545
```

The following command removes the USB filter that is second in the list for the ol7 VM.

```
$ VBoxManage usbfilter remove 1 --target ol7
```

15.55 vboximg-mount

FUSE mount a virtual disk image for Mac OS and Linux hosts

15.55.1 Synopsis

vboximg#mount <#? | #h | ##help>

vboximg#mount <##image=*image#UUID*> [##guest#filesystem] [#o=*FUSE#option* [,*FUSE#option*...]] [##root] [##rw] <*mountpoint*>

vboximg#mount <##list> [##image=*image#UUID*] [##verbose] [##vm=*vm#UUID*] [##wide]

15.55.2 Description

The **vboximg-mount** command enables you to make Oracle VirtualBox disk images available to a Mac OS or Linux host operating system (OS) for privileged or non-priviliged access. You can mount any version of the disk from its available history of snapshots. Use this command to mount, view, and optionally modify the contents of an Oracle VirtualBox virtual disk image, and you can also use this command to view information about registered virtual machines (VMs).

This command uses the Filesystem in Userspace (FUSE) technology to provide raw access to an Oracle VirtualBox virtual disk image.

When you use the --image option to specify a base image identifier, only the base image is mounted. Any related snapshots are disregarded. Alternatively, if you use the --image option to specify a snapshot, the state of the FUSE-mounted virtual disk is synthesized from the implied chain of snapshots, including the base image.

The **vboximg-mount** command features read-only access to file systems inside a VM disk image. This feature enables you to extract some files from the VM disk image without starting the VM and without requiring third-party file system drivers on the host system. Oracle VirtualBox supports the FAT, NTFS, ext2, ext3, and ext4 file systems.

The virtual disk is exposed as a device node within a FUSE-based file system that overlays the specified mount point.

The FUSE file system includes a directory that contains a number of files. The file system can also contain a directory that includes a symbolic link that has the same base name (see the **basename**(1) man page) as the virtual disk base image and points to the location of the virtual disk base image. The directory can be of the following types:

- vhdd provides access to the raw disk image data as a flat image
- vol*ID* provides access to an individual volume on the specified disk image
- fs*ID* provides access to a supported file system without requiring a host file system driver

15.55.2.1 General Command Options

vboximg#mount <#? | #h | ##help>

Use the following options to obtain information about the **vboximg-mount** command and its options.

--help, --h, or--?

Shows usage information.

15.55.2.2 Mounting an Oracle VirtualBox Disk Image

vboximg#mount <##image=*image#UUID*> [##guest#filesystem] [#o=*FUSE#option* [,*FUSE#option*...]] [##root] [##rw] <*mountpoint*>

Use the **vboximg-mount** command to mount an Oracle VirtualBox virtual disk image on a Mac OS or Linux host system. When mounted, you can view the contents of the disk image or modify the contents of the disk image.

You can use the **vboximg-mount** command to restrict FUSE-based access to a subsection of the virtual disk.

--image=*disk-image*

Specifies the Universally Unique Identifier (UUID), name, or path of the Oracle VirtualBox disk image.

The short form of the --image option is -i.

--guest-filesystem

Enables read-only support for guest file systems. When you specify this option, all known file systems are made available to access.

The short form of the --guest-filesystem option is -g.

-o=*FUSE-option*[,*FUSE-option*...]

Specifies FUSE mount options.

The **vboximg-mount** command enables you to use the FUSE mount options that are described in the **mount.fuse**(8) man page.

--root

Overrides the security measure that restricts file access to the file system owner by also granting file access to the root user.

Same as the -o allow_root option. See the -o option description.

This option is incompatible with the -o allow_other option.

--rw

Mounts the specified image as read-write, which is required if you want to modify its contents. By default, images are mounted as read-only.

mount-point

Specifies the path name of a directory on which to mount the Oracle VirtualBox disk image.

15.55.2.3 Viewing Oracle VirtualBox Disk Image Information

vboximg#mount <##list> [##image=*image#UUID*] [##verbose] [##vm=*vm#UUID*] [##wide]

Use the **vboximg-mount** command to view information about registered VMs or an Oracle VirtualBox virtual disk image.

--list

Shows information about the disks that are associated with the registered VMs. If you specify a disk image, this option shows information about the partitions of the specified image.

When you specify the --verbose option, the output includes detailed information about the VMs and media, including snapshot images and file paths.

The short form of the --list option is -l.

--image=*disk-image*

Specifies the UUID, name, or path of the Oracle VirtualBox disk image.

The short form of the --image option is -i.

--verbose

Shows or logs detailed information.

The short form of the --verbose option is -v.

--vm=*vm-UUID*

Outputs information about the VM that is associated with the specified UUID.

--wide

Outputs information in a wide format. This output includes the lock state information of running VMs. For VMs that are not running, the state is created.

The wide output uses a tree-like structure in the VM column to show the relationship between a VM base image and its snapshots.

15.55.3 Examples

The following example shows how to mount a virtual disk image on the host operating system (OS).

```
$ mkdir fuse_mount_point
$ vboximg-mount --image=b490e578-08be-4f7d-98e9-4c0ef0952377 fuse_mount_point
$ ls fuse_mount_point
ubu.vdi[32256:2053029880]   vhdd
$ sudo mount fuse_mount_point/vhdd /mnt
```

The **mkdir** command creates a mount point called fuse_mount_point on the host OS. The **vboximg-mount** command is then used to mount the specified disk image on the fuse_mount_point mount point. The mount includes all snapshots for the disk image.

The **ls** command shows the contents of fuse_mount_point. The **mount** command is then used to mount the FUSE-mounted device node, **vhdd**, on the /mnt mount point. The **vhdd** device node represents the virtual disk image.

The following example shows how to make the known file systems of the b490e578-08be-4f7d-98e9-4c0ef0952377 disk image accessible when the image is mounted on the fuse_mount_point mount point:

```
$ vboximg-mount --image=b490e578-08be-4f7d-98e9-4c0ef0952377 \
--guest-filesystem fuse_mount_point
```

The following command outputs detailed information about all registered VMs and their snapshots:

```
$ vboximg-mount --list --verbose
```

The following command shows an excerpt of the list output in wide format.

```
$ vboximg-mount --list --wide

VM  Image                Size Type State   UUID (hierarchy)
------------------------------------------  ------------------------------------
Proxy                                  0833f5bc-6304-42e1-b799-cdc81c576c60
 |
 +- Proxy.vdi            4.8G VDI  rlock   d5f84afb-0794-4952-ab71-6bbcbee07737
 |  +- <snapshot>        12.3G VDI  rlock     dffc67aa-3023-477f-8033-b27e3daf4f54
 |  +- <snapshot>         8.8G VDI  rlock       3b2755bd-5f2a-4171-98fe-647d510b6274
 |  +- <snapshot>        14.6G VDI  rlock         e2ccdb5f-49e8-4123-8623-c61f363cc5cf
 |  +- <snapshot>         7.4G VDI  wlock           3c1e6794-9091-4be3-9e80-11aba40c2649

------------------------------------------  ------------------------------------
Oracle Linux 7                         5365ab5f-470d-44c0-9863-dad532ee5905
 |
 +- Oracle Linux 7.vdi     7.0G VDI created 96d2e92e-0d4e-46ab-a0f1-008fdbf997e7
 | +- <snapshot>          15.9G VDI created   f9cc866a-9166-42e9-a503-bbfe9b7312e8
 |
 +- kernel.vdi           11.1G VDI created 79a370bd-0c4f-480a-30bb-10cdea68423f
```

The output shows that the Proxy VM is running the fourth snapshot of the **Proxy.vdi** virtual disk image. The running state is indicated by the **wlock** value in the State column.

The Oracle Linux 7 VM is not running. It has two images: **Oracle Linux 7.vdi** and **kernel.vdi**. The **Oracle Linux 7.vdi** image has a snapshot.

The following command shows information about the VM with the specified UUID:

```
$ vboximg-mount --list --vm=b1d5563b-2a5b-4013-89f1-26c81d6bbfa0
------------------------------------------------------------------------
VM:   ubu
UUID: b1d5563b-2a5b-4013-89f1-26c81d6bbfa0

 Image:   ubu.vdi
 UUID:    b490e578-08be-4f7d-98e9-4c0ef0952377

     Snapshot: 35afe1e0-0a51-44f3-a228-caf172f3306f
     Size:     12.1G

     Snapshot: 874279c1-4425-4282-ada8-a9c07c00bbf9
     Size:     13.6G

 Image:   kernel.vdi
 UUID:    79a370bd-6eb7-4dbf-8bc6-d29118f127e0
```

16 Reference

16.1 Experimental Features

These Oracle VirtualBox features are considered experimental and are not covered by Oracle Premier Support. However, feedback and suggestions about the features are welcome.

- *16.1.1 Windows on Arm Hosts on page 469*
- *16.1.2 macOS Guests on page 469*
- *16.1.3 CD/DVD Passthrough on page 470*
- *16.1.4 PC Speaker Passthrough on page 470*
- *16.1.5 Virtual I/O Device SCSI Hard Disk Controller on page 472*
- *16.1.6 Access iSCSI Targets Using Internal Networking on page 472*

16.1.1 Windows on Arm Hosts

The installation package for Windows 11 includes the ability to run Oracle VirtualBox on an Arm host processor.

This feature is experimental. If you plan to use it, contact Oracle Sales with an indication of the number of hosts so that we can estimate demand for support of this feature.

16.1.2 macOS Guests

Oracle VirtualBox enables you to install and execute unmodified versions of macOS and Mac OS X guests on supported host hardware. This feature is experimental and thus unsupported.

Be aware of the following important issues before you try to install a macOS guest:

- macOS is commercial, licensed software and contains **both license and technical restrictions** that limit its use to certain hardware and usage scenarios. You must understand and comply with these restrictions.

  In particular, Apple prohibits the installation of most versions of macOS on non-Apple hardware.

  These license restrictions are also enforced on a technical level. macOS verifies that it is running on Apple hardware. Most DVDs that accompany Apple hardware check for the exact model. These restrictions are *not* circumvented by Oracle VirtualBox and continue to apply.
- Only CPUs that are known and tested by Apple are supported. As a result, if your Intel CPU is newer than the macOS build, or if you have a non-Intel CPU, you will likely encounter a panic during bootup with an **Unsupported CPU** exception.

  Ensure that you use the macOS DVD that comes with your Apple hardware.
- The macOS installer expects the hard disk to be *partitioned*. So, the installer will not offer a partition selection to you. Before you can install the software successfully, start the **Disk Utility** from the **Tools** menu and partition the hard disk. Close the Disk Utility and proceed with the installation.

Limitations

- The graphics resolution currently defaults to 1024x768 as macOS falls back to the built-in EFI display support. See *Video Modes in EFI* for more information on how to change EFI video modes.
- Depending on your system and version of macOS, you might experience guest hangs after some time. This can be fixed by turning off energy saving. Set the timeout to **Never** in the system preferences.
- By default, the Oracle VirtualBox EFI enables debug output of the macOS kernel to help you diagnose boot problems. Note that there is a lot of output and not all errors are fatal. They would also show when using a physical Apple computer. You can turn off these messages by using the following command:

  ```
  $ VBoxManage setextradata VM-name "VBoxInternal2/EfiBootArgs" "  "
  ```

  To revert to the previous behavior, use the following command:

  ```
  $ VBoxManage setextradata VM-name "VBoxInternal2/EfiBootArgs" ""
  ```
- It is currently not possible to start a macOS guest in safe mode by specifying the `-x` option in `VBoxInternal2/EfiBootArgs` extradata.

16.1.3 CD/DVD Passthrough

The standard CD/DVD emulation enables reading of standard data CD and DVD formats only. As an experimental feature, for additional capabilities, it is possible to give the guest direct access to the CD/DVD host drive by enabling *passthrough* mode. Depending on the host hardware, this may potentially enable the following things to work:

- CD/DVD writing from within the guest, if the host DVD drive is a CD/DVD writer
- Playing audio CDs
- Playing encrypted DVDs

To enable host drive passthrough you can use the `--passthrough` option of the `VBoxManage storageattach` command. See *15.48 VBoxManage storageattach on page 448*.

Even if passthrough is enabled, unsafe commands, such as updating the drive firmware, will be blocked. Video CD formats are never supported, not even in passthrough mode, and cannot be played from a virtual machine.

On Oracle Solaris hosts, passthrough requires running Oracle VirtualBox with real root permissions due to security measures enforced by the host.

16.1.4 PC Speaker Passthrough

As an experimental feature, primarily due to being limited to Linux host only and unknown Linux distribution coverage, Oracle VirtualBox supports passing through the PC speaker to the host. The PC speaker, sometimes called the system speaker, is a way to produce audible feedback such as beeps without the need for regular audio and sound card support.

The PC speaker passthrough feature in Oracle VirtualBox handles beeps only. Advanced PC speaker use by the VM, such as PCM audio, will not work, resulting in undefined host behavior.

Producing beeps on Linux is a very complex topic. Oracle VirtualBox offers a collection of options, in an attempt to make this work deterministically and reliably on as many Linux distributions and system configurations as possible. These are summarized in the following table.

Table 11: PC Speaker Configuration Options

PC Speaker Configuration Options

Code	Device	Notes
1	/dev/input/by-path/platform-pcspkr-event-spkr	Direct host PC speaker use.
2	/dev/tty	Uses the terminal association of the VM process. VM needs to be started on a virtual console.
3	/dev/tty0 or /dev/vc/0	Can only be used by user root or users with cap_sys_tty_config capability.
9	A user-specified console or evdev device path.	As for codes 1 to 3, but with a custom device path.
70	/dev/tty	Standard beep only. Loses frequency and length. See code 2.
79	A user-specified terminal device path.	As for code 70, but with a custom device path.
100	All of the above.	Tries all the available codes.

To enable PC speaker passthrough use the following command:

VBoxManage setextradata *VM-name* "VBoxInternal/Devices/i8254/0/Config/PassthroughSpeaker" *N*

Replace *N* with the code representing the case you want to use. Changing this setting takes effect when you next start the VM. It is safe to enable PC speaker passthrough on all host OSes. It will only have an effect on Linux.

The VM log file, VBox.log, contains lines with the prefix PIT: speaker: showing the PC speaker passthrough setup activities. It gives hints which device it picked or why it failed.

Enabling PC speaker passthrough for the VM is usually the simple part. The real difficulty is making sure that Oracle VirtualBox can access the necessary device, because in a typical Linux install most of them can only be accessed by user root. You should follow the preferred way to persistently change this, such as by referring to your distribution's documentation. Since there are countless Linux distribution variants, we can only give the general hints that there is often a way to give the X11 session user access to additional devices, or you need to find a working solution using a udev configuration file. If everything fails you might try setting the permissions using a script which is run late enough in the host system startup.

Sometimes additional rules are applied by the kernel to limit access. For example, that the VM process must have the same controlling terminal as the device configured to be used for beeping, something which is often very difficult to achieve for GUI applications such as Oracle VirtualBox. The table above contains some hints, but in general refer to the Linux documentation.

If you have trouble getting any beeps even if the device permissions are set up and VBox.log confirms that it uses evdev or console for the PC speaker control, check if your system has a PC speaker. Some systems do not have one. Other complications can arise from Linux rerouting the PC speaker output to a sound card. Check if the beeps are audible if you connect speakers to your sound card. Today almost all systems have one. Finally, check if the audio mixer control has a channel named *beep*, which could be hidden in the mixer settings, and that it is not muted.

16.1.5 Virtual I/O Device SCSI Hard Disk Controller

The use of hard disk controllers is described at *8.1 Hard Disk Controllers on page 125*. In addition to those listed, virtio-scsi is an experimental feature.

Virtual I/O Device SCSI is a standard to connect virtual storage devices like hard disks or optical drives to a VM. Recent Linux and Windows versions support these devices, but Windows needs additional drivers. Drivers are available from Oracle Support.

> **Note:**
>
> The virtio-scsi controller will only be seen by OSes with device support for it. In particular, *there is no built-in support in Windows*. So Windows will not see such disks unless you install additional drivers.

Up to 256 slots can be attached to the virtio-scsi controller, if enabled and supported by the guest OS.

16.1.6 Access iSCSI Targets Using Internal Networking

As an experimental feature, Oracle VirtualBox enables access to an iSCSI target running in a virtual machine which is configured to use Internal Networking mode. See *iSCSI Servers*, *Internal Networking*, and *15.48 VBoxManage storageattach on page 448*.

The IP stack accessing Internal Networking must be configured in the virtual machine which accesses the iSCSI target. A free static IP and a MAC address not used by other virtual machines must be chosen. In the example below, adapt the name of the virtual machine, the MAC address, the IP configuration, and the Internal Networking name (MyIntNet) according to your needs. The following eight commands must first be issued:

```
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/Trusted 1
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/Config/MAC 08:00:27:01:02:0f
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/Config/IP 10.0.9.1
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/Config/Netmask 255.255.255.0
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/LUN#0/Driver IntNet
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/LUN#0/Config/Network MyIntNet
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/LUN#0/Config/TrunkType 2
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/LUN#0/Config/IsService 1
```

Finally the iSCSI disk must be attached with the `--intnet` option to tell the iSCSI initiator to use internal networking, as follows:

```
$ VBoxManage storageattach ... --medium iscsi --server 10.0.9.30 \
--target iqn.2008-12.com.sun:sampletarget --intnet
```

Compared to a regular iSCSI setup, the IP address of the target *must* be specified as a numeric IP address, as there is no DNS resolver for internal networking.

The virtual machine with the iSCSI target should be started before the VM using it is powered on. If a virtual machine using an iSCSI disk is started without having the iSCSI target powered up, it can take up to 200 seconds to detect this situation. The VM will fail to power up.

16.2 Oracle VirtualBox Privacy Information

Version 6, July 19, 2024

The *Oracle Privacy Policies* apply to your personal data collected and used by Oracle. The following privacy information describes in more detail which information is exchanged between the Oracle VirtualBox application and Oracle, and which information is collected by the virtualbox.org website.

§ 1 virtualbox.org. The virtualbox.org website logs anonymous usage information such as your IP address, geographical location, browser type, referral source, length of visit and number of page views while you visit (collectively, "anonymous data"). In addition, but only if you choose to register an Oracle Single Sign On account, the website's bug tracking and forum services store the data you choose to reveal in your profile, such as your user name and contact information.

§ 2 Cookies. The virtualbox.org website, the bug tracker and the forum services use cookies to identify and track the visiting web browser and, if you have registered, to facilitate login. Most browsers allow you to refuse to accept cookies. While you can still visit the website with cookies disabled, logging into the bug tracker and forum services will not work without them.

§ 3 Update notifications. The Oracle VirtualBox application may contact Oracle to find out whether a new version of Oracle VirtualBox has been released and notify the user if that is the case. In the process, anonymous data such as your IP address and a non-identifying counter, together with the product version and the platform being used, is sent so that the server can find out whether an update is available. By default, this check is performed once a day. You change this interval or disable these checks altogether in the Oracle VirtualBox preferences.

§ 4 Usage of personal information. Oracle may use anonymous and personal data collected by the means above for statistical purposes as well as to automatically inform you about new notices related to your posts on the bug tracker and forum services, to administer the website and to contact you due to technical issues. Oracle may also inform you about new product releases related to Oracle VirtualBox.

In no event will personal data without your express consent be provided to any third parties, unless Oracle may be required to do so by law or in connection with legal proceedings.

§ 5 Updates. Oracle may update the privacy policy at any time by posting a new version at *Oracle Privacy Policies* and the privacy information will be kept up to date in the documentation which comes with the Oracle VirtualBox application. You should check these places occasionally to ensure you are happy with any changes.

17 Change Log

This section summarizes the changes between Oracle VirtualBox versions. Note that this change log is not exhaustive and not all changes are listed.

Oracle VirtualBox version numbers consist of three numbers separated by dots where the first and second number represent the major version and the third number the minor version. Minor version numbers of official releases are always even. An odd minor version number represents an internal development or test build. In addition, each build contains a revision number.

17.1 Version 7.2.22 (2026-10-20)

This is a maintenance release with security-related fixes.

17.2 Version 7.2.20 (2026-09-22)

This is a maintenance release. The following items were fixed or added:

- Windows Host: Fixed regression causing VMs to fail with VERR_SUP_VP_FOUND_EXEC_MEMORY (github:gh-870)

17.3 Version 7.2.18 (2026-09-15)

This is a maintenance release. The following items were fixed or added:

- VMM: Fixed Windows 11 on ARM guests crashing with a blue screen after restoring from a saved state
- GUI: Fixed German and Traditional Chinese translations (github:gh-847, github:gh-809)
- Storage: Fixed data corruption in VDI differencing images after writing full blocks of zeroes and reopening the image (github:gh-850)
- Graphics: Fixed a VM process crash that could occur on Linux hosts with 3D acceleration enabled (github:gh-829)
- Shared Clipboard: Fixed the first character being removed from filenames when copying files located directly in a filesystem root
- Linux Host: Fixed builds across the RHEL 9.8 file-open API transition (github:gh-830)
- Linux Host: Fixed builds for AMD systems where FRED is not available (Intel KVM only, github:gh-784, github:gh-835)
- Linux Host: Fixed issues with Kernel 7.3 compilation
- Linux Host: Preserved the shared DKMS directory during uninstallation (github:gh-826)
- Linux Host and Guest: Added support for RHEL 10.3 kernel (github:gh-833)
- Linux Guest: Fixed builds for kernel 6.12.103 (github:gh-845)

17.4 Version 7.2.16 (2026-08-18)

This is a maintenance release. The following items were fixed or added:

- GUI: Updated Catalan translations
- GUI: Fixed OVF import warning visibility
- GUI: Added graceful handling of inaccessible VMs
- Graphics: VMSVGA 3D performance improvements
- Video Recording: Fixed a hang when stopping recording after a large number of display updates
- Host: OpenSSL 4.0 build fixes (github:gh-794)
- Linux Host: Support for FRED (github:gh-784)
- Linux Host and Guest: Improvements in shared clipboard handling in Wayland
- Linux Guest: Fixed support for RHEL 9.8 kernels (github:gh-732, github:gh-771)

17.5 Version 7.2.14 (2026-07-21)

This is a maintenance release. The following items were fixed or added:

- VMM: Avoided querying/setting xcr0 for CPUs without xsave feature when using Windows Hyper-V as the virtualization engine
- Windows installer: Added support for detecting the Visual C++ runtime via the servicing infrastructure (github:gh-723)
- Windows Host: Fixed clipboard handling of Unicode formats (github:gh-677)
- Linux Host: Added initial support for kernel 7.2
- Linux Guest: Fixed support for updated RHEL 9.8 and 9.9 kernels
- UEFI: Fixed possible bug check and reboot of Windows 11 when updating Secure Boot DBX entries
- BIOS: Simplified build prerequisites, NASM 2.16 or later is now usable for everything (github:gh-520)

17.6 Version 7.2.12 (2026-06-30)

This is a maintenance release. The following items were fixed or added:

- Windows Guest: Added DX11 performance improvements and fixes
- Linux Host: Fixed kernel panic (github:gh-711, github:gh-712)
- Linux Host and Guest: Fixed various NASM build issues (github:gh-520)

17.7 Version 7.2.10 (2026-06-16)

This is a maintenance release. The following items were fixed or added:

- VMM: Fixed issue when CentOS 10 VM was not booting due to the message "Fatal glibc error: CPU does not support x86-64-v3" (github:gh-642)
- Devices/EFI: Fixed booting issue when ARM VM had less than 1024 MiB of RAM assigned (github:gh-679)
- USB: Fixed issue when it was not possible to attach USB device to headless VM on Apple Silicon/macOS 26.4.1 (github:gh-631)
- Storage: Fixed issue when VIRTIO-SCSI device was not recognized as SSD device by guest system (github:gh-634)

- Network: Fixed issue in E1000 emulation code which triggered debug log creation (github:gh-645)
- Network: Fixed issue in E1000 emulation code which prevented OS/2 guest from booting (github:gh-683)
- Linux Host: Fixed issue when VMs could not be started due to kernel oops (github:gh-639)
- Linux Host and Guest: Fixed issue when kernel modules were failing to build with openSUSE 16.0 kernel
- Linux Host and Guest: Added initial support for kernel 7.1
- Linux Host and Guest: Added extra fixes for RHEL 9.8 kernel (github:gh-676)
- Linux Host and Guest: Added possibility to build source code using NASM instead of YASM as the assembler (github:gh-520)
- Linux Guest Additions: Added initial support for Extended Data Control Protocol for clipboard sharing with Plasma on Wayland guests (github:gh-33)
- Linux Guest Additions: Added extra fixes for preventing vboxvideo kernel module build with kernel version 7.0 and newer (github:gh-655)
- OS/2 Guest Additions: Fixed issue when Shared Folders automount and clipboard sharing stopped working (github:gh-551)

17.8 Version 7.2.8 (2026-04-21)

This is a maintenance release. The following items were fixed or added:

- VMM: Fixed issue which caused a Guru Meditation with VERR_IEM_IPE_4 if the guest was trying to execute the wrong hypercall instruction but injected a UD exception instead (github:gh-616)
- NAT Network: Fixed issue when internal DNS server could not be reached
- Graphics: Fixed issue when mouse cursor did not change shape by context in Ubuntu 25.10 / Wayland (github:gh-464)
- Main: Fixed crash on FreeBSD 16.0 shutdown with multiple devices attached to LSI Logic SAS controller (github:gh-538)
- IPRT: Merged Github pull request 503 (fix: infinite loop in vsscanf whitespace processing). github-merge-author: lachlanharrisdev
- Unattended: General improvements
- Linux Host: Added initial support for kernels 6.19 and 7.0 (github:gh-467, github:gh-623)
- Linux Host: Added support for guest time accounting (github:gh-2)
- Linux Host and Guest: Introduced additional fixes for RHEL 10.1 and 10.2 kernels (github:gh-455)
- Linux Host and Guest: Added support for UEK9 kernel on Oracle Linux 9
- Linux Host and Guest: Added improvements to make 'rcvboxdrv/rcvboxadd setup' and installation process faster
- Linux Guest Additions: Deprecated vboxvideo kernel module for kernels 7.0 and newer; please consider using VMSVGA graphics or vboxvideo module which comes with Linux kernel or provided by your Linux distribution if guest running kernel 7.0+; vboxvideo will still be available for older kernels
- Linux Guest Additions: Fixed issue when clipboard sharing was not possible in combination of Wayland guest and Windows host (github:gh-33)
- Linux Guest Additions: Fixed issue when last character was not pasted into Windows host clipboard when copying from Wayland guest (bug:22339)

- Windows Guest: Fixed issue when Windows 11 guest experienced BSOD - DRIVER_OVERRAN_STACK_BUFFER (github:gh-590)
- UEFI: Fixed errors with secure boot certificate updates and Windows 11 guests (github:gh-133)
- DMI: Fixed issue when 0.0 value was provided for the BIOS release and BIOS firmware version numbers so Windows did not populate the registry keys under HKLM\HARDWARE\System\BIOS which some components rely on (bug:21943)

17.9 Version 7.2.6 (2026-01-20)

This is a maintenance release. The following items were fixed or added:

- VMM: Fixed issue when VM process was crashing during RHEL5 guest boot
- VMM: Fixed issue when VMX nested-guest VM-entry was checking the wrong VM-execution control bit in the virtual VMCS (github:gh-313)
- VMM: Fixed issue when VM was crashing on start after recent Windows update (KB5066793) (github:gh-360)
- VMM: Fixed issue when guest process was crashing inside Windows guest on AMD system (github:gh-400)
- VMM: Fixed issue when VM process was crashing on Windows host (github:gh-426, github:gh-407, github:gh-404, github:gh-369, github:gh-238, github:gh-207, github:gh-187, github:gh-178)
- VMM: Fixed Guru Meditation issue on VM start on Windows host (github:gh-346)
- VMM: Fixed issue when VM was failing to shut down on Windows 11 ARM host (github:gh-416)
- VMM: Fixed issue when booting Red Hat 6.1 i386 was failing on AMD Zen4 Windows 11 Pro host (github:gh-466)
- GUI: Added fixes for full-screen support in multi-monitor case (github:gh-197, github:gh-243)
- GUI: Fixed issue when downloading update files was failing (github:gh-327, github:gh-372)
- GUI: Fixed issue when list of VMs was not properly displayed in Resource Manager tab (github:gh-364)
- GUI: Fixed issue when with switching between light/dark modes on macOS host (github:gh-457)
- GUI: Fixed issue when storage controller type list was displayed incorrectly (github:gh-413)
- DevACPI: Fixed issue with file path key names for Dsdt/Ssdt (github:gh-381)
- DevACPI: Added change to make OemTabId configurable using AcpiOemTabId option (github:gh-383)
- NAT: Fixed issue with high CPU usage when VM was using NAT (github:gh-356)
- RDP: The VRDP server was moved to the open source base package
- SmartCard: The USB smartcard emulation was moved to the open source base package
- VM encryption: The disk and VM encryption feature was moved to the open source base package
- VBoxManage: Fixed issue when VBoxManage was not displaying interface name for FreeBSD guests (github:gh-403)
- VBoxManage: Fixed issue when VM could not be started from command line in some circumstances (github:gh-418)
- Main: Improved filename check for drag-and-drop operations (github:gh-68)

- Linux Host: Fixed issue when vboxautostart-service did not start corresponding VMs on system boot (github:gh-309)
- Linux Host: Fixed issue when VM was not able to start if host was running realtime kernel configuration (github:gh-332)
- Guest Additions: Fixed installation on Windows XP 64-bit guests (github:gh-142)
- Guest Additions: Fixed issue when guest process was crashing due to low memory in the system (github:gh-410)
- Linux Guest Additions: Fixed build issue for kernels 2.5.52 and older
- Linux Guest Additions: Fixed issue when VBoxService was not started due to abandoned pid file
- Linux Guest Additions: Fixed issue when user session services were not started on old Linux distributions
- Linux Guest Additions: Fixed check if kernel modules were loaded for old Linux distributions
- Linux Guest Additions: Fixed issue when Guest Additions processes were left running on system reboot or shutdown (github:gh-311)
- Linux Guest Additions: Added additional fixes for RHEL 9.8, 10.1 and 10.2 kernels
- Linux Guest Additions: Added initial support for kernel 6.19 (github:gh-467)
- BIOS: Fixed issue with booting VM using IPXE (github:gh-417)

17.10 Version 7.2.4 (2025-10-21)

This is a maintenance release. The following items were fixed or added:

- GUI: Fixed VirtualBox VM Manager crash when host was resuming from sleep (github:gh-121, github:gh-170)
- GUI: Updated native language support for Traditional Chinese, Greek, Swedish, Hungarian and Indonesian translations
- NAT: Fixed issue when multiple port forwarding rules affected NAT functionality (github:gh-232)
- Linux host and guest: Introduced initial support for kernel 6.18
- Linux Guest Additions: Introduced additional fixes for RHEL 9.6 and 9.7 kernels (github:gh-12)
- Windows Guest Additions: Introduced additional fixes for issue when installation was failing in Windows XP SP2 guest (github:gh-142)

17.11 Version 7.2.2 (2025-09-10)

This is a maintenance release. The following items were fixed or added:

- VMM: Fixed issue when VM was not able to start on Windows Arm host (issue github:gh-8)
- GUI: Fixed VBox Manager crash when some VM has a lot of snapshots (issue github:gh-119)
- GUI: Fixed issue when error notifications could not be displayed on snapshot deletion (issue github:gh-75)
- GUI: Fixed VBox Manager crash while attempting to show error notifications too early (issues github:gh-135 and github:gh-171)
- GUI: Fixed VBox Manager crash while removing all VMs from VM list

- GUI: Fixed VBox Manager freeze on Linux hosts at startup or while attempting to add a VM (issues github:gh-70 and github:gh-168)
- GUI: Fixed VBox Manager layout bug with too strict size constraints (issue github:gh-87)
- GUI: Updated VBox VM network status-bar indicator tooltip (IP address) on guest additions change (issue github:gh-179)
- GUI: Added possibility for Windows 11 host to use legacy light/dark themes from Windows 10 (issues github:gh-137 and github:gh-151)
- GUI: Forcing xdgdesktopportal platform theme on Linux when org.freedesktop.portal.Desktop DBus service is available (issues github:gh-138 and github:gh-150)
- Network (NAT, DNS): Fixed potential issue where a nameserver in the 127/8 network could have been passed to the guest (issue github:gh-136)
- Network: Added a new experimental type of e1000 adapter (82583V). It requires the ICH9 chipset, since MSIs are not supported by PIIX3
- USB: Fixed passing through USB devices exposed over USB/IP (issue github:gh-192)
- USB Webcam: The virtual USB webcam is now part of the open source base package
- Arm host: Improved high CPU usage for idling VMs (issue github:gh-34)
- Linux host: Use KVM APIs on kernel 6.16.0 and newer for acquiring/releasing VT-x (issue github:gh-81, github:gh-139 and github:gh-141)
- macOS host: Fixed internal networking, including NAT networks on macOS (7.2.0 regression; issue github:gh-140)
- macOS host: Fixed VM crash on Arm host on VM start (issue github:gh-101)
- Linux Guest Additions: Fixed issue when VBoxClient was reporting it's unable to load shared libraries on start (issue github:gh-165)
- Windows Guest Additions: Fixed issue when installation was failing on Windows XP SP2 64-bit (issue github:gh-142)
- EFI: Fixed TPM device not working with certain guests (issue github:gh-143)

17.12 Version 7.2.0 (2025-08-14)

This is a major update. The following new features were added:

- GUI: Moved global and VM tools from hamburger menus to global tools taskbar (vertically on the left) and the VM tools tabs (horizontally above the right hand panel) to make them easier to reach
- Windows/Arm host: Arm virtualization of VMs added, in the unified Windows installer package
- Arm host: Virtualization of Windows 11/Arm VMs
- Linux host: Video decoding acceleration when 3D is enabled
- Windows/Arm guest: Guest additions for new OS type Windows 11/Arm
- macOS Arm host: Experimental 3D acceleration support using DXMT, removing the previous non working solution using DXVK on top of MoltenVK. 3D acceleration is not supported on macOS hosts using Intel CPUs anymore.
- Storage: The NVMe storage controller emulation is now part of the open source base package

In addition, the following items were fixed or added:

- Arm VMs: Note that the saved state of Arm VMs from VirtualBox 7.1 is **incompatible** with VirtualBox 7.2, so please shut down such VMs in saved state before upgrading to 7.2 (snapshots with associated saved state created with 7.1 will no longer work with 7.2)

- VMM: Improved x86_64 and Arm CPU feature reporting when using Windows Hyper-V as the virtualization engine
- VMM: Added xsave/xrestor instruction handling when using Windows/x86_64 Hyper-V as the virtualization engine, offering the x86_64-v3 instruction set extensions (including AVX and AVX2) on recent CPUs
- VMM: Fixed issue when X86_64-v3 features were not passed to the guest (github:gh-36)
- VMM/HM: Fixed Nested Virtualization feature on Intel CPUs
- GUI: Fixed a bug in clone VM wizard which made impossible to include snapshots in clone result (github:gh-59)
- GUI: Polished Preferences and Settings pages, NLS fixing
- GUI: Improved handling of keyboard LEDs in the Soft Keyboard
- GUI: Added checkbox for making a Shared Folder global to all VMs
- GUI: Removed IO-APIC from Arm VM settings
- Graphics: Avoid assertion when guest tries to use VMSVGA 3D functions when the feature is disabled
- Audio: Fixed crash in rare circumstances (github:gh-72)
- NAT: Multiple fixes and improvements, for example better DNS server handling, saving of the VM settings and generating a boot file name which stays within the length limit
- NAT Network: Use the (almost) same code as for NAT, unifying behavior and features
- NAT: Fixed possible crash in rare circumstances when no nameservers could be detected in the host system
- Storage: Fixed corruption of VMDK images when resizing
- Video Recording: Fixed frame synchronization, a small memory leak and other bugs
- TPM: Fixed save state load failures
- Arm VMs: ACPI now available
- API/Unattended: Added explicit unattended installation support for Oracle Linux 10
- API and VBoxManage: Added functionality to define global Shared Folders for all VMs
- API: Fixed issue when OVF/OVA import resulted in a broken VM on Arm (bug #22370)
- API: Fixed issue when exporting a VM which had an inaccessible disk resulted in crash
- VBoxManage: Document currently unavailable NAT options
- Linux host and guest: Initial support for kernel version 6.16
- Linux/Solaris host: Fixed swapped scan code for Pause and Num Lock keys in the table used when relying on Xkb for translation
- Windows host: Removed release assertion causing crash of VBoxUsbMon driver if unloading fails
- Arm host: vboxwebsrv is now included in the packages
- Linux host and guest: Introduced initial support for kernel 6.17
- Linux guest: Fixed handling of (long optional) vboxvideo kernel module in init script
- Linux guest: Fixed start failure of VBoxClient with kernel from the 2.6 series or older
- Windows/Arm guest: Added WDDM Graphics driver, with 2D and 3D mode
- Windows/Arm guest: Added Shared Folder feature
- Windows Host: Added improvements in Windows drivers installation
- Linux Guest Additions: Fixed issue when autorun installer was not automatically starting on Additions ISO image insert for Oracle Linux 10 and RHEL 10 guests
- BIOS: Fixed keyboard translation, added and updated several entries and do not report keypresses when scan code and ASCII code are both zero
- BIOS: Fixed error reporting fo single sided floppy disks

- UEFI: Added workaround for Grub bug causing guest OS crashes
- UEFI: Fixed macOS kernel logging over serial port (github:gh-82)
- 3rd Party Tools: Eliminated build time dependency on libIDL and IASL

17.13 Change Logs for Legacy Versions

To view the change log for a legacy version of VirtualBox see the documentation for the relevant Oracle VirtualBox release.

Change logs are also available at:

https://www.virtualbox.org/wiki/Changelog.

18 Licensing Information User Manual for Release 7.2

Preface

This document provides information about the third-party components used by Oracle VirtualBox.

Audience

This document is intended for users and administrators of Oracle VirtualBox.

Related Documents

The documentation for this product is available at:

https://docs.oracle.com/en/virtualization/virtualbox/index.html

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18.2.3.1 A-Profile Architecture

A-Profile Architecture

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AARCHMRS containing the JSON files for Arm A-profile architecture (2024-12)
16th December 2024

****

Intention and quality statements for all ArmARM architecture releases
The intention and scope of the Architecture releases is to describe changes from the existing architecture to the next release. The quality of the architecture releases refers to the accuracy and completeness of the changes described in the specifications.

The intention and scope of the XML releases is to describe the content and behavior of the registers, system registers, instructions, pseudocode, and features of the architecture in full for human readers. The release enables correct information for the current or any previous release to be deduced. The quality of the XML releases refers to the accuracy and completeness of the content to a human reader.

The intention and scope of the JSON releases is to describe aspects of the XML releases in a structured, machine readable format. The content of the architectural content will be approximately equivalent to the corresponding XML release. However there are some aspects of the architecture which cannot yet be represented in a machine readable format.

The intention and scope of the Schema for the JSON releases is to describe the syntax and format of the JSON files used in the JSON releases. The schema is still under development and is subject to change.

Product status
The content and quality of this JSON release is approximately equivalent to the 2024-12 XML release.

There are some aspects of the architecture which cannot yet be represented in a machine readable format, and will be omitted.

The package contains the Proprietary Notice which defines the terms and conditions for this release. The README file describes the contents of the package.

****

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18.2.3.2 alsa-lib

alsa-lib

include/asoundlib.h:
/**
 * \file include/asoundlib.h
 * \brief Application interface library for the ALSA driver

```
 * \author Jaroslav Kysela <perex@perex.cz>
 * \author Abramo Bagnara <abramo@alsa-project.org>
 * \author Takashi Iwai <tiwai@suse.de>
 * \date 1998-2001
 *
 * Application interface library for the ALSA driver
 */
/*
 *   This library is free software; you can redistribute it and/or modify
 *   it under the terms of the GNU Lesser General Public License as
 *   published by the Free Software Foundation; either version 2.1 of
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 *
 */
```

==========

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ROM BIOS for use with Bochs/Plex86/QEMU emulation environment

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18.2.3.4 cereal

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base64

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18.2.3.5 compositeproto

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18.2.3.6 curl

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18.2.3.8 dnsproxy

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18.2.3.9 dri2proto

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18.2.3.10 dxmt

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18.2.3.11 dxvk

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18.2.3.12 EDK2

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18.2.3.13 EGL-Registry

https://github.com/KhronosGroup/EGL-Registry/blob/main/api/KHR/khrplatform.h:

```
/*
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18.2.3.14 fixesproto

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 *  TODO:
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 *       oConsidering for word alignment for other platform.
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 * alias_pptp.c
 *
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 *      from: Id: in_cksum.c,v 1.8 1995/12/03 18:35:19 bde Exp
 * $FreeBSD: src/sys/amd64/include/in_cksum.h,v 1.5.20.1 2009/04/15 03:14:26 kensmith Exp $
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 *
 *      @(#)uipc_mbuf.c 8.2 (Berkeley) 1/4/94
 */
============================================================
https://svnweb.freebsd.org/base/releng/7.2/sys/sys/mbuf.h:
```

```
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 *
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 * $FreeBSD: src/sys/sys/mbuf.h,v 1.217.2.3.4.1 2009/04/15 03:14:26 kensmith Exp $
 */
============================================================
https://svnweb.freebsd.org/base/releng/7.2/sys/sys/sbuf.h:
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 *
 *      $FreeBSD: src/sys/sys/sbuf.h,v 1.14.18.1.2.1 2009/04/15 03:14:26 kensmith Exp $
 */
```

18.2.3.17 Glib

Glib

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18.2.3.18 glibc

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18.2.3.19 glproto

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18.2.3.20 glslang

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18.2.3.21 gSOAP

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gsoap/stdsoap2.cpp

stdsoap2.c[pp] 2.8.122

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*/

18.2.3.22 gtk3 (GNOME desktop)

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18.2.3.23 inputproto

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18.2.3.24 iPXE

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18.2.3.26 kbproto

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18.2.3.28 libjpeg-turbo

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https://github.com/libjpeg-turbo/libjpeg-turbo/blob/3.1.0/README.ijg

libjpeg-turbo note: This file has been modified by The libjpeg-turbo Project to include only information relevant to libjpeg-turbo, to wordsmith certain sections, and to remove impolitic language that existed in the libjpeg v8 README. It is included only for reference. Please see README.md for information specific to libjpeg-turbo.

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DOCUMENTATION ROADMAP
==========

This file contains the following sections:

OVERVIEW General description of JPEG and the IJG software.
LEGAL ISSUES Copyright, lack of warranty, terms of distribution.
REFERENCES Where to learn more about JPEG.
ARCHIVE LOCATIONS Where to find newer versions of this software.
FILE FORMAT WARS Software *not* to get.

TO DO Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:
doc/usage.txt Usage instructions for cjpeg, djpeg, jpegtran, rdjpgcom, and wrjpgcom.
doc/*.1 Unix-style man pages for programs (same info as usage.txt).
doc/wizard.txt Advanced usage instructions for JPEG wizards only.
doc/change.log Version-to-version change highlights.
Programmer and internal documentation:
doc/libjpeg.txt How to use the JPEG library in your own programs.
src/example.c Sample code for calling the JPEG library.
doc/structure.txt Overview of the JPEG library's internal structure.
doc/coderules.txt Coding style rules --- please read if you contribute code.

Please read at least usage.txt. Some information can also be found in the JPEG FAQ (Frequently Asked Questions) article. See ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or more of the REFERENCES, then looking at the documentation files (in roughly the order listed) before diving into the code.

OVERVIEW
========

This package contains C software to implement JPEG image encoding, decoding, and transcoding. JPEG (pronounced "jay-peg") is a standardized compression method for full-color and grayscale images. JPEG's strong suit is compressing photographic images or other types of images that have smooth color and brightness transitions between neighboring pixels. Images with sharp lines or other abrupt features may not compress well with JPEG, and a higher JPEG quality may have to be used to avoid visible compression artifacts with such images.

JPEG is normally lossy, meaning that the output pixels are not necessarily identical to the input pixels. However, on photographic content and other "smooth" images, very good compression ratios can be obtained with no visible compression artifacts, and extremely high compression ratios are possible if you are willing to sacrifice image quality (by reducing the "quality" setting in the compressor.)

This software implements JPEG baseline, extended-sequential, progressive, and lossless compression processes. Provision is made for supporting all variants of these processes, although some uncommon parameter settings aren't implemented yet. We have made no provision for supporting the hierarchical processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files, plus two sample applications "cjpeg" and "djpeg", which use the library to perform conversion between JPEG and some other popular image file formats. The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included considerable functionality beyond the bare JPEG coding/decoding capability; for example, the color quantization modules are not strictly part of JPEG decoding, but they are essential for output to colormapped file formats. These extra functions can be compiled out of the library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between different JPEG processes, and "rdjpgcom" and "wrjpgcom", two simple applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and flexibility, while also making it fast enough to be useful. In particular, the software is not intended to be read as a tutorial on JPEG. (See the

REFERENCES section for introductory material.) Rather, it is intended to
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REFERENCES
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We recommend reading one or more of these references before trying to
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The best short technical introduction to the JPEG compression algorithm is
      Wallace, Gregory K. "The JPEG Still Picture Compression Standard",
      Communications of the ACM, April 1991 (vol. 34 no. 4), pp. 30-44.
(Adjacent articles in that issue discuss MPEG motion picture compression,
applications of JPEG, and related topics.) If you don't have the CACM issue
handy, a PDF file containing a revised version of Wallace's article is

available at http://www.ijg.org/files/Wallace.JPEG.pdf. The file (actually
a preprint for an article that appeared in IEEE Trans. Consumer Electronics)
omits the sample images that appeared in CACM, but it includes corrections
and some added material. Note: the Wallace article is copyright ACM and IEEE,
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A somewhat less technical, more leisurely introduction to JPEG can be found in
"The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by
M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides
good explanations and example C code for a multitude of compression methods
including JPEG. It is an excellent source if you are comfortable reading C
code but don't know much about data compression in general. The book's JPEG
sample code is far from industrial-strength, but when you are ready to look
at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still
Image Data Compression Standard" by William B. Pennebaker and Joan L.
Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1.
Price US$59.95, 638 pp. The book includes the complete text of the ISO JPEG
standards (DIS 10918-1 and draft DIS 10918-2).

The original JPEG standard is divided into two parts, Part 1 being the actual
specification, while Part 2 covers compliance testing methods. Part 1 is
titled "Digital Compression and Coding of Continuous-tone Still Images,
Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS
10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of
Continuous-tone Still Images, Part 2: Compliance testing" and has document
numbers ISO/IEC IS 10918-2, ITU-T T.83.

The JPEG standard does not specify all details of an interchangeable file
format. For the omitted details, we follow the "JFIF" conventions, revision
1.02. JFIF version 1 has been adopted as ISO/IEC 10918-5 (05/2013) and
Recommendation ITU-T T.871 (05/2011): Information technology - Digital
compression and coding of continuous-tone still images: JPEG File Interchange
Format (JFIF). It is available as a free download in PDF file format from
https://www.iso.org/standard/54989.html and http://www.itu.int/rec/T-REC-T.871.
A PDF file of the older JFIF 1.02 specification is available at
http://www.w3.org/Graphics/JPEG/jfif3.pdf.

The TIFF 6.0 file format specification can be obtained from
http://mirrors.ctan.org/graphics/tiff/TIFF6.ps.gz. The JPEG incorporation
scheme found in the TIFF 6.0 spec of 3-June-92 has a number of serious
problems. IJG does not recommend use of the TIFF 6.0 design (TIFF Compression
tag 6). Instead, we recommend the JPEG design proposed by TIFF Technical Note
#2 (Compression tag 7). Copies of this Note can be obtained from
http://www.ijg.org/files/. It is expected that the next revision
of the TIFF spec will replace the 6.0 JPEG design with the Note's design.
Although IJG's own code does not support TIFF/JPEG, the free libtiff library
uses our library to implement TIFF/JPEG per the Note.

ARCHIVE LOCATIONS
=================

The "official" archive site for this software is www.ijg.org.
The most recent released version can always be found there in
directory "files".

The JPEG FAQ (Frequently Asked Questions) article is a source of some
general information about JPEG. It is available at
http://www.faqs.org/faqs/jpeg-faq.

FILE FORMAT COMPATIBILITY
=========================

This software implements ITU T.81 | ISO/IEC 10918 with some extensions from
ITU T.871 | ISO/IEC 10918-5 (JPEG File Interchange Format-- see REFERENCES).
Informally, the term "JPEG image" or "JPEG file" most often refers to JFIF or
a subset thereof, but there are other formats containing the name "JPEG" that
are incompatible with the original JPEG standard or with JFIF (for instance,

JPEG 2000 and JPEG XR). This software therefore does not support these
formats. Indeed, one of the original reasons for developing this free software
was to help force convergence on a common, interoperable format standard for
JPEG files.

JFIF is a minimal or "low end" representation. TIFF/JPEG (TIFF revision 6.0 as
modified by TIFF Technical Note #2) can be used for "high end" applications
that need to record a lot of additional data about an image.

TO DO
=====

Please send bug reports, offers of help, etc. to jpeg-info@jpegclub.org.

http://zlib.net/zlib_license.html
/* zlib.h -- interface of the 'zlib' general purpose compression library
version 1.3.1, January 22nd, 2024

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Jean-loup Gailly Mark Adler
jloup@gzip.org madler@alumni.caltech.edu

*/

18.2.3.29 libogg

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18.2.3.30 libpam

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=========================================================================
From libpam/include/security/_pam_macros.h:
/*
 * All kind of macros used by PAM, but usable in some other
 * programs too.
 * Organized by Cristian Gafton <gafton@redhat.com>
 */
=========================================================================
From AUTHORS:

Original authors and current maintainers of Linux-PAM:

Andrew G. Morgan       <morgan@kernel.org>
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Sebastien Tricaud      <toady@gscore.org>
Tomas Mraz             <t8m@centrum.cz>
```

18.2.3.31 libpciaccess

```
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 *
 */

/**
 * \file pciaccess.h
 *
 * \author Ian Romanick <idr@us.ibm.com>
 */
```

18.2.3.32 libpng

libpng v1.6.43

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```

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arm/palette_neon_intrinsics.c

```
/* palette_neon_intrinsics.c - NEON optimised palette expansion functions
 *
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```

```
 * Written by Richard Townsend <Richard.Townsend@arm.com>, February 2017.
 *
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 */

## Files:
contrib/gregbook/readpng.h

/*---------------------------------------------------------------------------

   rpng - simple PNG display program                            readpng.h

  ---------------------------------------------------------------------------

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  ---------------------------------------------------------------------------*/

## Files:
contrib/pngminus/pnm2png.c

/*
 *  pnm2png.c --- conversion from PBM/PGM/PPM-file to PNG-file
 *  copyright (C) 1999-2019 by Willem van Schaik <willem at schaik dot com>
```

```
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 */

## Files:
png.h

/*
 * A "png_get_copyright" function is available, for convenient use in "about"
 * boxes and the like:
 *
 *    printf("%s", png_get_copyright(NULL));
 *
 * Also, the PNG logo (in PNG format, of course) is supplied in the
 * files "pngbar.png" and "pngbar.jpg (88x31) and "pngnow.png" (98x31).
 */

## Files:
powerpc/powerpc_init.c

/* powerpc_init.c - POWERPC optimised filter functions
 *
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 * Written by Vadim Barkov, 2017.
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## Files:
contrib/visupng/cexcept.h

/*===
cexcept.h 2.0.1 (2008-Jul-19-Sat)
http://www.nicemice.net/cexcept/
Adam M. Costello
http://www.nicemice.net/amc/

An interface for exception-handling in ANSI C (C89 and subsequent ISO
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The cexcept interface is not compatible with and cannot interact
with system exceptions (like division by zero or memory segmentation
violation), compiler-generated exceptions (like C++ exceptions), or
other exception-handling interfaces.

When using this interface across multiple .c files, do not include
this header file directly.  Instead, create a wrapper header file that
includes this header file and then invokes the define_exception_type
macro (see below).  The .c files should then include that header file.

The interface consists of one type, one well-known name, and six macros.


define_exception_type(type_name);

   This macro is used like an external declaration.  It specifies
   the type of object that gets copied from the exception thrower to
   the exception catcher.  The type_name can be any type that can be
```

assigned to, that is, a non-constant arithmetic type, struct, union, or pointer. Examples:

```
define_exception_type(int);

enum exception { out_of_memory, bad_arguments, disk_full };
define_exception_type(enum exception);

struct exception { int code; const char *msg; };
define_exception_type(struct exception);
```

Because throwing an exception causes the object to be copied (not just once, but twice), programmers may wish to consider size when choosing the exception type.

struct exception_context;

This type may be used after the define_exception_type() macro has been invoked. A struct exception_context must be known to both the thrower and the catcher. It is expected that there be one context for each thread that uses exceptions. It would certainly be dangerous for multiple threads to access the same context. One thread can use multiple contexts, but that is likely to be confusing and not typically useful. The application can allocate this structure in any way it pleases--automatic, static, or dynamic. The application programmer should pretend not to know the structure members, which are subject to change.

struct exception_context *the_exception_context;

The Try/Catch and Throw statements (described below) implicitly refer to a context, using the name the_exception_context. It is the application's responsibility to make sure that this name yields the address of a mutable (non-constant) struct exception_context wherever those statements are used. Subject to that constraint, the application may declare a variable of this name anywhere it likes (inside a function, in a parameter list, or externally), and may use whatever storage class specifiers (static, extern, etc) or type qualifiers (const, volatile, etc) it likes. Examples:

```
static struct exception_context
  * const the_exception_context = &foo;

{ struct exception_context *the_exception_context = bar; ... }

int blah(struct exception_context *the_exception_context, ...);

extern struct exception_context the_exception_context[1];
```

The last example illustrates a trick that avoids creating a pointer object separate from the structure object.

The name could even be a macro, for example:

```
struct exception_context ec_array[numthreads];
#define the_exception_context (ec_array + thread_id)
```

Be aware that the_exception_context is used several times by the Try/Catch/Throw macros, so it shouldn't be expensive or have side effects. The expansion must be a drop-in replacement for an identifier, so it's safest to put parentheses around it.

void init_exception_context(struct exception_context *ec);

For context structures allocated statically (by an external definition or using the "static" keyword), the implicit initialization to all zeros is sufficient, but contexts allocated by other means must be initialized using this macro before they

are used by a Try/Catch statement. It does no harm to initialize a context more than once (by using this macro on a statically allocated context, or using this macro twice on the same context), but a context must not be re-initialized after it has been used by a Try/Catch statement.

Try statement
Catch (expression) statement

The Try/Catch/Throw macros are capitalized in order to avoid confusion with the C++ keywords, which have subtly different semantics.

A Try/Catch statement has a syntax similar to an if/else statement, except that the parenthesized expression goes after the second keyword rather than the first. As with if/else, there are two clauses, each of which may be a simple statement ending with a semicolon or a brace-enclosed compound statement. But whereas the else clause is optional, the Catch clause is required. The expression must be a modifiable lvalue (something capable of being assigned to) of the same type (disregarding type qualifiers) that was passed to define_exception_type().

If a Throw that uses the same exception context as the Try/Catch is executed within the Try clause (typically within a function called by the Try clause), and the exception is not caught by a nested Try/Catch statement, then a copy of the exception will be assigned to the expression, and control will jump to the Catch clause. If no such Throw is executed, then the assignment is not performed, and the Catch clause is not executed.

The expression is not evaluated unless and until the exception is caught, which is significant if it has side effects, for example:

```
Try foo();
Catch (p[++i].e) { ... }
```

IMPORTANT: Jumping into or out of a Try clause (for example via return, break, continue, goto, longjmp) is forbidden--the compiler will not complain, but bad things will happen at run-time. Jumping into or out of a Catch clause is okay, and so is jumping around inside a Try clause. In many cases where one is tempted to return from a Try clause, it will suffice to use Throw, and then return from the Catch clause. Another option is to set a flag variable and use goto to jump to the end of the Try clause, then check the flag after the Try/Catch statement.

IMPORTANT: The values of any non-volatile automatic variables changed within the Try clause are undefined after an exception is caught. Therefore, variables modified inside the Try block whose values are needed later outside the Try block must either use static storage or be declared with the "volatile" type qualifier.

Throw expression;

A Throw statement is very much like a return statement, except that the expression is required. Whereas return jumps back to the place where the current function was called, Throw jumps back to the Catch clause of the innermost enclosing Try clause. The expression must be compatible with the type passed to define_exception_type(). The exception must be caught, otherwise the program may crash.

Slight limitation: If the expression is a comma-expression, it must be enclosed in parentheses.

Try statement
Catch_anonymous statement

When the value of the exception is not needed, a Try/Catch statement
can use Catch_anonymous instead of Catch (expression).

Everything below this point is for the benefit of the compiler. The
application programmer should pretend not to know any of it, because it
is subject to change.

===*/

Files:
contrib/tools/sRGB.h

```
/*-
 * sRGB.h
 *
 * Last changed in libpng 1.6.0 [February 14, 2013]
 *
 * COPYRIGHT: Written by John Cunningham Bowler, 2013.
 * To the extent possible under law, the author has waived all copyright and
 * related or neighboring rights to this work.  This work is published from:
 * United States.
 *
 * Utility file; not actually a header, this contains definitions of sRGB
 * calculation functions for inclusion in those test programs that need them.
 *
 * All routines take and return a floating point value in the range
 * 0 to 1.0, doing a calculation according to the sRGB specification
 * (in fact the source of the numbers is the wikipedia article at
 * https://en.wikipedia.org/wiki/SRGB).
 */
```

Files:
contrib/libtests/timepng.c

```
/* timepng.c
 *
 * Copyright (c) 2013,2016 John Cunningham Bowler
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * Load an arbitrary number of PNG files (from the command line, or, if there
 * are no arguments on the command line, from stdin) then run a time test by
 * reading each file by row or by image (possibly with transforms in the latter
 * case).  The only output is a time as a floating point number of seconds with
 * 9 decimal digits.
 */
```

Files:
example.c

```
/* example.c - an example of using libpng
 *
 * Maintained 2018 Cosmin Truta
 * Maintained 1998-2016 Glenn Randers-Pehrson
 * Maintained 1996-1997 Andreas Dilger
 * Written 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * To the extent possible under law, the authors have waived
 * all copyright and related or neighboring rights to this file.
 * This work is published from: United States, Canada.
 */
```

Files:
intel/filter_sse2_intrinsics.c

```
/* filter_sse2_intrinsics.c - SSE2 optimized filter functions
 *
 * Copyright (c) 2018 Cosmin Truta
```

```
 * Copyright (c) 2016-2017 Glenn Randers-Pehrson
 * Written by Mike Klein and Matt Sarett
 * Derived from arm/filter_neon_intrinsics.c
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 */

## Files:
contrib/libtests/makepng.c

/* Max out the text compression level in an attempt to make the license
 * small.   If --small then do the same for the IDAT.
 */

## Files:
powerpc/filter_vsx_intrinsics.c

/* filter_vsx_intrinsics.c - PowerPC optimised filter functions
 *
 * Copyright (c) 2018 Cosmin Truta
 * Copyright (c) 2017 Glenn Randers-Pehrson
 * Written by Vadim Barkov, 2017.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 */

## Files:
contrib/examples/iccfrompng.c

/*- iccfrompng
 *
 * COPYRIGHT: Written by John Cunningham Bowler, 2011.
 * To the extent possible under law, the author has waived all copyright and
 * related or neighboring rights to this work.  This work is published from:
 * United States.
 *
 * Extract any icc profiles found in the given PNG files.  This is a simple
 * example of a program that extracts information from the header of a PNG file
 * without processing the image.  Notice that some header information may occur
 * after the image data. Textual data and comments are an example; the approach
 * in this file won't work reliably for such data because it only looks for the
 * information in the section of the file that precedes the image data.
 *
 * Compile and link against libpng and zlib, plus anything else required on the
 * system you use.
 *
 * To use supply a list of PNG files containing iCCP chunks, the chunks will be
 * extracted to a similarly named file with the extension replaced by 'icc',
 * which will be overwritten without warning.
 */

## Files:
contrib/examples/pngpixel.c

/*- pngpixel
 *
 * COPYRIGHT: Written by John Cunningham Bowler, 2011.
 * To the extent possible under law, the author has waived all copyright and
 * related or neighboring rights to this work.  This work is published from:
 * United States.
 *
 * Read a single pixel value from a PNG file.
 *
 * This code illustrates basic 'by-row' reading of a PNG file using libpng.
 * Rows are read until a particular pixel is found; the value of this pixel is
 * then printed on stdout.
 *
```

```
 * The code illustrates how to do this on interlaced as well as non-interlaced
 * images.  Normally you would call png_set_interlace_handling() to have libpng
 * deal with the interlace for you, but that obliges you to buffer half of the
 * image to assemble the interlaced rows.  In this code
 * png_set_interlace_handling() is not called and, instead, the code handles the
 * interlace passes directly looking for the required pixel.
 */

## Files:
contrib/gregbook/readppm.c

/*---------------------------------------------------------------------------

   rpng - simple PNG display program                          readppm.c

  ---------------------------------------------------------------------------

   This is a special-purpose replacement for readpng.c that allows binary
   PPM files to be used in place of PNG images.

  ---------------------------------------------------------------------------

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      GNU General Public License for more details.

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      along with this program; if not, write to the Free Software Foundation,
      Inc., 59 Temple Place, Suite 330, Boston, MA  02111-1307  USA

  ---------------------------------------------------------------------------*/
```

Files:
pngrutil.c

```
/* pngrutil.c - utilities to read a PNG file
 *
 * Copyright (c) 2018-2022 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2018 Glenn Randers-Pehrson
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * This file contains routines that are only called from within
 * libpng itself during the course of reading an image.
 */
```

Files:
contrib/libtests/makepng.c

```
/*
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * Make a test PNG image.  The arguments are as follows:
 *
 *    makepng [--sRGB|--linear|--1.8] [--tRNS] [--nofilters] \
 *       color-type bit-depth [file-name]
 *
 * The color-type may be numeric (and must match the numbers used by the PNG
 * specification) or one of the format names listed below.  The bit-depth is the
 * component bit depth, or the pixel bit-depth for a color-mapped image.
 *
 * Without any options no color-space information is written, with the options
 * an sRGB or the appropriate gAMA chunk is written.  "1.8" refers to the
 * display system used on older Apple computers to correct for high ambient
 * light levels in the viewing environment; it applies a transform of
 * approximately value^(1/1.45) to the color values and so a gAMA chunk of 65909
 * is written (1.45/2.2).
 *
 * The image data is generated internally.  Unless --color is given the images
 * used are as follows:
 *
 * 1 channel: a square image with a diamond, the least luminous colors are on
 *    the edge of the image, the most luminous in the center.
 *
 * 2 channels: the color channel increases in luminosity from top to bottom, the
 *    alpha channel increases in opacity from left to right.
 *
 * 3 channels: linear combinations of, from the top-left corner clockwise,
 *    black, green, white, red.
 *
 * 4 channels: linear combinations of, from the top-left corner clockwise,
 *    transparent, red, green, blue.
 *
 * For color-mapped images a four channel color-map is used and if --tRNS is
 * given the PNG file has a tRNS chunk, as follows:
 *
 * 1-bit: entry 0 is transparent-red, entry 1 is opaque-white
 * 2-bit: entry 0: transparent-green
 *        entry 1: 40%-red
 *        entry 2: 80%-blue
 *        entry 3: opaque-white
 * 4-bit: the 16 combinations of the 2-bit case
 * 8-bit: the 256 combinations of the 4-bit case
 *
 * The palette always has 2^bit-depth entries and the tRNS chunk one fewer.  The
 * image is the 1-channel diamond, but using palette index, not luminosity.
 *
```

```
 * For formats other than color-mapped ones if --tRNS is specified a tRNS chunk
 * is generated with all channels equal to the low bits of 0x0101.
 *
 * Image size is determined by the final pixel depth in bits, i.e. channels x
 * bit-depth, as follows:
 *
 * 8 bits or less:    64x64
 * 16 bits:           256x256
 * More than 16 bits: 1024x1024
 *
 * Row filtering is the libpng default but may be turned off (the 'none' filter
 * is used on every row) with the --nofilters option.
 *
 * The images are not interlaced.
 *
 * If file-name is given then the PNG is written to that file, else it is
 * written to stdout.  Notice that stdout is not supported on systems where, by
 * default, it assumes text output; this program makes no attempt to change the
 * text mode of stdout!
 *
 *    makepng --color=<color> ...
 *
 * If --color is given then the whole image has that color, color-mapped images
 * will have exactly one palette entry and all image files with be 16x16 in
 * size.  The color value is 1 to 4 decimal numbers as appropriate for the color
 * type.
 *
 *    makepng --small ...
 *
 * If --small is given the images are no larger than required to include every
 * possible pixel value for the format.
 *
 * For formats with pixels 8 bits or fewer in size the images consist of a
 * single row with 2^pixel-depth pixels, one of every possible value.
 *
 * For formats with 16-bit pixels a 256x256 image is generated containing every
 * possible pixel value.
 *
 * For larger pixel sizes a 256x256 image is generated where the first row
 * consists of each pixel that has identical byte values throughout the pixel
 * followed by rows where the byte values differ within the pixel.
 *
 * In all cases the pixel values are arranged in such a way that the SUB and UP
 * filters give byte sequences for maximal zlib compression.  By default (if
 * --nofilters is not given) the SUB filter is used on the first row and the UP
 * filter on all following rows.
 *
 * The --small option is meant to provide good test-case coverage, however the
 * images are not easy to examine visually.  Without the --small option the
 * images contain identical color values; the pixel values are adjusted
 * according to the gamma encoding with no gamma encoding being interpreted as
 * sRGB.
 *
 * LICENSING
 * =========
 *
 * This code is copyright of the authors, see the COPYRIGHT define above.  The
 * code is licensed as above, using the libpng license.  The code generates
 * images which are solely the product of the code; the options choose which of
 * the many possibilities to generate.  The images that result (but not the code
 * which generates them) are licensed as defined here:
 *
 * IMPORTANT: the COPYRIGHT #define must contain ISO-Latin-1 characters, the
 * IMAGE_LICENSING #define must contain UTF-8 characters.  The 'copyright'
 * symbol 0xA9U (\251) in ISO-Latin-1 encoding and 0xC20xA9 (\302\251) in UTF-8.
 */

## Files:
contrib/powerpc-vsx/linux.c

/* contrib/powerpc-vsx/linux.c
```

```
 *
 * Copyright (c) 2017 Glenn Randers-Pehrson
 * Written by Vadim Barkov, 2017.
 * Last changed in libpng 1.6.29 [March 16, 2017]
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * STATUS: TESTED
 * BUG REPORTS: png-mng-implement@sourceforge.net
 *
 * png_have_vsx implemented for Linux by reading the widely available
 * pseudo-file /proc/cpuinfo.
 *
 * This code is strict ANSI-C and is probably moderately portable; it does
 * however use <stdio.h> and it assumes that /proc/cpuinfo is never localized.
 */
```

Files:
pngerror.c

```
/* pngerror.c - stub functions for i/o and memory allocation
 *
 * Copyright (c) 2018 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2017 Glenn Randers-Pehrson
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * This file provides a location for all error handling.  Users who
 * need special error handling are expected to write replacement functions
 * and use png_set_error_fn() to use those functions.  See the instructions
 * at each function.
 */
```

Files:
contrib/pngminim/decoder/pngusr.h

```
/* minrdpngconf.h: headers to make a minimal png-read-only library
 *
 * Copyright (c) 2007, 2010-2013 Glenn Randers-Pehrson
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * Derived from pngcrush.h, Copyright 1998-2007, Glenn Randers-Pehrson
 */
```

Files:
contrib/libtests/pngunknown.c

```
/* pngunknown.c - test the read side unknown chunk handling
 *
 * Copyright (c) 2021 Cosmin Truta
 * Copyright (c) 2015,2017 Glenn Randers-Pehrson
 * Written by John Cunningham Bowler
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * NOTES:
 *   This is a C program that is intended to be linked against libpng.  It
 *   allows the libpng unknown handling code to be tested by interpreting
 *   arguments to save or discard combinations of chunks.  The program is
 *   currently just a minimal validation for the built-in libpng facilities.
```

```
 */

## Files:
pngwtran.c

/* pngwtran.c - transforms the data in a row for PNG writers
 *
 * Copyright (c) 2018 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2016,2018 Glenn Randers-Pehrson
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 */

## Files:
ci/ci_cmake.sh

# ci_cmake.sh
# Continuously integrate libpng using CMake.
#
# Copyright (c) 2019-2022 Cosmin Truta.
#
# This software is released under the libpng license.
# For conditions of distribution and use, see the disclaimer
# and license in png.h.

## Files:
contrib/pngminim/encoder/pngusr.h

/* minwrpngconf.h: headers to make a minimal png-write-only library
 *
 * Copyright (c) 2007, 2010-2013 Glenn Randers-Pehrson
 *
 * This code is released under the libpng license.
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 * and license in png.h
 *
 * Derived from pngcrush.h, Copyright 1998-2007, Glenn Randers-Pehrson
 */

## Files:
contrib/pngminus/png2pnm.c

/*
 *  png2pnm.c --- conversion from PNG-file to PGM/PPM-file
 *  copyright (C) 1999-2019 by Willem van Schaik <willem at schaik dot com>
 *
 *  This software is released under the MIT license. For conditions of
 *  distribution and use, see the LICENSE file part of this package.
 */

## Files:
pngconf.h

/* pngconf.h - machine-configurable file for libpng
 *
 * libpng version 1.6.38
 *
 * Copyright (c) 2018-2022 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2016,2018 Glenn Randers-Pehrson
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * Any machine specific code is near the front of this file, so if you
```

```
 * are configuring libpng for a machine, you may want to read the section
 * starting here down to where it starts to typedef png_color, png_text,
 * and png_info.
 */

## Files:
contrib/arm-neon/linux-auxv.c

/* contrib/arm-neon/linux-auxv.c
 *
 * Copyright (c) 2014 Glenn Randers-Pehrson
 * Written by Mans Rullgard, 2011.
 * Last changed in libpng 1.6.10 [March 6, 2014]
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * SEE contrib/arm-neon/README before reporting bugs
 *
 * STATUS: COMPILED, TESTED
 * BUG REPORTS: png-mng-implement@sourceforge.net
 *
 * png_have_neon implemented for Linux versions which allow access to
 * /proc/self/auxv.  This is probably faster, cleaner and safer than the code to
 * read /proc/cpuinfo in contrib/arm-neon/linux, however it is yet another piece
 * of potentially untested code and has more complex dependencies than the code
 * to read cpuinfo.
 *
 * This generic __linux__ implementation requires reading /proc/self/auxv and
 * looking at each element for one that records NEON capabilities.
 */

## Files:
contrib/gregbook/rpng2-win.c

/*---------------------------------------------------------------------------

   rpng2 - progressive-model PNG display program               rpng2-win.c

   This program decodes and displays PNG files progressively, as if it were
   a web browser (though the front end is only set up to read from files).
   It supports gamma correction, user-specified background colors, and user-
   specified background patterns (for transparent images).  This version is
   for 32-bit Windows; it may compile under 16-bit Windows with a little
   tweaking (or maybe not).  Thanks to Adam Costello and Pieter S. van der
   Meulen for the "diamond" and "radial waves" patterns, respectively.

   to do (someday, maybe):
    - handle quoted command-line args (especially filenames with spaces)
    - finish resizable checkerboard-gradient (sizes 4-128?)
    - use %.1023s to simplify truncation of title-bar string?
    - have minimum window width:  oh well

  ---------------------------------------------------------------------------

   Changelog:
    - 1.01:  initial public release
    - 1.02:  fixed cut-and-paste error in usage screen (oops...)
    - 1.03:  modified to allow abbreviated options
    - 1.04:  removed bogus extra argument from usage fprintf() [Glenn R-P?];
             fixed command-line parsing bug
    - 1.10:  enabled "message window"/console (thanks to David Geldreich)
    - 1.20:  added runtime MMX-enabling/disabling and new -mmx* options
    - 1.21:  made minor tweak to usage screen to fit within 25-line console
    - 1.22:  added AMD64/EM64T support (__x86_64__)
    - 2.00:  dual-licensed (added GNU GPL)
    - 2.01:  fixed 64-bit typo in readpng2.c
    - 2.02:  fixed improper display of usage screen on PNG error(s); fixed
             unexpected-EOF and file-read-error cases
    - 2.03:  removed runtime MMX-enabling/disabling and obsolete -mmx* options
```

- 2.04: check for integer overflow (Glenn R-P)

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      and contributors for the book, "PNG: The Definitive Guide,"
      published by O'Reilly and Associates.

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You should have received a copy of the GNU General Public License
along with this program; if not, write to the Free Software Foundation,
Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA

---*/

Files:
contrib/libtests/pngstest-errors.h

```
/* contrib/libtests/pngstest-errors.h
 *
 * BUILT USING: libpng version 1.6.19beta03 - September 25, 2015
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * THIS IS A MACHINE GENERATED FILE: do not edit it directly!
 * Instead run:
 *
 *    pngstest --accumulate
 *
 * on as many PNG files as possible; at least PNGSuite and
 * contrib/libtests/testpngs.
```

```
 */

## Files:
pngmem.c

/* pngmem.c - stub functions for memory allocation
 *
 * Copyright (c) 2018 Cosmin Truta
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 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * This file provides a location for all memory allocation.  Users who
 * need special memory handling are expected to supply replacement
 * functions for png_malloc() and png_free(), and to use
 * png_create_read_struct_2() and png_create_write_struct_2() to
 * identify the replacement functions.
 */

## Files:
ltmain.sh

# This file is a library for parsing options in your shell scripts along
# with assorted other useful supporting features that you can make use
# of too.
#
# For the simplest scripts you might need only:
#
#   #!/bin/sh
#   . relative/path/to/funclib.sh
#   . relative/path/to/options-parser
#   scriptversion=1.0
#   func_options ${1+"$@"}
#   eval set dummy "$func_options_result"; shift
#   ...rest of your script...
#
# In order for the '--version' option to work, you will need to have a
# suitably formatted comment like the one at the top of this file
# starting with '# Written by ' and ending with '# Copyright'.
#
# For '-h' and '--help' to work, you will also need a one line
# description of your script's purpose in a comment directly above the
# '# Written by ' line, like the one at the top of this file.
#
# The default options also support '--debug', which will turn on shell
# execution tracing (see the comment above debug_cmd below for another
# use), and '--verbose' and the func_verbose function to allow your script
# to display verbose messages only when your user has specified
# '--verbose'.
#
# After sourcing this file, you can plug in processing for additional
# options by amending the variables from the 'Configuration' section
# below, and following the instructions in the 'Option parsing'
# section further down.

## Files:
pngrio.c

/* pngrio.c - functions for data input
 *
 * Copyright (c) 2018 Cosmin Truta
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 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
```

```
 * and license in png.h
 *
 * This file provides a location for all input.  Users who need
 * special handling are expected to write a function that has the same
 * arguments as this and performs a similar function, but that possibly
 * has a different input method.  Note that you shouldn't change this
 * function, but rather write a replacement function and then make
 * libpng use it at run time with png_set_read_fn(...).
 */
```

Files:
png.h

```
/* png.h - header file for PNG reference library
 *
 * libpng version 1.6.38 - September 14, 2022
 *
 * Copyright (c) 2018-2022 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2018 Glenn Randers-Pehrson
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
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 *
 * Authors and maintainers:
 *   libpng versions 0.71, May 1995, through 0.88, January 1996: Guy Schalnat
 *   libpng versions 0.89, June 1996, through 0.96, May 1997: Andreas Dilger
 *   libpng versions 0.97, January 1998, through 1.6.35, July 2018:
 *     Glenn Randers-Pehrson
 *   libpng versions 1.6.36, December 2018, through 1.6.38, September 2022:
 *     Cosmin Truta
 *   See also "Contributing Authors", below.
 */
```

Files:
ltmain.sh

```
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# along with this program.  If not, see <http://www.gnu.org/licenses/>.
```

Files:
arm/arm_init.c

```
/* arm_init.c - NEON optimised filter functions
 *
 * Copyright (c) 2018-2022 Cosmin Truta
 * Copyright (c) 2014,2016 Glenn Randers-Pehrson
 * Written by Mans Rullgard, 2011.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 */
```

Files:
contrib/libtests/makepng.c

```
/* Insert standard copyright and licence text. */

## Files:
contrib/oss-fuzz/build.sh

#!/bin/bash -eu
# Copyright 2017-2018 Glenn Randers-Pehrson
# Copyright 2016 Google Inc.
#
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# You may obtain a copy of the License at
#
#      http://www.apache.org/licenses/LICENSE-2.0
#
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# distributed under the License is distributed on an "AS IS" BASIS,
# WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
# See the License for the specific language governing permissions and
# limitations under the License.
#
# Last changed in libpng 1.6.35 [July 15, 2018]
#
# Revisions by Glenn Randers-Pehrson, 2017:
# 1. Build only the library, not the tools (changed "make -j$(nproc) all" to
#     "make -j$(nproc) libpng16.la").
# 2. Disabled WARNING and WRITE options in pnglibconf.dfa.
# 3. Build zlib alongside libpng
################################################################################

## Files:
example.c

/* This is an example of how to use libpng to read and write PNG files.
 * The file libpng-manual.txt is much more verbose then this.  If you have
 * not read it, do so first.  This was designed to be a starting point of an
 * implementation.  This is not officially part of libpng, is hereby placed
 * in the public domain, and therefore does not require a copyright notice.
 *
 * This file does not currently compile, because it is missing certain
 * parts, like allocating memory to hold an image.  You will have to
 * supply these parts to get it to compile.  For an example of a minimal
 * working PNG reader/writer, see pngtest.c, included in this distribution;
 * see also the programs in the contrib directory.
 */

## Files:
contrib/libtests/gentests.sh

#!/bin/sh
#
# Copyright (c) 2013 John Cunningham Bowler
#
# This code is released under the libpng license.
# For conditions of distribution and use, see the disclaimer
# and license in png.h
#
# Generate a set of PNG test images.  The images are generated in a
# sub-directory called 'tests' by default, however a command line argument will
# change that name.  The generation requires a built version of makepng in the
# current directory.
#

## Files:
arm/filter_neon_intrinsics.c

/* filter_neon_intrinsics.c - NEON optimised filter functions
 *
 * Copyright (c) 2018 Cosmin Truta
 * Copyright (c) 2014,2016 Glenn Randers-Pehrson
```

```
 * Written by James Yu <james.yu at linaro.org>, October 2013.
 * Based on filter_neon.S, written by Mans Rullgard, 2011.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 */
```

Files:
scripts/symbols.c

```
/* symbols.c - find all exported symbols
 *
 * Last changed in libpng version 1.6.16 [December 22, 2014]
 * Copyright (c) 2011-2014 Glenn Randers-Pehrson
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 */
```

Files:
contrib/libtests/makepng.c

```
/* These are used to insert Copyright and Licence fields, they allow the text to
 * have \n unlike the --insert option.
 */
```

Files:
contrib/powerpc-vsx/linux_aux.c

```
/* contrib/powerpc-vsx/linux_aux.c
 *
 * Copyright (c) 2017 Glenn Randers-Pehrson
 * Written by Vadim Barkov, 2017.
 * Last changed in libpng 1.6.29 [March 16, 2017]
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * STATUS: TESTED
 * BUG REPORTS: png-mng-implement@sourceforge.net
 *
 * png_have_vsx implemented for Linux by using the auxiliary vector mechanism.
 *
 * This code is strict ANSI-C and is probably moderately portable; it does
 * however use <stdio.h> and it assumes that /proc/cpuinfo is never localized.
 */
```

Files:
contrib/visupng/PngFile.c

```
/*-------------------------------------
 *  PNGFILE.C -- Image File Functions
 *-------------------------------------
 *
 * Copyright 2000,2017 Willem van Schaik.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 */
```

Files:
pngwutil.c

```
/* pngwutil.c - utilities to write a PNG file
 *
 * Copyright (c) 2018 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2018 Glenn Randers-Pehrson
```

```
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
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 * and license in png.h
 */

## Files:
pngread.c

/* pngread.c - read a PNG file
 *
 * Copyright (c) 2018-2019 Cosmin Truta
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 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
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 * and license in png.h
 *
 * This file contains routines that an application calls directly to
 * read a PNG file or stream.
 */

## Files:
contrib/gregbook/readpng.c

/*---------------------------------------------------------------------------

   rpng - simple PNG display program                            readpng.c

  ---------------------------------------------------------------------------

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```
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    along with this program; if not, write to the Free Software Foundation,
    Inc., 59 Temple Place, Suite 330, Boston, MA  02111-1307  USA

  ------------------------------------------------------------------------------*/

## Files:
mips/mips_init.c

/* mips_init.c - MSA optimised filter functions
 *
 * Copyright (c) 2018 Cosmin Truta
 * Copyright (c) 2016 Glenn Randers-Pehrson
 * Written by Mandar Sahastrabuddhe, 2016.
 *
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 * and license in png.h
 */

## Files:
ltmain.sh

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## Files:
contrib/mips-msa/linux.c

/* contrib/mips-msa/linux.c
 *
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 * Copyright (c) 2016 Glenn Randers-Pehrson
 * Written by Mandar Sahastrabuddhe, 2016.
 *
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 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * SEE contrib/mips-msa/README before reporting bugs
 *
 * STATUS: SUPPORTED
 * BUG REPORTS: png-mng-implement@sourceforge.net
 *
 * png_have_msa implemented for Linux by reading the widely available
 * pseudo-file /proc/cpuinfo.
 *
 * This code is strict ANSI-C and is probably moderately portable; it does
 * however use <stdio.h> and it assumes that /proc/cpuinfo is never localized.
 */

## Files:
pngset.c

/* pngset.c - storage of image information into info struct
 *
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 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
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```

```
 * and license in png.h
 *
 * The functions here are used during reads to store data from the file
 * into the info struct, and during writes to store application data
 * into the info struct for writing into the file.  This abstracts the
 * info struct and allows us to change the structure in the future.
 */

## Files:
contrib/tools/makesRGB.c

/* makesRGB.c -- build sRGB-to-linear and linear-to-sRGB conversion tables
 *
 * Last changed in libpng 1.6.0 [February 14, 2013]
 *
 * COPYRIGHT: Written by John Cunningham Bowler, 2013.
 * To the extent possible under law, the author has waived all copyright and
 * related or neighboring rights to this work.  This work is published from:
 * United States.
 *
 * Make a table to convert 8-bit sRGB encoding values into the closest 16-bit
 * linear value.
 *
 * Make two tables to take a linear value scaled to 255*65535 and return an
 * approximation to the 8-bit sRGB encoded value.  Calculate the error in these
 * tables and display it.
 */

## Files:
pngtrans.c

/* pngtrans.c - transforms the data in a row (used by both readers and writers)
 *
 * Copyright (c) 2018 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2018 Glenn Randers-Pehrson
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
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 * and license in png.h
 */

## Files:
contrib/libtests/fakepng.c

/* Fake a PNG - just write it out directly.
 *
 * COPYRIGHT: Written by John Cunningham Bowler, 2014.
 * To the extent possible under law, the author has waived all copyright and
 * related or neighboring rights to this work.  This work is published from:
 * United States.
 *
 */

## Files:
contrib/gregbook/rpng-win.c

/*---------------------------------------------------------------------------

   rpng - simple PNG display program                            rpng-win.c

   This program decodes and displays PNG images, with gamma correction and
   optionally with a user-specified background color (in case the image has
   transparency).  It is very nearly the most basic PNG viewer possible.
   This version is for 32-bit Windows; it may compile under 16-bit Windows
   with a little tweaking (or maybe not).

   to do:
    - handle quoted command-line args (especially filenames with spaces)
    - have minimum window width:  oh well
```

```
   - use %.1023s to simplify truncation of title-bar string?

  ---------------------------------------------------------------------------

  Changelog:
   - 1.00:  initial public release
   - 1.01:  modified to allow abbreviated options; fixed long/ulong mis-
            match; switched to png_jmpbuf() macro
   - 1.02:  added extra set of parentheses to png_jmpbuf() macro; fixed
            command-line parsing bug
   - 1.10:  enabled "message window"/console (thanks to David Geldreich)
   - 2.00:  dual-licensed (added GNU GPL)
   - 2.01:  fixed improper display of usage screen on PNG error(s)
   - 2.02:  check for integer overflow (Glenn R-P)

  ---------------------------------------------------------------------------

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     Inc., 59 Temple Place, Suite 330, Boston, MA  02111-1307  USA

  ---------------------------------------------------------------------------*/

## Files:
scripts/intprefix.c

/* intprefix.c - generate an unprefixed internal symbol list
 *
```

```
 * Last changed in libpng version 1.6.16 [December 22, 2014]
 * Copyright (c) 2013-2014 Glenn Randers-Pehrson
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 */

## Files:
contrib/tools/pngfix.c

/* pngfix.c
 *
 * Last changed in libpng 1.6.31 [July 27, 2017]
 * Copyright (c) 2014-2017 John Cunningham Bowler
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * Tool to check and fix the zlib inflate 'too far back' problem.
 * See the usage message for more information.
 */

## Files:
pngtest.c

/* pngtest.c - a simple test program to test libpng
 *
 * Copyright (c) 2018-2019 Cosmin Truta
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 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * This program reads in a PNG image, writes it out again, and then
 * compares the two files.  If the files are identical, this shows that
 * the basic chunk handling, filtering, and (de)compression code is working
 * properly.  It does not currently test all of the transforms, although
 * it probably should.
 *
 * The program will report "FAIL" in certain legitimate cases:
 * 1) when the compression level or filter selection method is changed.
 * 2) when the maximum IDAT size (PNG_ZBUF_SIZE in pngconf.h) is not 8192.
 * 3) unknown unsafe-to-copy ancillary chunks or unknown critical chunks
 *    exist in the input file.
 * 4) others not listed here...
 * In these cases, it is best to check with another tool such as "pngcheck"
 * to see what the differences between the two files are.
 *
 * If a filename is given on the command-line, then this file is used
 * for the input, rather than the default "pngtest.png".  This allows
 * testing a wide variety of files easily.  You can also test a number
 * of files at once by typing "pngtest -m file1.png file2.png ..."
 */

## Files:
contrib/oss-fuzz/libpng_read_fuzzer.cc

// libpng_read_fuzzer.cc
// Copyright 2017-2018 Glenn Randers-Pehrson
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// Use of this source code is governed by a BSD-style license that may
// be found in the LICENSE file https://cs.chromium.org/chromium/src/LICENSE

## Files:
pngrtran.c
```

```
/* pngrtran.c - transforms the data in a row for PNG readers
 *
 * Copyright (c) 2018-2019 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2018 Glenn Randers-Pehrson
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
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 * and license in png.h
 *
 * This file contains functions optionally called by an application
 * in order to tell libpng how to handle data when reading a PNG.
 * Transformations that are used in both reading and writing are
 * in pngtrans.c.
 */
```

Files:
pngget.c

```
/* pngget.c - retrieval of values from info struct
 *
 * Copyright (c) 2018 Cosmin Truta
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 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
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 * and license in png.h
 *
 */
```

Files:
contrib/libtests/readpng.c

```
/* readpng.c
 *
 * Copyright (c) 2013 John Cunningham Bowler
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * Load an arbitrary number of PNG files (from the command line, or, if there
 * are no arguments on the command line, from stdin) then run a time test by
 * reading each file by row.  The test does nothing with the read result and
 * does no transforms.  The only output is a time as a floating point number of
 * seconds with 9 decimal digits.
 */
```

Files:
pngstruct.h

```
/* pngstruct.h - header file for PNG reference library
 *
 * Copyright (c) 2018-2022 Cosmin Truta
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 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
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 * and license in png.h
 */
```

Files:
pngpread.c

```
/* pngpread.c - read a png file in push mode
 *
```

```
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 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
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 * and license in png.h
 */

## Files:
png.c

/* png.c - location for general purpose libpng functions
 *
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 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
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 * and license in png.h
 */

## Files:
contrib/gregbook/writepng.c

/*---------------------------------------------------------------------------

   wpng - simple PNG-writing program                        writepng.c

  ---------------------------------------------------------------------------

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  ------------------------------------------------------------------------------*/

## Files:
contrib/testpngs/makepngs.sh

# Copyright (c) 2015 John Cunningham Bowler

## Files:
pnginfo.h

/* pnginfo.h - header file for PNG reference library
 *
 * Copyright (c) 2018 Cosmin Truta
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 * Copyright (c) 1996-1997 Andreas Dilger
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 *
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 * and license in png.h
 */

## Files:
contrib/gregbook/writepng.h

/*---------------------------------------------------------------------------

   wpng - simple PNG-writing program                        writepng.h

  ---------------------------------------------------------------------------

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  ------------------------------------------------------------------------*/

## Files:
contrib/visupng/PngFile.h

/* Copyright 2000, Willem van Schaik.*/

## Files:
contrib/tools/pngcp.c

/* pngcp.c
 *
 * Copyright (c) 2016 John Cunningham Bowler
 *
 * Last changed in libpng 1.6.24 [August 4, 2016]
 *
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 * and license in png.h
 *
 * This is an example of copying a PNG without changes using the png_read_png
 * and png_write_png interfaces.  A considerable number of options are provided
 * to manipulate the compression of the PNG data and other compressed chunks.
 *
 * For a more extensive example that uses the transforms see
 * contrib/libtests/pngimage.c in the libpng distribution.
 */

## Files:
png.h

/* With all write APIs if image is in one of the linear formats with 16-bit
 * data then setting convert_to_8_bit will cause the output to be an 8-bit PNG
 * gamma encoded according to the sRGB specification, otherwise a 16-bit linear
 * encoded PNG file is written.
 *
 * With color-mapped data formats the colormap parameter point to a color-map
 * with at least image->colormap_entries encoded in the specified format.  If
 * the format is linear the written PNG color-map will be converted to sRGB
 * regardless of the convert_to_8_bit flag.
 *
 * With all APIs row_stride is handled as in the read APIs - it is the spacing
 * from one row to the next in component sized units (1 or 2 bytes) and if
 * negative indicates a bottom-up row layout in the buffer.  If row_stride is
 * zero, libpng will calculate it for you from the image width and number of
 * channels.
 *
 * Note that the write API does not support interlacing, sub-8-bit pixels or
 * most ancillary chunks.  If you need to write text chunks (e.g. for copyright
 * notices) you need to use one of the other APIs.
 */

## Files:
contrib/tools/cvtcolor.c
```

```
/*-
 * convert.c
 *
 * Last changed in libpng 1.6.0 [February 14, 2013]
 *
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 * To the extent possible under law, the author has waived all copyright and
 * related or neighboring rights to this work.  This work is published from:
 * United States.
 *
 * Convert 8-bit sRGB or 16-bit linear values to another format.
 */
```

Files:
png.h

```
/*
 * COPYRIGHT NOTICE, DISCLAIMER, and LICENSE
 * =========================================
 *
 * PNG Reference Library License version 2
 * ---------------------------------------
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 *     source or altered source distribution.
 *
 *
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 * -----------------------------------------------------------------------
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 *     Eric S. Raymond
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 *     Cosmin Truta
 *     Gilles Vollant
 *     James Yu
```

```
*     Mandar Sahastrabuddhe
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*
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* list of Contributing Authors:
*
*     Tom Lane
*     Glenn Randers-Pehrson
*     Willem van Schaik
*
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* Copyright (c) 1996-1997 Andreas Dilger, are derived from libpng-0.88,
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*     Kevin Bracey
*     Sam Bushell
*     Magnus Holmgren
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```

```
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 * been distributed and maintained world-wide, continually since 1995,
 * the Copyright owners claim "common-law trademark protection" in any
 * jurisdiction where common-law trademark is recognized.
 */

## Files:
scripts/sym.c

/* sym.c - define format of libpng.sym
 *
 * Last changed in libpng version 1.6.16 [December 22, 2014]
 * Copyright (c) 2011-2014 Glenn Randers-Pehrson
 *
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 * and license in png.h
 */

## Files:
contrib/gregbook/rpng2-x.c

/*---------------------------------------------------------------------------

   rpng2 - progressive-model PNG display program                rpng2-x.c

   This program decodes and displays PNG files progressively, as if it were
   a web browser (though the front end is only set up to read from files).
   It supports gamma correction, user-specified background colors, and user-
   specified background patterns (for transparent images).  This version is
   for the X Window System (tested by the author under Unix and by Martin
   Zinser under OpenVMS; may work under OS/2 with a little tweaking).

   Thanks to Adam Costello and Pieter S. van der Meulen for the "diamond"
   and "radial waves" patterns, respectively.

   to do (someday, maybe):
    - fix expose/redraw code:  don't draw entire row if only part exposed
    - 8-bit (colormapped) X support
    - finish resizable checkerboard-gradient (sizes 4-128?)
    - use %.1023s to simplify truncation of title-bar string?

  ---------------------------------------------------------------------------

   Changelog:
    - 1.01:  initial public release
    - 1.02:  modified to allow abbreviated options; fixed char/uchar mismatch
    - 1.10:  added support for non-default visuals; fixed X pixel-conversion
    - 1.11:  added -usleep option for demos; fixed command-line parsing bug
    - 1.12:  added -pause option for demos and testing
    - 1.20:  added runtime MMX-enabling/disabling and new -mmx* options
    - 1.21:  fixed some small X memory leaks (thanks to Fran#ois Petitjean)
    - 1.22:  fixed XFreeGC() crash bug (thanks to Patrick Welche)
    - 1.23:  added -bgpat 0 mode (std white/gray checkerboard, 8x8 squares)
```

```
   - 1.30:  added -loop option for -bgpat (ifdef FEATURE_LOOP); fixed bpp =
            24; added support for X resources (thanks to Gerhard Niklasch)
   - 1.31:  added code to skip unused chunks (thanks to Glenn Randers-Pehrson)
   - 1.32:  added AMD64/EM64T support (__x86_64__); added basic expose/redraw
            handling
   - 2.00:  dual-licensed (added GNU GPL)
   - 2.01:  fixed 64-bit typo in readpng2.c; fixed -pause usage description
   - 2.02:  fixed improper display of usage screen on PNG error(s); fixed
            unexpected-EOF and file-read-error cases; fixed Trace() cut-and-
            paste bugs
   - 2.03:  deleted runtime MMX-enabling/disabling and obsolete -mmx* options
   - 2.04:  Added "void(foo);" statements to quiet pedantic compiler warnings
            about unused variables (GR-P)
   - 2.05:  Use nanosleep() instead of usleep(), which is deprecated (GR-P).
   - 2.06:  check for integer overflow (Glenn R-P)
  ------------------------------------------------------------------------------

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  ------------------------------------------------------------------------------*/

## Files:
contrib/gregbook/readpng2.c

/*------------------------------------------------------------------------------
```

```
  rpng2 - progressive-model PNG display program              readpng2.c

 ---------------------------------------------------------------------------

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 ---------------------------------------------------------------------------

  Changelog:
    2015-11-12 - Check return value of png_get_bKGD() (Glenn R-P)
    2017-04-22 - Guard against integer overflow (Glenn R-P)

  ---------------------------------------------------------------------------*/

## Files:
contrib/examples/simpleover.c

/*- simpleover
 *
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 * related or neighboring rights to this work.  This work is published from:
 * United States.
 *
 * Read several PNG files, which should have an alpha channel or transparency
```

```
 * information, and composite them together to produce one or more 16-bit linear
 * RGBA intermediates.  This involves doing the correct 'over' composition to
 * combine the alpha channels and corresponding data.
 *
 * Finally read an output (background) PNG using the 24-bit RGB format (the
 * PNG will be composited on green (#00ff00) by default if it has an alpha
 * channel), and apply the intermediate image generated above to specified
 * locations in the image.
 *
 * The command line has the general format:
 *
 *    simpleover <background.png> [output.png]
 *       {--sprite=width,height,name {[--at=x,y] {sprite.png}}}
 *       {--add=name {x,y}}
 *
 * The --sprite and --add options may occur multiple times. They are executed
 * in order.  --add may refer to any sprite already read.
 *
 * This code is intended to show how to composite multiple images together
 * correctly.  Apart from the libpng Simplified API the only work done in here
 * is to combine multiple input PNG images into a single sprite; this involves
 * a Porter-Duff 'over' operation and the input PNG images may, as a result,
 * be regarded as being layered one on top of the other with the first (leftmost
 * on the command line) being at the bottom and the last on the top.
 */

## Files:
ci/ci_autotools.sh

# ci_autotools.sh
# Continuously integrate libpng using the GNU Autotools.
#
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#
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## Files:
contrib/examples/pngtopng.c

/*- pngtopng
 *
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 *
 * Last changed in libpng 1.6.29 [March 16, 2017]
 *
 * Read a PNG and write it out in a fixed format, using the 'simplified API'
 * that was introduced in libpng-1.6.0.
 *
 * This sample code is just the code from the top of 'example.c' with some error
 * handling added.  See example.c for more comments.
 */

## Files:
contrib/pngminim/preader/pngusr.h

/* minrdpngconf.h: headers to make a minimal png-read-only library
 *
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 *
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 * and license in png.h
 *
 * Derived from pngcrush.h, Copyright 1998-2007, Glenn Randers-Pehrson
 */
```

Files:
contrib/arm-neon/android-ndk.c

```
/* contrib/arm-neon/android-ndk.c
 *
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 * Written by John Bowler, 2014.
 * Last changed in libpng 1.6.10 [March 6, 2014]
 *
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 *
 * SEE contrib/arm-neon/README before reporting bugs
 *
 * STATUS: COMPILED, UNTESTED
 * BUG REPORTS: png-mng-implement@sourceforge.net
 *
 * png_have_neon implemented for the Android NDK, see:
 *
 * Documentation:
 *    http://www.kandroid.org/ndk/docs/CPU-ARM-NEON.html
 *    https://code.google.com/p/android/issues/detail?id=49065
 *
 * NOTE: this requires that libpng is built against the Android NDK and linked
 * with an implementation of the Android ARM 'cpu-features' library.  The code
 * has been compiled only, not linked: no version of the library has been found,
 * only the header files exist in the NDK.
 */
```

Files:
contrib/libtests/tarith.c

```
/* tarith.c
 *
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 *
 * This code is released under the libpng license.
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 * and license in png.h
 *
 * Test internal arithmetic functions of libpng.
 *
 * This code must be linked against a math library (-lm), but does not require
 * libpng or zlib to work.  Because it includes the complete source of 'png.c'
 * it tests the code with whatever compiler options are used to build it.
 * Changing these options can substantially change the errors in the
 * calculations that the compiler chooses!
 */
```

Files:
contrib/tools/genpng.c

```
/*- genpng
 *
 * COPYRIGHT: Written by John Cunningham Bowler, 2015.
 * Revised by Glenn Randers-Pehrson, 2017, to add buffer-size check.
 * To the extent possible under law, the authors have waived all copyright and
 * related or neighboring rights to this work.  This work is published from:
 * United States.
 *
 * Generate a PNG with an alpha channel, correctly.
 *
 * This is a test case generator; the resultant PNG files are only of interest
 * to those of us who care about whether the edges of circles are green, red,
 * or yellow.
 *
 * The program generates an RGB+Alpha PNG of a given size containing the given
 * shapes on a transparent background:
 *
```

```
 *  genpng width height { shape }
 *    shape ::= color width shape x1 y1 x2 y2
 *
 * 'color' is:
 *
 *  black white red green yellow blue brown purple pink orange gray cyan
 *
 * The point is to have colors that are linguistically meaningful plus that old
 * bugbear of the department store dress murders, Cyan, the only color we argue
 * about.
 *
 * 'shape' is:
 *
 *  circle: an ellipse
 *  square: a rectangle
 *  line: a straight line
 *
 * Each shape is followed by four numbers, these are two points in the output
 * coordinate space (as real numbers) which describe the circle, square, or
 * line.  The shape is filled if it is preceded by 'filled' (not valid for
 * 'line') or is drawn with a line, in which case the width of the line must
 * precede the shape.
 *
 * The whole set of information can be repeated as many times as desired:
 *
 *    shape ::= color width shape x1 y1 x2 y2
 *
 *    color ::= black|white|red|green|yellow|blue
 *    color ::= brown|purple|pink|orange|gray|cyan
 *    width ::= filled
 *    width ::= <number>
 *    shape ::= circle|square|line
 *    x1    ::= <number>
 *    x2    ::= <number>
 *    y1    ::= <number>
 *    y2    ::= <number>
 *
 * The output PNG is generated by down-sampling a 4x supersampled image using
 * a bi-cubic filter.  The bi-cubic has a 2 (output) pixel width, so an 8x8
 * array of super-sampled points contribute to each output pixel.  The value of
 * a super-sampled point is found using an unfiltered, aliased, infinite
 * precision image: Each shape from the last to the first is checked to see if
 * the point is in the drawn area and, if it is, the color of the point is the
 * color of the shape and the alpha is 1, if not the previous shape is checked.
 *
 * This is an aliased algorithm because no filtering is done; a point is either
 * inside or outside each shape and 'close' points do not contribute to the
 * sample.  The down-sampling is relied on to correct the error of not using
 * a filter.
 *
 * The line end-caps are 'flat'; they go through the points.  The square line
 * joins are mitres; the outside of the lines are continued to the point of
 * intersection.
 */
```

Files:
contrib/tools/png-fix-itxt.c

```
/* png-fix-itxt version 1.0.0
 *
 * Copyright 2015 Glenn Randers-Pehrson
 * Last changed in libpng 1.6.18 [July 23, 2015]
 *
 * This code is released under the libpng license.
 * For conditions of distribution and use, see the disclaimer
 * and license in png.h
 *
 * Usage:
 *
 *     png-fix-itxt.exe < bad.png > good.png
 *
```

```
 * Fixes a PNG file written with libpng-1.6.0 or 1.6.1 that has one or more
 * uncompressed iTXt chunks.  Assumes that the actual length is greater
 * than or equal to the value in the length byte, and that the CRC is
 * correct for the actual length.  This program hunts for the CRC and
 * adjusts the length byte accordingly.  It is not an error to process a
 * PNG file that has no iTXt chunks or one that has valid iTXt chunks;
 * such files will simply be copied.
 *
 * Requires zlib (for crc32 and Z_NULL); build with
 *
 *     gcc -O -o png-fix-itxt png-fix-itxt.c -lz
 *
 * If you need to handle iTXt chunks larger than 500000 kbytes you must
 * rebuild png-fix-itxt with a larger values of MAX_LENGTH (or a smaller value
 * if you know you will never encounter such huge iTXt chunks).
 */
```

Files:
pngwrite.c

```
/* pngwrite.c - general routines to write a PNG file
 *
 * Copyright (c) 2018-2022 Cosmin Truta
 * Copyright (c) 1998-2002,2004,2006-2018 Glenn Randers-Pehrson
 * Copyright (c) 1996-1997 Andreas Dilger
 * Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
 *
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 * and license in png.h
 */
```

Files:
contrib/visupng/VisualPng.c

```
/*-------------------------------------
 *  VisualPng.C -- Shows a PNG image
 *-------------------------------------
 *
 * Copyright 2000,2017 Willem van Schaik.
 *
 * This code is released under the libpng license.
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 * and license in png.h
 */
```

Files:
contrib/testpngs/makepngs.sh

```
# This code is released under the libpng license.
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# and license in png.h
```

Files:
pngdebug.h

```
/* pngdebug.h - Debugging macros for libpng, also used in pngtest.c
 *
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 */
```

Files:
mips/filter_msa_intrinsics.c

```
/* filter_msa_intrinsics.c - MSA optimised filter functions
 *
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 * Copyright (c) 2016 Glenn Randers-Pehrson
 * Written by Mandar Sahastrabuddhe, August 2016.
 *
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 * and license in png.h
 */

## Files:
pngpriv.h

/* pngpriv.h - private declarations for use inside libpng
 *
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 */

## Files:
ltmain.sh

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## Files:
scripts/prefix.c

/* prefix.c - generate an unprefixed symbol list
 *
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 * and license in png.h
 */

## Files:
ci/ci_legacy.sh

# ci_legacy.sh
# Continuously integrate libpng using the legacy makefiles.
#
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#
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## Files:
contrib/libtests/pngvalid.c

/* pngvalid.c - validate libpng by constructing then reading png files.
 *
```

```
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 *
 * This code is released under the libpng license.
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 * and license in png.h
 *
 * NOTES:
 *   This is a C program that is intended to be linked against libpng.  It
 *   generates bitmaps internally, stores them as PNG files (using the
 *   sequential write code) then reads them back (using the sequential
 *   read code) and validates that the result has the correct data.
 *
 *   The program can be modified and extended to test the correctness of
 *   transformations performed by libpng.
 */
```

Files:
contrib/visupng/PngFile.h

```
/* This code is released under the libpng license.*/
```

Files:
contrib/gregbook/readpng2.h

```
/*---------------------------------------------------------------------------

   rpng2 - progressive-model PNG display program                readpng2.h

  ---------------------------------------------------------------------------

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 ----------------------------------------------------------------------------*/

## Files:
scripts/vers.c

/* vers.c - define format of libpng.vers
 *
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 *
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 */

## Files:
contrib/gregbook/wpng.c

/*----------------------------------------------------------------------------

  wpng - simple PNG-writing program                          wpng.c

  This program converts certain NetPBM binary files (grayscale and RGB,
  maxval = 255) to PNG.  Non-interlaced PNGs are written progressively;
  interlaced PNGs are read and written in one memory-intensive blast.

  Thanks to Jean-loup Gailly for providing the necessary trick to read
  interactive text from the keyboard while stdin is redirected.  Thanks
  to Cosmin Truta for Cygwin fixes.

  NOTE:  includes provisional support for PNM type "8" (portable alphamap)
       images, presumed to be a 32-bit interleaved RGBA format; no pro-
       vision for possible interleaved grayscale+alpha (16-bit) format.
       THIS IS UNLIKELY TO BECOME AN OFFICIAL NETPBM ALPHA FORMAT!

  to do:
   - delete output file if quit before calling any writepng routines
   - process backspace with -text option under DOS/Win? (currently get ^H)

 ----------------------------------------------------------------------------

  Changelog:
   - 1.01:  initial public release
   - 1.02:  modified to allow abbreviated options
   - 1.03:  removed extraneous character from usage screen; fixed bug in
            command-line parsing
   - 1.04:  fixed DOS/OS2/Win32 detection, including partial Cygwin fix
            (see http://home.att.net/~perlspinr/diffs/GregBook_cygwin.diff)
   - 2.00:  dual-licensed (added GNU GPL)
   - 2.01:  check for integer overflow (Glenn R-P)

      [REPORTED BUG (win32 only):  "contrib/gregbook/wpng.c - cmd line
       dose not work!  In order to do something useful I needed to redirect
       both input and output, with cygwin and with bcc32 as well.  Under
       Linux, the same wpng appears to work fine.  I don't know what is
       the problem."]

 ----------------------------------------------------------------------------

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 --*/

Files:
contrib/libtests/pngstest.c

```
/* pngstest.c
 *
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 *
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 * and license in png.h
 *
 * Test for the PNG 'simplified' APIs.
 */
```

Files:
ltmain.sh

```
# func_version
# ------------
# Echo version message to standard output and exit.
# The version message is extracted from the calling file's header
# comments, with leading '# ' stripped:
#   1. First display the progname and version
#   2. Followed by the header comment line matching  /^# Written by /
#   3. Then a blank line followed by the first following line matching
#      /^# Copyright /
```

```
#   4. Immediately followed by any lines between the previous matches,
#      except lines preceding the intervening completely blank line.
# For example, see the header comments of this file.

## Files:
intel/intel_init.c

/* intel_init.c - SSE2 optimized filter functions
 *
 * Copyright (c) 2018 Cosmin Truta
 * Copyright (c) 2016-2017 Glenn Randers-Pehrson
 * Written by Mike Klein and Matt Sarett, Google, Inc.
 * Derived from arm/arm_init.c
 *
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 */

## Files:
contrib/arm-neon/linux.c

/* contrib/arm-neon/linux.c
 *
 * Last changed in libpng 1.6.31 [July 27, 2017]
 * Copyright (c) 2014, 2017 Glenn Randers-Pehrson
 * Written by John Bowler, 2014, 2017.
 *
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 *
 * SEE contrib/arm-neon/README before reporting bugs
 *
 * STATUS: SUPPORTED
 * BUG REPORTS: png-mng-implement@sourceforge.net
 *
 * png_have_neon implemented for Linux by reading the widely available
 * pseudo-file /proc/cpuinfo.
 *
 * This code is strict ANSI-C and is probably moderately portable; it does
 * however use <stdio.h> and it assumes that /proc/cpuinfo is never localized.
 */

## Files:
contrib/tools/checksum-icc.c

/* checksum-icc.c
 *
 * Copyright (c) 2013 John Cunningham Bowler
 *
 * Last changed in libpng 1.6.0 [February 14, 2013]
 *
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 * and license in png.h
 *
 * Generate crc32 and adler32 checksums of the given input files, used to
 * generate check-codes for use when matching ICC profiles within libpng.
 */

## Files:
contrib/gregbook/rpng-x.c

/*---------------------------------------------------------------------------

   rpng - simple PNG display program                            rpng-x.c

   This program decodes and displays PNG images, with gamma correction and
   optionally with a user-specified background color (in case the image has
   transparency).  It is very nearly the most basic PNG viewer possible.
```

This version is for the X Window System (tested by author under Unix and
by Martin Zinser under OpenVMS; may work under OS/2 with some tweaking).

to do:
 - 8-bit (colormapped) X support
 - use %.1023s to simplify truncation of title-bar string?

Changelog:
 - 1.01: initial public release
 - 1.02: modified to allow abbreviated options; fixed long/ulong mis-
          match; switched to png_jmpbuf() macro
 - 1.10: added support for non-default visuals; fixed X pixel-conversion
 - 1.11: added extra set of parentheses to png_jmpbuf() macro; fixed
          command-line parsing bug
 - 1.12: fixed some small X memory leaks (thanks to Fran#ois Petitjean)
 - 1.13: fixed XFreeGC() crash bug (thanks to Patrick Welche)
 - 1.14: added support for X resources (thanks to Gerhard Niklasch)
 - 2.00: dual-licensed (added GNU GPL)
 - 2.01: fixed improper display of usage screen on PNG error(s)
 - 2.02: Added "void(argc);" statement to quiet pedantic compiler warnings
          about unused variable (GR-P)
 - 2.03: check for integer overflow (Glenn R-P)

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```
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  ----------------------------------------------------------------------------*/

## Files:
contrib/libtests/makepng.c

/* Copyright: */

## Files:
contrib/libtests/pngimage.c

/* pngimage.c
 *
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 *
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 * and license in png.h
 *
 * Test the png_read_png and png_write_png interfaces.  Given a PNG file load it
 * using png_read_png and then write with png_write_png.  Test all possible
 * transforms.
 */

## Files:
ltmain.sh

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## Files:
contrib/visupng/PngFile.h

/* and license in png.h*/

## Files:
contrib/tools/intgamma.sh

#!/bin/sh
#
# intgamma.sh
#
# Last changed in libpng 1.6.0 [February 14, 2013]
#
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# related or neighboring rights to this work.  This work is published from:
# United States.
#
# Shell script to generate png.c 8-bit and 16-bit log tables (see the code in
# png.c for details).
#
# This script uses the "bc" arbitrary precision calculator to calculate 32-bit
# fixed point values of logarithms appropriate to finding the log of an 8-bit
# (0..255) value and a similar table for the exponent calculation.
#
# "bc" must be on the path when the script is executed, and the math library
# (-lm) must be available
#
```

```
# function to print out a list of numbers as integers; the function truncates
# the integers which must be one-per-line

## Files:
pngwio.c

/* pngwio.c - functions for data output
 *
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 * Copyright (c) 1996-1997 Andreas Dilger
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 *
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 * and license in png.h
 *
 * This file provides a location for all output.  Users who need
 * special handling are expected to write functions that have the same
 * arguments as these and perform similar functions, but that possibly
 * use different output methods.  Note that you shouldn't change these
 * functions, but rather write replacement functions and then change
 * them at run time with png_set_write_fn(...).
 */
```

18.2.3.33 libslirp

```
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```
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/*
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 */
```

==========
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```
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 *
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 *
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 */
```

18.2.3.34 libssh

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From random source file (server.c in src directory):

```
/*
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 *
 * This file is part of the SSH Library
 *
 * Copyright (c) 2004-2013 by Aris Adamantiadis
 *
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```
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*/
```

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18.2.3.35 libtpms

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18.2.3.36 libvorbis

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18.2.3.37 libvpx

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third_party/googletest/src/include/gtest/internal/gtest-internal.h
third_party/googletest/src/include/gtest/internal/gtest-port.h
third_party/googletest/src/include/gtest/internal/gtest-string.h
third_party/googletest/src/src/gtest-assertion-result.cc
third_party/googletest/src/src/gtest-death-test.cc
third_party/googletest/src/src/gtest-internal-inl.h
third_party/googletest/src/src/gtest.cc

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Files:
third_party/googletest/src/include/gtest/internal/custom/gtest-printers.h

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This file provides an injection point for custom printers in a local
installation of gTest.
It will be included from gtest-printers.h and the overrides in this file
will be visible to everyone.

Injection point for custom user configurations. See README for details

** Custom implementation starts here **

Files:
tools/cpplint.py

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Files:
third_party/googletest/src/include/gtest/internal/custom/gtest-port.h
third_party/googletest/src/include/gtest/internal/custom/gtest.h

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Injection point for custom user configurations. See README for details

** Custom implementation starts here **

Files:
third_party/googletest/src/include/gtest/gtest-typed-test.h
third_party/googletest/src/include/gtest/internal/gtest-param-util.h
third_party/googletest/src/include/gtest/internal/gtest-type-util.h
third_party/googletest/src/src/gtest-typed-test.cc

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Files:
third_party/googletest/src/include/gtest/gtest-matchers.h
third_party/googletest/src/include/gtest/gtest-printers.h
third_party/googletest/src/include/gtest/gtest-spi.h
third_party/googletest/src/src/gtest-matchers.cc
third_party/googletest/src/src/gtest-printers.cc

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Files:
third_party/googletest/src/include/gtest/internal/gtest-port-arch.h

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Files:
third_party/googletest/src/include/gtest/gtest_prod.h
third_party/googletest/src/src/gtest_main.cc

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Files:
third_party/libyuv/include/libyuv/macros_msa.h
third_party/libyuv/source/rotate_msa.cc
third_party/libyuv/source/row_msa.cc
third_party/libyuv/source/scale_msa.cc

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Files:
test/vp9_ext_ratectrl_test.cc
test/vp9_ratectrl_rtc_test.cc
vp9/encoder/vp9_ext_ratectrl.c
vp9/encoder/vp9_ext_ratectrl.h
vp9/ratectrl_rtc.cc
vp9/ratectrl_rtc.h
vpx/vpx_ext_ratectrl.h
vpx_ports/compiler_attributes.h
vpx_ports/mips.h
vpx_ports/mips_cpudetect.c
vpx_ports/static_assert.h

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Files:
examples/vp9cx_set_ref.c
test/add_noise_test.cc
test/buffer.h
test/decode_svc_test.cc
test/encode_api_test.cc
test/hadamard_test.cc
test/level_test.cc
test/minmax_test.cc
test/realtime_test.cc
test/sum_squares_test.cc
third_party/libwebm/common/file_util.cc
third_party/libwebm/common/file_util.h
third_party/libwebm/common/hdr_util.cc
third_party/libwebm/common/hdr_util.h
tools/tiny_ssim.c
vp9/encoder/x86/vp9_frame_scale_ssse3.c
vpx_dsp/arm/deblock_neon.c
vpx_dsp/arm/hadamard_neon.c
vpx_dsp/arm/highbd_idct4x4_add_neon.c
vpx_dsp/arm/highbd_idct8x8_add_neon.c
vpx_dsp/arm/highbd_intrapred_neon.c
vpx_dsp/arm/highbd_loopfilter_neon.c
vpx_dsp/arm/highbd_vpx_convolve8_neon.c
vpx_dsp/arm/highbd_vpx_convolve_avg_neon.c
vpx_dsp/arm/highbd_vpx_convolve_copy_neon.c
vpx_dsp/arm/highbd_vpx_convolve_neon.c
vpx_dsp/arm/idct32x32_135_add_neon.c
vpx_dsp/arm/idct32x32_34_add_neon.c
vpx_dsp/arm/idct_neon.h
vpx_dsp/arm/loopfilter_neon.c
vpx_dsp/arm/transpose_neon.h
vpx_dsp/deblock.c
vpx_dsp/mips/deblock_msa.c
vpx_dsp/postproc.h
vpx_dsp/psnr.c
vpx_dsp/psnr.h
vpx_dsp/sum_squares.c
vpx_dsp/x86/sum_squares_sse2.c

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Files:
md5_utils.h

This is the header file for the MD5 message-digest algorithm.
The algorithm is due to Ron Rivest. This code was
written by Colin Plumb in 1993, no copyright is claimed.
This code is in the public domain; do with it what you wish.

Equivalent code is available from RSA Data Security, Inc.
This code has been tested against that, and is equivalent,
except that you don't need to include two pages of legalese
with every copy.

To compute the message digest of a chunk of bytes, declare an
MD5Context structure, pass it to MD5Init, call MD5Update as
needed on buffers full of bytes, and then call MD5Final, which
will fill a supplied 16-byte array with the digest.

Changed so as no longer to depend on Colin Plumb's `usual.h'
header definitions

- Ian Jackson <ian@chiark.greenend.org.uk>.
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Files:
test/twopass_encoder.sh

```
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#
#  This file tests the libvpx twopass_encoder example. To add new tests to this
#  file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to twopass_encoder_tests (on a new line).
#
```

Files:
vp8/common/loongarch/idct_lsx.c
vp8/encoder/loongarch/dct_lsx.c
vp8/encoder/loongarch/encodeopt_lsx.c
vp8/encoder/loongarch/vp8_quantize_lsx.c
vp9/encoder/arm/neon/vp9_dct_neon.c
vp9/encoder/arm/neon/vp9_diamond_search_sad_neon.c
vp9/encoder/x86/vp9_quantize_ssse3.c
vpx_dsp/arm/fdct32x32_neon.h
vpx_dsp/arm/fdct4x4_neon.h
vpx_dsp/arm/fdct8x8_neon.h
vpx_dsp/arm/fdct_neon.h
vpx_dsp/arm/highbd_quantize_neon.c
vpx_dsp/arm/highbd_sad_neon.c
vpx_dsp/arm/highbd_variance_neon.c
vpx_dsp/arm/highbd_variance_neon_dotprod.c
vpx_dsp/loongarch/avg_lsx.c
vpx_dsp/loongarch/avg_pred_lsx.c
vpx_dsp/loongarch/bitdepth_conversion_lsx.h
vpx_dsp/loongarch/fwd_dct32x32_lsx.c
vpx_dsp/loongarch/fwd_txfm_lsx.c
vpx_dsp/loongarch/fwd_txfm_lsx.h
vpx_dsp/loongarch/idct32x32_lsx.c
vpx_dsp/loongarch/loopfilter_4_lsx.c
vpx_dsp/loongarch/loopfilter_8_lsx.c
vpx_dsp/loongarch/loopfilter_lsx.h
vpx_dsp/loongarch/quantize_lsx.c
vpx_dsp/loongarch/sad_lsx.c
vpx_dsp/loongarch/sub_pixel_variance_lsx.c
vpx_dsp/loongarch/subtract_lsx.c
vpx_dsp/loongarch/txfm_macros_lsx.h
vpx_dsp/loongarch/variance_lsx.c
vpx_dsp/loongarch/variance_lsx.h
vpx_dsp/loongarch/vpx_convolve8_avg_horiz_lsx.c
vpx_dsp/loongarch/vpx_convolve8_avg_lsx.c
vpx_dsp/loongarch/vpx_convolve8_avg_vert_lsx.c
vpx_dsp/loongarch/vpx_convolve8_horiz_lsx.c
vpx_dsp/loongarch/vpx_convolve8_lsx.c
vpx_dsp/loongarch/vpx_convolve8_vert_lsx.c
vpx_dsp/loongarch/vpx_convolve_avg_lsx.c
vpx_dsp/loongarch/vpx_convolve_copy_lsx.c
vpx_dsp/loongarch/vpx_convolve_lsx.h
vpx_dsp/x86/highbd_quantize_intrin_avx2.c
vpx_dsp/x86/highbd_sad4d_avx2.c
vpx_dsp/x86/highbd_sad_avx2.c
vpx_dsp/x86/quantize_avx2.c
vpx_dsp/x86/subtract_avx2.c
vpx_util/loongson_intrinsics.h

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Files:
vpx_util/loongson_intrinsics.h

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Contributed by Shiyou Yin <yinshiyou-hf@loongson.cn>
Xiwei Gu <guxiwei-hf@loongson.cn>
Lu Wang <wanglu@loongson.cn>

This file is a header file for loongarch builtin extension.

Files:
test/vp9_c_vs_simd_encode.sh

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#
This script checks the bit exactness between C and SIMD
implementations of VP9 encoder.
#

Files:
vp8/common/loongarch/loopfilter_filters_lsx.c

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Files:
y4minput.c
y4minput.h

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Files:
test/comp_avg_pred_test.cc
test/dct_partial_test.cc
test/dct_test.cc
test/vp9_motion_vector_test.cc
test/vp9_scale_test.cc
vp8/common/mips/mmi/copymem_mmi.c
vp8/common/mips/mmi/dequantize_mmi.c
vp8/common/mips/mmi/idct_blk_mmi.c
vp8/common/mips/mmi/idctllm_mmi.c
vp8/common/mips/mmi/loopfilter_filters_mmi.c
vp8/common/mips/mmi/sixtap_filter_mmi.c
vp8/encoder/ethreading.h
vp8/encoder/mips/mmi/dct_mmi.c
vp8/encoder/mips/mmi/vp8_quantize_mmi.c
vp8/encoder/picklpf.h
vp8/encoder/temporal_filter.h
vp9/encoder/arm/neon/vp9_denoiser_neon.c
vp9/encoder/arm/neon/vp9_frame_scale_neon.c
vp9/encoder/vp9_frame_scale.c
vp9/encoder/vp9_job_queue.h
vp9/encoder/vp9_multi_thread.c
vp9/encoder/vp9_multi_thread.h
vp9/encoder/x86/temporal_filter_sse4.c
vp9/encoder/x86/vp9_quantize_avx2.c
vpx_dsp/arm/avg_pred_neon.c
vpx_dsp/arm/fdct16x16_neon.c
vpx_dsp/arm/fdct16x16_neon.h
vpx_dsp/arm/fdct32x32_neon.c
vpx_dsp/arm/fdct4x4_neon.c
vpx_dsp/arm/fdct_partial_neon.c
vpx_dsp/arm/highbd_idct16x16_add_neon.c
vpx_dsp/arm/highbd_idct32x32_1024_add_neon.c
vpx_dsp/arm/highbd_idct32x32_135_add_neon.c
vpx_dsp/arm/highbd_idct32x32_34_add_neon.c
vpx_dsp/arm/highbd_idct32x32_add_neon.c
vpx_dsp/arm/mem_neon.h
vpx_dsp/arm/quantize_neon.c
vpx_dsp/arm/sum_neon.h
vpx_dsp/arm/vpx_scaled_convolve8_neon.c
vpx_dsp/mips/sad_mmi.c
vpx_dsp/mips/subtract_mmi.c
vpx_dsp/mips/sum_squares_msa.c
vpx_dsp/mips/variance_mmi.c
vpx_dsp/ppc/bitdepth_conversion_vsx.h
vpx_dsp/ppc/hadamard_vsx.c
vpx_dsp/ppc/intrapred_vsx.c
vpx_dsp/ppc/sad_vsx.c
vpx_dsp/ppc/transpose_vsx.h
vpx_dsp/ppc/types_vsx.h
vpx_dsp/ppc/variance_vsx.c
vpx_dsp/ppc/vpx_convolve_vsx.c
vpx_dsp/skin_detection.c
vpx_dsp/skin_detection.h
vpx_dsp/x86/avg_intrin_avx2.c
vpx_dsp/x86/avg_pred_sse2.c
vpx_dsp/x86/bitdepth_conversion_avx2.h
vpx_dsp/x86/bitdepth_conversion_sse2.h
vpx_dsp/x86/convolve_avx2.h
vpx_dsp/x86/convolve_ssse3.h
vpx_dsp/x86/highbd_convolve_avx2.c
vpx_dsp/x86/highbd_idct16x16_add_sse4.c
vpx_dsp/x86/highbd_idct32x32_add_sse4.c
vpx_dsp/x86/highbd_idct4x4_add_sse4.c
vpx_dsp/x86/highbd_idct8x8_add_sse4.c
vpx_dsp/x86/highbd_intrapred_intrin_sse2.c
vpx_dsp/x86/highbd_intrapred_intrin_ssse3.c

vpx_dsp/x86/highbd_inv_txfm_sse4.h
vpx_dsp/x86/inv_txfm_ssse3.c
vpx_dsp/x86/inv_txfm_ssse3.h
vpx_dsp/x86/mem_sse2.h
vpx_dsp/x86/quantize_avx.c
vpx_dsp/x86/quantize_sse2.h
vpx_dsp/x86/quantize_ssse3.c
vpx_dsp/x86/quantize_ssse3.h
vpx_dsp/x86/sad4d_avx512.c
vpx_ports/asmdefs_mmi.h
vpx_ports/ppc.h
vpx_ports/ppc_cpudetect.c
vpx_util/vpx_atomics.h

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Files:
build/make/gen_msvs_vcxproj.sh

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#

Files:
vpx_dsp/psnrhvs.c

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This code was originally written by: Gregory Maxwell, at the Daala
project.

Files:
test/vpx_image_test.cc

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Files:
third_party/libyuv/include/libyuv/rotate_row.h
third_party/libyuv/include/libyuv/scale_row.h
third_party/libyuv/source/rotate_win.cc
third_party/libyuv/source/scale_common.cc
third_party/libyuv/source/scale_gcc.cc
third_party/libyuv/source/scale_win.cc

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Files:
vpx_ports/loongarch.h
vpx_ports/loongarch_cpudetect.c

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Contributed by Jin Bo <jinbo@loongson.cn>
Contributed by Lu Wang <wanglu@loongson.cn>

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Files:
test/postproc.sh

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#
This file tests the libvpx postproc example code. To add new tests to this
file, do the following:
1. Write a shell function (this is your test).
2. Add the function to postproc_tests (on a new line).
#

Files:
test/tools_common.sh

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#
This file contains shell code shared by test scripts for libvpx tools.

Files:
third_party/libyuv/source/compare_msa.cc

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Files:
build/make/msvs_common.sh

```
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#
```

Files:
third_party/libyuv/include/libyuv/convert_argb.h
third_party/libyuv/include/libyuv/convert_from_argb.h
third_party/libyuv/include/libyuv/mjpeg_decoder.h
third_party/libyuv/include/libyuv/rotate_argb.h
third_party/libyuv/include/libyuv/scale_argb.h
third_party/libyuv/include/libyuv/version.h
third_party/libyuv/source/compare_common.cc
third_party/libyuv/source/compare_gcc.cc
third_party/libyuv/source/compare_neon.cc
third_party/libyuv/source/compare_neon64.cc
third_party/libyuv/source/compare_win.cc
third_party/libyuv/source/convert_from.cc
third_party/libyuv/source/convert_from_argb.cc
third_party/libyuv/source/mjpeg_decoder.cc
third_party/libyuv/source/mjpeg_validate.cc
third_party/libyuv/source/rotate_argb.cc
third_party/libyuv/source/row_any.cc

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Files:
test/vpx_temporal_svc_encoder.sh

```
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#
#  This file tests the libvpx vpx_temporal_svc_encoder example. To add new
#  tests to this file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to vpx_tsvc_encoder_tests (on a new line).
#
```

Files:
test/android/get_files.py

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This simple script pulls test files from the webm homepage
It is intelligent enough to only pull files if
  1) File / test_data folder does not exist
  2) SHA mismatch

Files:
test/active_map_refresh_test.cc
test/test_intra_pred_speed.cc
test/vp9_arf_freq_test.cc
test/vp9_skip_loopfilter_test.cc
vp8/common/mips/msa/bilinear_filter_msa.c
vp8/common/mips/msa/copymem_msa.c
vp8/common/mips/msa/idct_msa.c
vp8/common/mips/msa/loopfilter_filters_msa.c
vp8/common/mips/msa/mfqe_msa.c
vp8/common/mips/msa/sixtap_filter_msa.c
vp8/common/mips/msa/vp8_macros_msa.h
vp8/common/vp8_skin_detection.c
vp8/common/vp8_skin_detection.h
vp8/encoder/mips/msa/dct_msa.c
vp8/encoder/mips/msa/denoising_msa.c
vp8/encoder/mips/msa/encodeopt_msa.c
vp8/encoder/mips/msa/quantize_msa.c
vp8/encoder/mips/msa/temporal_filter_msa.c
vp9/common/mips/msa/vp9_idct16x16_msa.c
vp9/common/mips/msa/vp9_idct4x4_msa.c
vp9/common/mips/msa/vp9_idct8x8_msa.c
vp9/common/mips/msa/vp9_mfqe_msa.c
vp9/encoder/arm/neon/vp9_error_neon.c
vp9/encoder/mips/msa/vp9_error_msa.c
vp9/encoder/mips/msa/vp9_fdct16x16_msa.c
vp9/encoder/mips/msa/vp9_fdct4x4_msa.c
vp9/encoder/mips/msa/vp9_fdct8x8_msa.c
vp9/encoder/mips/msa/vp9_fdct_msa.h
vp9/encoder/vp9_noise_estimate.c
vp9/encoder/vp9_skin_detection.c
vp9/encoder/vp9_skin_detection.h
vp9/vp9_dx_iface.h
vpx_dsp/add_noise.c
vpx_dsp/arm/avg_neon.c
vpx_dsp/arm/fdct8x8_neon.c
vpx_dsp/arm/sad4d_neon.c
vpx_dsp/fwd_txfm.c
vpx_dsp/fwd_txfm.h
vpx_dsp/intrapred.c
vpx_dsp/inv_txfm.c
vpx_dsp/loopfilter.c
vpx_dsp/mips/add_noise_msa.c
vpx_dsp/mips/avg_msa.c
vpx_dsp/mips/common_dspr2.c
vpx_dsp/mips/fwd_dct32x32_msa.c
vpx_dsp/mips/fwd_txfm_msa.c
vpx_dsp/mips/fwd_txfm_msa.h
vpx_dsp/mips/idct16x16_msa.c
vpx_dsp/mips/idct32x32_msa.c
vpx_dsp/mips/idct4x4_msa.c
vpx_dsp/mips/idct8x8_msa.c
vpx_dsp/mips/intrapred16_dspr2.c
vpx_dsp/mips/intrapred4_dspr2.c
vpx_dsp/mips/intrapred8_dspr2.c
vpx_dsp/mips/intrapred_msa.c
vpx_dsp/mips/inv_txfm_msa.h
vpx_dsp/mips/itrans16_dspr2.c
vpx_dsp/mips/itrans4_dspr2.c
vpx_dsp/mips/itrans8_dspr2.c
vpx_dsp/mips/loopfilter_16_msa.c
vpx_dsp/mips/loopfilter_4_msa.c
vpx_dsp/mips/loopfilter_8_msa.c
vpx_dsp/mips/loopfilter_msa.h

vpx_dsp/mips/macros_msa.h
vpx_dsp/mips/sad_msa.c
vpx_dsp/mips/sub_pixel_variance_msa.c
vpx_dsp/mips/subtract_msa.c
vpx_dsp/mips/txfm_macros_msa.h
vpx_dsp/mips/variance_msa.c
vpx_dsp/mips/vpx_convolve8_avg_horiz_msa.c
vpx_dsp/mips/vpx_convolve8_avg_msa.c
vpx_dsp/mips/vpx_convolve8_avg_vert_msa.c
vpx_dsp/mips/vpx_convolve8_horiz_msa.c
vpx_dsp/mips/vpx_convolve8_msa.c
vpx_dsp/mips/vpx_convolve8_vert_msa.c
vpx_dsp/mips/vpx_convolve_avg_msa.c
vpx_dsp/mips/vpx_convolve_copy_msa.c
vpx_dsp/mips/vpx_convolve_msa.h
vpx_dsp/ppc/inv_txfm_vsx.c
vpx_dsp/quantize.c
vpx_dsp/quantize.h
vpx_dsp/sad.c
vpx_dsp/subtract.c
vpx_dsp/txfm_common.h
vpx_dsp/variance.h
vpx_dsp/vpx_dsp_common.h
vpx_dsp/vpx_dsp_rtcd.c
vpx_dsp/vpx_filter.h
vpx_dsp/x86/convolve.h
vpx_dsp/x86/fwd_txfm_sse2.c
vpx_dsp/x86/highbd_idct16x16_add_sse2.c
vpx_dsp/x86/highbd_idct32x32_add_sse2.c
vpx_dsp/x86/highbd_idct4x4_add_sse2.c
vpx_dsp/x86/highbd_idct8x8_add_sse2.c
vpx_dsp/x86/highbd_inv_txfm_sse2.h
vpx_dsp/x86/highbd_quantize_intrin_sse2.c
vpx_dsp/x86/inv_txfm_sse2.c
vpx_dsp/x86/inv_txfm_sse2.h
vpx_dsp/x86/quantize_sse2.c
vpx_dsp/x86/transpose_sse2.h
vpx_dsp/x86/txfm_common_sse2.h
vpx_ports/msvc.h
vpx_ports/system_state.h
vpx_ports/vpx_once.h
vpx_util/vpx_write_yuv_frame.c
vpx_util/vpx_write_yuv_frame.h

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Files:
vp9/encoder/vp9_alt_ref_aq.c
vp9/encoder/vp9_alt_ref_aq.h

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Files:
third_party/libyuv/include/libyuv/basic_types.h
third_party/libyuv/include/libyuv/compare.h
third_party/libyuv/include/libyuv/convert.h
third_party/libyuv/include/libyuv/convert_from.h

third_party/libyuv/include/libyuv/cpu_id.h
third_party/libyuv/include/libyuv/planar_functions.h
third_party/libyuv/include/libyuv/rotate.h
third_party/libyuv/include/libyuv/row.h
third_party/libyuv/include/libyuv/scale.h
third_party/libyuv/include/libyuv/video_common.h
third_party/libyuv/source/compare.cc
third_party/libyuv/source/convert.cc
third_party/libyuv/source/convert_argb.cc
third_party/libyuv/source/convert_jpeg.cc
third_party/libyuv/source/convert_to_argb.cc
third_party/libyuv/source/convert_to_i420.cc
third_party/libyuv/source/cpu_id.cc
third_party/libyuv/source/planar_functions.cc
third_party/libyuv/source/rotate.cc
third_party/libyuv/source/rotate_common.cc
third_party/libyuv/source/rotate_neon.cc
third_party/libyuv/source/row_common.cc
third_party/libyuv/source/row_gcc.cc
third_party/libyuv/source/row_neon.cc
third_party/libyuv/source/row_win.cc
third_party/libyuv/source/scale.cc
third_party/libyuv/source/scale_argb.cc
third_party/libyuv/source/scale_neon.cc
third_party/libyuv/source/video_common.cc

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Files:
test/non_greedy_mv_test.cc
test/simple_encode_test.cc
test/timestamp_test.cc
test/yuv_temporal_filter_test.cc
vp8/common/arm/loopfilter_arm.h
vp9/encoder/vp9_blockiness.h
vp9/encoder/vp9_non_greedy_mv.c
vp9/encoder/vp9_non_greedy_mv.h
vp9/encoder/x86/highbd_temporal_filter_sse4.c
vp9/simple_encode.cc
vp9/simple_encode.h
vp9/vp9_cx_iface.h
vpx_util/vpx_debug_util.c
vpx_util/vpx_debug_util.h
vpx_util/vpx_timestamp.h

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Files:
vpx_util/vpx_thread.c
vpx_util/vpx_thread.h

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Multi-threaded worker

Original source:
 https://chromium.googlesource.com/webm/libwebp

Files:
examples/svc_context.h
examples/svc_encodeframe.c
ivfdec.c
ivfdec.h
ivfenc.c
ivfenc.h
test/clear_system_state.h
test/codec_factory.h
test/decode_perf_test.cc
test/error_resilience_test.cc
test/partial_idct_test.cc
test/predict_test.cc
test/test_vector_test.cc
test/test_vectors.cc
test/test_vectors.h
test/tile_independence_test.cc
test/user_priv_test.cc
test/vp8_decrypt_test.cc
test/vp8_fdct4x4_test.cc
test/vp9_decrypt_test.cc
test/vp9_lossless_test.cc
test/vp9_thread_test.cc
vp9/common/mips/dspr2/vp9_itrans16_dspr2.c
vp9/common/mips/dspr2/vp9_itrans4_dspr2.c
vp9/common/mips/dspr2/vp9_itrans8_dspr2.c
vp9/common/vp9_scale.c
vp9/common/vp9_scale.h
vp9/common/vp9_scan.h
vp9/decoder/vp9_dsubexp.h
vp9/encoder/vp9_aq_360.c
vp9/encoder/vp9_aq_360.h
vp9/encoder/vp9_aq_variance.c
vp9/encoder/vp9_aq_variance.h
vp9/encoder/vp9_subexp.c
vp9/encoder/vp9_subexp.h
vp9/vp9_iface_common.h
vpx_dsp/arm/vpx_convolve_neon.c
vpx_dsp/bitreader_buffer.c
vpx_dsp/bitreader_buffer.h
vpx_dsp/bitwriter_buffer.c
vpx_dsp/bitwriter_buffer.h
vpx_dsp/mips/common_dspr2.h
vpx_dsp/mips/convolve2_avg_dspr2.c
vpx_dsp/mips/convolve2_avg_horiz_dspr2.c
vpx_dsp/mips/convolve2_dspr2.c
vpx_dsp/mips/convolve2_horiz_dspr2.c
vpx_dsp/mips/convolve2_vert_dspr2.c
vpx_dsp/mips/convolve8_avg_dspr2.c
vpx_dsp/mips/convolve8_avg_horiz_dspr2.c
vpx_dsp/mips/convolve8_dspr2.c
vpx_dsp/mips/convolve8_horiz_dspr2.c
vpx_dsp/mips/convolve8_vert_dspr2.c
vpx_dsp/mips/convolve_common_dspr2.h
vpx_dsp/mips/inv_txfm_dspr2.h
vpx_dsp/mips/itrans32_cols_dspr2.c
vpx_dsp/mips/itrans32_dspr2.c
vpx_dsp/mips/loopfilter_filters_dspr2.c
vpx_dsp/mips/loopfilter_filters_dspr2.h
vpx_dsp/mips/loopfilter_macros_dspr2.h
vpx_dsp/mips/loopfilter_masks_dspr2.h
vpx_dsp/mips/loopfilter_mb_dspr2.c

vpx_dsp/mips/loopfilter_mb_horiz_dspr2.c
vpx_dsp/mips/loopfilter_mb_vert_dspr2.c
vpx_dsp/prob.c
vpx_dsp/prob.h
vpx_dsp/vpx_convolve.c
vpx_dsp/vpx_convolve.h
vpx_scale/mips/dspr2/yv12extend_dspr2.c
vpxenc.h
vpxstats.c
vpxstats.h
warnings.c
warnings.h
webmdec.cc
webmdec.h
webmenc.h

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Files:
examples/vpx_dec_fuzzer.cc
test/bench.cc
test/bench.h
test/decode_corrupted.cc
test/svc_end_to_end_test.cc
test/svc_test.cc
test/svc_test.h
vp8/common/x86/bilinear_filter_sse2.c
vp9/common/arm/neon/vp9_highbd_iht16x16_add_neon.c
vp9/common/arm/neon/vp9_highbd_iht4x4_add_neon.c
vp9/common/arm/neon/vp9_highbd_iht8x8_add_neon.c
vp9/common/arm/neon/vp9_iht16x16_add_neon.c
vp9/common/arm/neon/vp9_iht_neon.h
vp9/common/ppc/vp9_idct_vsx.c
vp9/common/x86/vp9_highbd_iht16x16_add_sse4.c
vp9/common/x86/vp9_highbd_iht4x4_add_sse4.c
vp9/common/x86/vp9_highbd_iht8x8_add_sse4.c
vp9/decoder/vp9_job_queue.c
vp9/decoder/vp9_job_queue.h
vp9/encoder/ppc/vp9_quantize_vsx.c
vp9/encoder/vp9_partition_models.h
vpx_dsp/arm/highbd_idct_neon.h
vpx_dsp/arm/sum_squares_neon.c
vpx_dsp/arm/vpx_convolve8_neon_asm.c
vpx_dsp/arm/vpx_convolve8_neon_asm.h
vpx_dsp/mips/vpx_convolve8_mmi.c
vpx_dsp/ppc/deblock_vsx.c
vpx_dsp/ppc/fdct32x32_vsx.c
vpx_dsp/ppc/inv_txfm_vsx.h
vpx_dsp/ppc/quantize_vsx.c
vpx_dsp/ppc/subtract_vsx.c
vpx_dsp/ppc/txfm_common_vsx.h
vpx_dsp/x86/convolve_sse2.h
vpx_dsp/x86/post_proc_sse2.c
vpx_dsp/x86/vpx_subpixel_4t_intrin_sse2.c
vpx_ports/emms_mmx.c

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Files:
test/decode_with_drops.sh

```
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#
#  This file tests the libvpx decode_with_drops example. To add new tests to
#  this file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to decode_with_drops_tests (on a new line).
#
```

Files:
tools/cpplint.py

means no copyright line was found

Files:
test/simple_decoder.sh

```
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#
#  This file tests the libvpx simple_decoder example code. To add new tests to
#  this file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to simple_decoder_tests (on a new line).
#
```

Files:
tools/cpplint.py

Logs an error if no Copyright message appears at the top of the file.

Files:
vpx_dsp/fastssim.c

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This code was originally written by: Nathan E. Egge, at the Daala
project.

Files:
vp8/common/filter.h
vp8/common/rtcd.c
vp8/decoder/ec_types.h
vp8/decoder/error_concealment.c

vp8/decoder/error_concealment.h
vp8/encoder/lookahead.c
vp8/encoder/lookahead.h
vp9/common/vp9_filter.h
vp9/common/vp9_rtcd.c
vp9/encoder/vp9_lookahead.c
vp9/encoder/vp9_lookahead.h
vpx_scale/vpx_scale_rtcd.c

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Files:
vp9/encoder/vp9_encoder.c

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Files:
tools/diff.py
tools/intersect-diffs.py
tools/lint-hunks.py
tools/wrap-commit-msg.py

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#

Files:
third_party/libyuv/source/rotate_neon64.cc
third_party/libyuv/source/row_neon64.cc
third_party/libyuv/source/scale_neon64.cc

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Files:
tools/set_analyzer_env.sh

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#

```
#  Sourcing this file sets environment variables to simplify setting up
#  sanitizer builds and testing.
```

```
## Files:
test/vp8_ratectrl_rtc_test.cc
vp8/vp8_ratectrl_rtc.cc
vp8/vp8_ratectrl_rtc.h
vpx/internal/vpx_ratectrl_rtc.h
vpx_dsp/arm/sad4d_neon_dotprod.c
vpx_dsp/arm/sad_neon_dotprod.c
vpx_dsp/arm/variance_neon_dotprod.c
vpx_dsp/arm/vpx_convolve8_neon_dotprod.c

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```

```
## Files:
test/simple_encoder.sh

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#
#  This file tests the libvpx simple_encoder example. To add new tests to this
#  file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to simple_encoder_tests (on a new line).
#
```

```
## Files:
vp8/common/loongarch/sixtap_filter_lsx.c
vpx_dsp/loongarch/intrapred_lsx.c

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```

```
## Files:
vpx_dsp/loongarch/loopfilter_16_lsx.c

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```

```
## Files:
test/set_maps.sh
```

```
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#
#  This file tests the libvpx set_maps example. To add new tests to this file,
#  do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to set_maps_tests (on a new line).
#
```

```
## Files:
vp9/vp9_iface_common.c

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```

```
## Files:
test/decode_to_md5.sh

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#
#  This file tests the libvpx decode_to_md5 example. To add new tests to this
#  file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to decode_to_md5_tests (on a new line).
#
```

```
## Files:
third_party/libyuv/source/rotate_any.cc
third_party/libyuv/source/rotate_gcc.cc
third_party/libyuv/source/scale_any.cc

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```

```
## Files:
test/vpxenc.sh

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#
#  This file tests vpxenc using hantro_collage_w352h288.yuv as input. To add
#  new tests to this file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to vpxenc_tests (on a new line).
#


## Files:
tools/3D-Reconstruction/MotionEST/Anandan.py
tools/3D-Reconstruction/MotionEST/Exhaust.py
tools/3D-Reconstruction/MotionEST/GroundTruth.py
tools/3D-Reconstruction/MotionEST/HornSchunck.py
tools/3D-Reconstruction/MotionEST/MotionEST.py
tools/3D-Reconstruction/MotionEST/SearchSmooth.py
tools/3D-Reconstruction/MotionEST/Util.py
tools/3D-Reconstruction/genY4M/genY4M.py
tools/non_greedy_mv/non_greedy_mv.py

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#


## Files:
examples/resize_util.c
examples/vp9_lossless_encoder.c
rate_hist.c
rate_hist.h
test/active_map_test.cc
test/android/scrape_gtest_log.py
test/byte_alignment_test.cc
test/decode_api_test.cc
test/encode_perf_test.cc
test/external_frame_buffer_test.cc
test/frame_size_tests.cc
test/invalid_file_test.cc
test/lpf_test.cc
test/quantize_test.cc
test/vp8_denoiser_sse2_test.cc
test/vp8_fragments_test.cc
test/vp9_block_error_test.cc
test/vp9_denoiser_test.cc
test/vp9_encoder_parms_get_to_decoder.cc
test/vp9_end_to_end_test.cc
test/vp9_ethread_test.cc
test/vp9_intrapred_test.cc
test/vp9_quantize_test.cc
test/vp9_roi_test.cc
test/vpx_scale_test.cc
test/vpx_scale_test.h
test/yuv_video_source.h
video_common.h
video_reader.c
video_reader.h
video_writer.c
video_writer.h
vp8/common/arm/neon/bilinearpredict_neon.c
vp8/common/arm/neon/copymem_neon.c
vp8/common/arm/neon/dc_only_idct_add_neon.c
vp8/common/arm/neon/dequant_idct_neon.c
vp8/common/arm/neon/dequantizeb_neon.c
vp8/common/arm/neon/iwalsh_neon.c
vp8/common/arm/neon/loopfiltersimplehorizontaledge_neon.c
```

vp8/common/arm/neon/loopfiltersimpleverticaledge_neon.c
vp8/common/arm/neon/mbloopfilter_neon.c
vp8/common/arm/neon/shortidct4x4llm_neon.c
vp8/common/arm/neon/sixtappredict_neon.c
vp8/common/arm/neon/vp8_loopfilter_neon.c
vp8/encoder/arm/neon/fastquantizeb_neon.c
vp8/encoder/arm/neon/shortfdct_neon.c
vp8/encoder/arm/neon/vp8_shortwalsh4x4_neon.c
vp9/common/arm/neon/vp9_iht4x4_add_neon.c
vp9/common/arm/neon/vp9_iht8x8_add_neon.c
vp9/common/vp9_blockd.c
vp9/common/vp9_frame_buffers.c
vp9/common/vp9_frame_buffers.h
vp9/common/vp9_mfqe.c
vp9/common/vp9_mfqe.h
vp9/common/vp9_thread_common.c
vp9/common/vp9_thread_common.h
vp9/encoder/arm/neon/vp9_quantize_neon.c
vp9/encoder/vp9_aq_complexity.c
vp9/encoder/vp9_aq_complexity.h
vp9/encoder/vp9_aq_cyclicrefresh.c
vp9/encoder/vp9_aq_cyclicrefresh.h
vp9/encoder/vp9_blockiness.c
vp9/encoder/vp9_context_tree.c
vp9/encoder/vp9_context_tree.h
vp9/encoder/vp9_cost.c
vp9/encoder/vp9_cost.h
vp9/encoder/vp9_ethread.c
vp9/encoder/vp9_ethread.h
vp9/encoder/vp9_pickmode.c
vp9/encoder/vp9_pickmode.h
vp9/encoder/vp9_resize.c
vp9/encoder/vp9_resize.h
vp9/encoder/vp9_svc_layercontext.c
vp9/encoder/vp9_svc_layercontext.h
vp9/encoder/x86/vp9_denoiser_sse2.c
vp9/encoder/x86/vp9_error_avx2.c
vp9/encoder/x86/vp9_highbd_block_error_intrin_sse2.c
vp9/encoder/x86/vp9_quantize_sse2.c
vpx/vpx_frame_buffer.h
vpx_dsp/arm/idct16x16_1_add_neon.c
vpx_dsp/arm/idct16x16_add_neon.c
vpx_dsp/arm/idct32x32_1_add_neon.c
vpx_dsp/arm/idct32x32_add_neon.c
vpx_dsp/arm/idct4x4_1_add_neon.c
vpx_dsp/arm/idct4x4_add_neon.c
vpx_dsp/arm/idct8x8_1_add_neon.c
vpx_dsp/arm/idct8x8_add_neon.c
vpx_dsp/arm/intrapred_neon.c
vpx_dsp/arm/sad_neon.c
vpx_dsp/arm/subpel_variance_neon.c
vpx_dsp/arm/subtract_neon.c
vpx_dsp/arm/variance_neon.c
vpx_dsp/arm/vpx_convolve8_neon.c
vpx_dsp/arm/vpx_convolve8_neon.h
vpx_dsp/arm/vpx_convolve_avg_neon.c
vpx_dsp/arm/vpx_convolve_copy_neon.c
vpx_dsp/avg.c
vpx_dsp/ssim.h
vpx_dsp/x86/avg_intrin_sse2.c
vpx_dsp/x86/fwd_txfm_impl_sse2.h
vpx_dsp/x86/fwd_txfm_sse2.h
vpx_dsp/x86/highbd_loopfilter_sse2.c
vpx_dsp/x86/highbd_variance_sse2.c
vpx_dsp/x86/sad4d_avx2.c
webmenc.cc
y4menc.c
y4menc.h

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Files:
test/vpxdec.sh

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#
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1. Write a shell function (this is your test).
2. Add the function to vpxdec_tests (on a new line).
#

Files:
test/init_vpx_test.cc
test/init_vpx_test.h
vp9/encoder/arm/neon/vp9_highbd_error_neon.c
vp9/encoder/arm/neon/vp9_highbd_temporal_filter_neon.c
vp9/encoder/arm/neon/vp9_temporal_filter_neon.c
vp9/encoder/vp9_firstpass_stats.h
vp9/encoder/vp9_temporal_filter_constants.h
vp9/encoder/vp9_tpl_model.c
vp9/encoder/vp9_tpl_model.h
vpx/src/vpx_tpl.c
vpx/vpx_tpl.h
vpx_dsp/arm/highbd_avg_neon.c
vpx_dsp/arm/highbd_avg_pred_neon.c
vpx_dsp/arm/highbd_hadamard_neon.c
vpx_dsp/arm/highbd_sad4d_neon.c
vpx_dsp/arm/highbd_sse_neon.c
vpx_dsp/arm/highbd_subpel_variance_neon.c
vpx_dsp/arm/sse_neon.c
vpx_dsp/arm/sse_neon_dotprod.c
vpx_dsp/arm/vpx_convolve8_neon_i8mm.c
vpx_dsp/arm/vpx_convolve_neon_dotprod.c
vpx_dsp/arm/vpx_convolve_neon_i8mm.c
vpx_dsp/sse.c
vpx_dsp/x86/avg_pred_avx2.c
vpx_dsp/x86/inv_txfm_avx2.c
vpx_dsp/x86/sse_avx2.c
vpx_dsp/x86/sse_sse4.c
vpx_ports/aarch32_cpudetect.c
vpx_ports/aarch64_cpudetect.c
vpx_ports/arm_cpudetect.h

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Files:
test/stress.sh

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#
#  This file performs a stress test. It runs (STRESS_ONEPASS_MAX_JOBS,
#  default=5) one, (STRESS_TWOPASS_MAX_JOBS, default=5) two pass &
#  (STRESS_RT_MAX_JOBS, default=5) encodes and (STRESS_<codec>_DECODE_MAX_JOBS,
#  default=30) decodes in parallel.


## Files:
test/vp8_multi_resolution_encoder.sh

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#
#  This file tests the libvpx vp8_multi_resolution_encoder example. To add new
#  tests to this file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to vp8_mre_tests (on a new line).
#


## Files:
build/make/armlink_adapter.sh
build/make/gen_asm_deps.sh
build/make/gen_msvs_def.sh
build/make/gen_msvs_sln.sh
build/make/version.sh

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#


## Files:
vp9/decoder/vp9_decodemv.c
vp9/decoder/vp9_dsubexp.c

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## Files:
test/cx_set_ref.sh

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#
#  This file tests the libvpx cx_set_ref example. To add new tests to this
#  file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to cx_set_ref_tests (on a new line).
#


## Files:
examples/vp9_spatial_svc_encoder.c
examples/vpx_temporal_svc_encoder.c
test/acm_random.h
test/alt_ref_aq_segment_test.cc
test/altref_test.cc
test/aq_segment_test.cc
test/avg_test.cc
test/blockiness_test.cc
test/borders_test.cc
test/config_test.cc
test/consistency_test.cc
test/cpu_speed_test.cc
test/cq_test.cc
test/dct16x16_test.cc
test/dct32x32_test.cc
test/decode_test_driver.cc
test/decode_test_driver.h
test/encode_test_driver.cc
test/encode_test_driver.h
test/fdct8x8_test.cc
test/i420_video_source.h
test/idct8x8_test.cc
test/ivf_video_source.h
test/keyframe_test.cc
test/md5_helper.h
test/pp_filter_test.cc
test/register_state_check.h
test/resize_test.cc
test/sad_test.cc
test/set_roi.cc
test/superframe_test.cc
test/svc_datarate_test.cc
test/test_libvpx.cc
test/util.h
test/variance_test.cc
test/video_source.h
test/vp8_boolcoder_test.cc
test/vp8_datarate_test.cc
test/vp9_boolcoder_test.cc
test/vp9_datarate_test.cc
test/vp9_subtract_test.cc
test/webm_video_source.h
test/y4m_test.cc
test/y4m_video_source.h
third_party/libwebm/common/webmids.h
third_party/libwebm/mkvmuxer/mkvmuxer.cc
third_party/libwebm/mkvmuxer/mkvmuxer.h
third_party/libwebm/mkvmuxer/mkvmuxertypes.h
third_party/libwebm/mkvmuxer/mkvmuxerutil.cc
third_party/libwebm/mkvmuxer/mkvmuxerutil.h
third_party/libwebm/mkvmuxer/mkvwriter.cc
third_party/libwebm/mkvmuxer/mkvwriter.h
third_party/libwebm/mkvparser/mkvparser.cc
third_party/libwebm/mkvparser/mkvparser.h
vp8/common/mfqe.c
vp8/common/mips/dspr2/dequantize_dspr2.c
vp8/common/mips/dspr2/filter_dspr2.c
vp8/common/mips/dspr2/idct_blk_dspr2.c
vp8/common/mips/dspr2/idctllm_dspr2.c
```

vp8/common/mips/dspr2/reconinter_dspr2.c
vp8/common/mips/dspr2/vp8_loopfilter_filters_dspr2.c
vp8/encoder/arm/neon/denoising_neon.c
vp8/encoder/dct_value_cost.h
vp8/encoder/dct_value_tokens.h
vp8/encoder/denoising.c
vp8/encoder/denoising.h
vp8/encoder/encodeframe.h
vp8/encoder/x86/denoising_sse2.c
vp8/encoder/x86/quantize_sse4.c
vp8/encoder/x86/vp8_enc_stubs_sse2.c
vp8/encoder/x86/vp8_quantize_sse2.c
vp8/encoder/x86/vp8_quantize_ssse3.c
vp9/common/vp9_mvref_common.c
vp9/common/vp9_mvref_common.h
vp9/common/vp9_pred_common.c
vp9/common/vp9_pred_common.h
vp9/common/vp9_seg_common.h
vp9/common/x86/vp9_idct_intrin_sse2.c
vp9/encoder/vp9_denoiser.c
vp9/encoder/vp9_denoiser.h
vp9/encoder/vp9_noise_estimate.h
vp9/encoder/vp9_segmentation.c
vp9/encoder/x86/vp9_dct_intrin_sse2.c
vpx_dsp/x86/fwd_dct32x32_impl_avx2.h
vpx_dsp/x86/fwd_dct32x32_impl_sse2.h
vpx_dsp/x86/fwd_txfm_avx2.c
vpx_dsp/x86/sad_avx2.c
vpx_dsp/x86/variance_avx2.c
vpx_ports/emmintrin_compat.h

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Files:
vpx_util/endian_inl.h

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Endian related functions.

Files:
args.c
args.h
examples/decode_to_md5.c
examples/decode_with_drops.c
examples/postproc.c
examples/set_maps.c
examples/simple_decoder.c
examples/simple_encoder.c
examples/twopass_encoder.c
examples/vp8_multi_resolution_encoder.c
examples/vp8cx_set_ref.c
test/convolve_test.cc
test/idct_test.cc
third_party/libwebm/mkvparser/mkvreader.cc
third_party/libwebm/mkvparser/mkvreader.h

tools_common.c
tools_common.h
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vp8/common/common.h
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vp8/common/debugmodes.c
vp8/common/default_coef_probs.h
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vp8/common/entropy.h
vp8/common/entropymode.c
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vp8/common/entropymv.h
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vp8/decoder/decoderthreading.h
vp8/decoder/detokenize.c

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vp9/vp9_dx_iface.c
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vpx/src/vpx_decoder.c
vpx/src/vpx_encoder.c
vpx/src/vpx_image.c
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vpx/vp8cx.h
vpx/vp8dx.h
vpx/vpx_codec.h
vpx/vpx_decoder.h
vpx/vpx_encoder.h
vpx/vpx_image.h

vpx/vpx_integer.h
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vpx_dsp/bitwriter.h
vpx_dsp/inv_txfm.h
vpx_dsp/ssim.c
vpx_dsp/variance.c
vpx_dsp/x86/loopfilter_avx2.c
vpx_dsp/x86/loopfilter_sse2.c
vpx_dsp/x86/variance_sse2.c
vpx_dsp/x86/vpx_subpixel_8t_intrin_avx2.c
vpx_dsp/x86/vpx_subpixel_8t_intrin_ssse3.c
vpx_mem/include/vpx_mem_intrnl.h
vpx_mem/vpx_mem.c
vpx_mem/vpx_mem.h
vpx_ports/arm.h
vpx_ports/bitops.h
vpx_ports/mem.h
vpx_ports/mem_ops.h
vpx_ports/mem_ops_aligned.h
vpx_ports/vpx_timer.h
vpx_ports/x86.h
vpx_scale/generic/gen_scalers.c
vpx_scale/generic/vpx_scale.c
vpx_scale/generic/yv12config.c
vpx_scale/generic/yv12extend.c
vpx_scale/vpx_scale.h
vpx_scale/yv12config.h
vpxdec.c
vpxenc.c

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Files:
md5_utils.c

This code implements the MD5 message-digest algorithm.
The algorithm is due to Ron Rivest. This code was
written by Colin Plumb in 1993, no copyright is claimed.
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Equivalent code is available from RSA Data Security, Inc.
This code has been tested against that, and is equivalent,
except that you don't need to include two pages of legalese
with every copy.

To compute the message digest of a chunk of bytes, declare an
MD5Context structure, pass it to MD5Init, call MD5Update as
needed on buffers full of bytes, and then call MD5Final, which
will fill a supplied 16-byte array with the digest.

Changed so as no longer to depend on Colin Plumb's `usual.h' header
definitions
 - Ian Jackson <ian@chiark.greenend.org.uk>.
Still in the public domain.

Files:
test/resize_util.sh

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```
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#
#  This file tests the libvpx resize_util example code. To add new tests to
#  this file, do the following:
#    1. Write a shell function (this is your test).
#    2. Add the function to resize_util_tests (on a new line).
#


## Files:
test/examples.sh

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#
#  This file runs all of the tests for the libvpx examples.
#


## Files:
build/make/iosbuild.sh

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#
#
# This script generates 'VPX.framework'. An iOS app can encode and decode VPx
# video by including 'VPX.framework'.
#
# Run iosbuild.sh to create 'VPX.framework' in the current directory.
#
```

18.2.3.38 libXcomposite

```
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18.2.3.39 libXdamage

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18.2.3.40 libXext

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18.2.3.41 libXfixes

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==========

include/X11/extensions/Xfixes.h:

```
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 * $XFree86: xc/lib/Xfixes/Xfixes.h,v 1.1 2002/11/30 06:21:45 keithp Exp $
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 */
```

18.2.3.42 libxml2

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18.2.3.43 Lightweight TCP/IP stack (LWIP)

Lightweight TCP/IP stack (LWIP)

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18.2.3.44 Linux Kernel 5.10.110

vmwgfx kernel drivers

The following files are used from https://git.kernel.org/pub/scm/linux/kernel/git/stable/linux.git/tree/drivers/gpu/drm/vmwgfx/device_include?h=v5.10.110

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18.2.3.45 Linux kernel 6.15.4

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```
**********************************************************************
***               nsProcess NSIS plugin v1.6                   ***
**********************************************************************

2006 Shengalts Aleksander aka Instructor (Shengalts@mail.ru)

Source function FIND_PROC_BY_NAME based
```

upon the Ravi Kochhar (kochhar@physiology.wisc.edu) code
Thanks iceman_k (FindProcDLL plugin) and
DITMan (KillProcDLL plugin) for direct me
NSIS UNICODE compatible version (1.6) by brainsucker
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Microsoft
Patents/Applications covered
US-2008-0201137-A1
US-2010-0174535-A1
US-2010-0174534-A1
US-2010-0174547-A1
US-2010-0174532-A1

US-2010-0174537-A1
US-2010-0174542-A1
US-2010-0174531-A1
US-2010-0174541-A1
US-2010-0174538-A1
US-2011-0077940-A1
and any other applicable
Microsoft Opus Patent Terms
11-7-2012

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6.8. Reference Implementation. “Reference Implementation” means the implementation of the Opus encoder and/or decoder code extracted from Appendix A of the Specification.
6.9. Specification. Specification” means IETF RFC 6716 dated September 2012.
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Other disclosures
While Xiph.Org, Broadcom, and Microsoft filed IPR disclosures giving royalty-free licenses to their patents used in Opus, four companies that did not directly participate in the development of Opus, Qualcomm, Huawei, France Telecom, and Ericsson, filed IPR disclosures with potentially royalty-bearing terms. The IETF allows anyone (and their dog) to file an IPR disclosures if they think that their patents "covers or may ultimately cover" a standard. In fact, for any organization who can be said to have contributed in any (very loosely defined) way, these IPR statements are not just allowed, but required. It is thus safer for organisations to declare as much as they can. As an example, one can find similar non-free Qualcomm IPR statements on both SIP and SDP. To our advantage, however, the IETF IPR disclosure policies require companies to provide the actual patent numbers. This allows anyone to verify these claims for themselves, which is definitely a good thing.
When it comes to patents, it is difficult to say much without making lawyers nervous. However, we can say something quite direct: external counsel Dergosits & Noah has advised us that Opus can be implemented without the need to license the patents disclosed by Qualcomm, Huawei, France Telecom, or Ericsson. We can also say that Mozilla is confident enough in Opus to ship it to hundreds of millions of Firefox users. Similarly, Cisco and Google are also supporting Opus in some products. More companies are expected to do the same soon.
Mozilla invested significant legal resources into avoiding known patent thickets when designing Opus. Whenever possible, we used processes and methods that have been long known in the field and which are considered patent-free. In addition, we filed numerous patent applications on the new things we invented to help defend the Opus community. As a result, Opus is available on a royalty-free basis and can be deployed by anyone, including other open-source projects. Everyone knows this is an incredibly challenging legal environment to operate in, but we think we've succeeded.
LIBJPEG-TURBO README FILE:
****
** Background
****
libjpeg-turbo is a JPEG image codec that uses SIMD instructions (MMX, SSE2,
NEON) to accelerate baseline JPEG compression and decompression on x86, x86-64,
and ARM systems. On such systems, libjpeg-turbo is generally 2-4x as fast as
libjpeg, all else being equal. On other types of systems, libjpeg-turbo can
still outperform libjpeg by a significant amount, by virtue of its
highly-optimized Huffman coding routines. In many cases, the performance of
libjpeg-turbo rivals that of proprietary high-speed JPEG codecs.
libjpeg-turbo implements both the traditional libjpeg API as well as the less
powerful but more straightforward TurboJPEG API. libjpeg-turbo also features
colorspace extensions that allow it to compress from/decompress to 32-bit and
big-endian pixel buffers (RGBX, XBGR, etc.), as well as a full-featured Java
interface.
libjpeg-turbo was originally based on libjpeg/SIMD, an MMX-accelerated

derivative of libjpeg v6b developed by Miyasaka Masaru. The TigerVNC and
VirtualGL projects made numerous enhancements to the codec in 2009, and in
early 2010, libjpeg-turbo spun off into an independent project, with the goal
of making high-speed JPEG compression/decompression technology available to a
broader range of users and developers.
****
** License
****
Most of libjpeg-turbo inherits the non-restrictive, BSD-style license used by
libjpeg (see README.) The TurboJPEG wrapper (both C and Java versions) and
associated test programs bear a similar license, which is reproduced below:
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****
** Using libjpeg-turbo
****
libjpeg-turbo includes two APIs that can be used to compress and decompress
JPEG images:
  TurboJPEG API: This API provides an easy-to-use interface for compressing
  and decompressing JPEG images in memory. It also provides some functionality
  that would not be straightforward to achieve using the underlying libjpeg
  API, such as generating planar YUV images and performing multiple
  simultaneous lossless transforms on an image. The Java interface for
  libjpeg-turbo is written on top of the TurboJPEG API.
  libjpeg API: This is the de facto industry-standard API for compressing and
  decompressing JPEG images. It is more difficult to use than the TurboJPEG
  API but also more powerful. The libjpeg API implementation in libjpeg-turbo
  is both API/ABI-compatible and mathematically compatible with libjpeg v6b.
  It can also optionally be configured to be API/ABI-compatible with libjpeg v7
  and v8 (see below.)
There is no significant performance advantage to either API when both are used
to perform similar operations.
====================
Colorspace Extensions
====================
libjpeg-turbo includes extensions that allow JPEG images to be compressed
directly from (and decompressed directly to) buffers that use BGR, BGRX,
RGBX, XBGR, and XRGB pixel ordering. This is implemented with ten new
colorspace constants:
  JCS_EXT_RGB /* red/green/blue */
  JCS_EXT_RGBX /* red/green/blue/x */
  JCS_EXT_BGR /* blue/green/red */
  JCS_EXT_BGRX /* blue/green/red/x */
  JCS_EXT_XBGR /* x/blue/green/red */
  JCS_EXT_XRGB /* x/red/green/blue */
  JCS_EXT_RGBA /* red/green/blue/alpha */
  JCS_EXT_BGRA /* blue/green/red/alpha */
  JCS_EXT_ABGR /* alpha/blue/green/red */
  JCS_EXT_ARGB /* alpha/red/green/blue */
Setting cinfo.in_color_space (compression) or cinfo.out_color_space
(decompression) to one of these values will cause libjpeg-turbo to read the
red, green, and blue values from (or write them to) the appropriate position in

the pixel when compressing from/decompressing to an RGB buffer.
Your application can check for the existence of these extensions at compile
time with:
  #ifdef JCS_EXTENSIONS
At run time, attempting to use these extensions with a libjpeg implementation
that does not support them will result in a "Bogus input colorspace" error.
Applications can trap this error in order to test whether run-time support is
available for the colorspace extensions.
When using the RGBX, BGRX, XBGR, and XRGB colorspaces during decompression, the
X byte is undefined, and in order to ensure the best performance, libjpeg-turbo
can set that byte to whatever value it wishes. If an application expects the X
byte to be used as an alpha channel, then it should specify JCS_EXT_RGBA,
JCS_EXT_BGRA, JCS_EXT_ABGR, or JCS_EXT_ARGB. When these colorspace constants
are used, the X byte is guaranteed to be 0xFF, which is interpreted as opaque.
Your application can check for the existence of the alpha channel colorspace
extensions at compile time with:
  #ifdef JCS_ALPHA_EXTENSIONS
jcstest.c, located in the libjpeg-turbo source tree, demonstrates how to check
for the existence of the colorspace extensions at compile time and run time.
==================================
libjpeg v7 and v8 API/ABI Emulation
==================================
With libjpeg v7 and v8, new features were added that necessitated extending the
compression and decompression structures. Unfortunately, due to the exposed
nature of those structures, extending them also necessitated breaking backward
ABI compatibility with previous libjpeg releases. Thus, programs that were
built to use libjpeg v7 or v8 did not work with libjpeg-turbo, since it is
based on the libjpeg v6b code base. Although libjpeg v7 and v8 are not
as widely used as v6b, enough programs (including a few Linux distros) made
the switch that there was a demand to emulate the libjpeg v7 and v8 ABIs
in libjpeg-turbo. It should be noted, however, that this feature was added
primarily so that applications that had already been compiled to use libjpeg
v7+ could take advantage of accelerated baseline JPEG encoding/decoding
without recompiling. libjpeg-turbo does not claim to support all of the
libjpeg v7+ features, nor to produce identical output to libjpeg v7+ in all
cases (see below.)
By passing an argument of --with-jpeg7 or --with-jpeg8 to configure, or an
argument of -DWITH_JPEG7=1 or -DWITH_JPEG8=1 to cmake, you can build a version
of libjpeg-turbo that emulates the libjpeg v7 or v8 ABI, so that programs
that are built against libjpeg v7 or v8 can be run with libjpeg-turbo. The
following section describes which libjpeg v7+ features are supported and which
aren't.
Support for libjpeg v7 and v8 Features:

Fully supported:
-- libjpeg: IDCT scaling extensions in decompressor
   libjpeg-turbo supports IDCT scaling with scaling factors of 1/8, 1/4, 3/8,
   1/2, 5/8, 3/4, 7/8, 9/8, 5/4, 11/8, 3/2, 13/8, 7/4, 15/8, and 2/1 (only 1/4
   and 1/2 are SIMD-accelerated.)
-- libjpeg: arithmetic coding
-- libjpeg: In-memory source and destination managers
   See notes below.
-- cjpeg: Separate quality settings for luminance and chrominance
   Note that the libpjeg v7+ API was extended to accommodate this feature only
   for convenience purposes. It has always been possible to implement this
   feature with libjpeg v6b (see rdswitch.c for an example.)
-- cjpeg: 32-bit BMP support
-- cjpeg: -rgb option
-- jpegtran: lossless cropping
-- jpegtran: -perfect option
-- jpegtran: forcing width/height when performing lossless crop
-- rdjpgcom: -raw option
-- rdjpgcom: locale awareness
Not supported:
NOTE: As of this writing, extensive research has been conducted into the
usefulness of DCT scaling as a means of data reduction and SmartScale as a
means of quality improvement. The reader is invited to peruse the research at
http://www.libjpeg-turbo.org/About/SmartScale and draw his/her own conclusions,
but it is the general belief of our project that these features have not
demonstrated sufficient usefulness to justify inclusion in libjpeg-turbo.
-- libjpeg: DCT scaling in compressor

cinfo.scale_num and cinfo.scale_denom are silently ignored.
There is no technical reason why DCT scaling could not be supported when
emulating the libjpeg v7+ API/ABI, but without the SmartScale extension (see
below), only scaling factors of 1/2, 8/15, 4/7, 8/13, 2/3, 8/11, 4/5, and
8/9 would be available, which is of limited usefulness.
-- libjpeg: SmartScale
cinfo.block_size is silently ignored.
SmartScale is an extension to the JPEG format that allows for DCT block
sizes other than 8x8. Providing support for this new format would be
feasible (particularly without full acceleration.) However, until/unless
the format becomes either an official industry standard or, at minimum, an
accepted solution in the community, we are hesitant to implement it, as
there is no sense of whether or how it might change in the future. It is
our belief that SmartScale has not demonstrated sufficient usefulness as a
lossless format nor as a means of quality enhancement, and thus, our primary
interest in providing this feature would be as a means of supporting
additional DCT scaling factors.
-- libjpeg: Fancy downsampling in compressor
cinfo.do_fancy_downsampling is silently ignored.
This requires the DCT scaling feature, which is not supported.
-- jpegtran: Scaling
This requires both the DCT scaling and SmartScale features, which are not
supported.
-- Lossless RGB JPEG files
This requires the SmartScale feature, which is not supported.
What About libjpeg v9?
---
libjpeg v9 introduced yet another field to the JPEG compression structure
(color_transform), thus making the ABI backward incompatible with that of
libjpeg v8. This new field was introduced solely for the purpose of supporting
lossless SmartScale encoding. Further, there was actually no reason to extend
the API in this manner, as the color transform could have just as easily been
activated by way of a new JPEG colorspace constant, thus preserving backward
ABI compatibility.
Our research (see link above) has shown that lossless SmartScale does not
generally accomplish anything that can't already be accomplished better with
existing, standard lossless formats. Thus, at this time, it is our belief that
there is not sufficient technical justification for software to upgrade from
libjpeg v8 to libjpeg v9, and therefore, not sufficient technical justification
for us to emulate the libjpeg v9 ABI.
==========
In-Memory Source/Destination Managers
==========
By default, libjpeg-turbo 1.3 and later includes the jpeg_mem_src() and
jpeg_mem_dest() functions, even when not emulating the libjpeg v8 API/ABI.
Previously, it was necessary to build libjpeg-turbo from source with libjpeg v8
API/ABI emulation in order to use the in-memory source/destination managers,
but several projects requested that those functions be included when emulating
the libjpeg v6b API/ABI as well. This allows the use of those functions by
programs that need them without breaking ABI compatibility for programs that
don't, and it allows those functions to be provided in the "official"
libjpeg-turbo binaries.
Those who are concerned about maintaining strict conformance with the libjpeg
v6b or v7 API can pass an argument of --without-mem-srcdst to configure or
an argument of -DWITH_MEM_SRCDST=0 to CMake prior to building libjpeg-turbo.
This will restore the pre-1.3 behavior, in which jpeg_mem_src() and
jpeg_mem_dest() are only included when emulating the libjpeg v8 API/ABI.
On Un*x systems, including the in-memory source/destination managers changes
the dynamic library version from 62.0.0 to 62.1.0 if using libjpeg v6b API/ABI
emulation and from 7.0.0 to 7.1.0 if using libjpeg v7 API/ABI emulation.
Note that, on most Un*x systems, the dynamic linker will not look for a
function in a library until that function is actually used. Thus, if a program
is built against libjpeg-turbo 1.3+ and uses jpeg_mem_src() or jpeg_mem_dest(),
that program will not fail if run against an older version of libjpeg-turbo or
against libjpeg v7- until the program actually tries to call jpeg_mem_src() or
jpeg_mem_dest(). Such is not the case on Windows. If a program is built
against the libjpeg-turbo 1.3+ DLL and uses jpeg_mem_src() or jpeg_mem_dest(),
then it must use the libjpeg-turbo 1.3+ DLL at run time.
Both cjpeg and djpeg have been extended to allow testing the in-memory
source/destination manager functions. See their respective man pages for more
details.

```
************************************************************************************
**     Mathematical Compatibility
************************************************************************************

For the most part, libjpeg-turbo should produce identical output to libjpeg
v6b.  The one exception to this is when using the floating point DCT/IDCT, in
which case the outputs of libjpeg v6b and libjpeg-turbo can differ for the
following reasons:

-- The SSE/SSE2 floating point DCT implementation in libjpeg-turbo is ever so
   slightly more accurate than the implementation in libjpeg v6b, but not by
   any amount perceptible to human vision (generally in the range of 0.01 to
   0.08 dB gain in PNSR.)
-- When not using the SIMD extensions, libjpeg-turbo uses the more accurate
   (and slightly faster) floating point IDCT algorithm introduced in libjpeg
   v8a as opposed to the algorithm used in libjpeg v6b.  It should be noted,
   however, that this algorithm basically brings the accuracy of the floating
   point IDCT in line with the accuracy of the slow integer IDCT.  The floating
   point DCT/IDCT algorithms are mainly a legacy feature, and they do not
   produce significantly more accuracy than the slow integer algorithms (to put
   numbers on this, the typical difference in PNSR between the two algorithms
   is less than 0.10 dB, whereas changing the quality level by 1 in the upper
   range of the quality scale is typically more like a 1.0 dB difference.)
-- When not using the SIMD extensions, then the accuracy of the floating point
   DCT/IDCT can depend on the compiler and compiler settings.

While libjpeg-turbo does emulate the libjpeg v8 API/ABI, under the hood, it is
still using the same algorithms as libjpeg v6b, so there are several specific
cases in which libjpeg-turbo cannot be expected to produce the same output as
libjpeg v8:

-- When decompressing using scaling factors of 1/2 and 1/4, because libjpeg v8
   implements those scaling algorithms differently than libjpeg v6b does, and
   libjpeg-turbo's SIMD extensions are based on the libjpeg v6b behavior.
-- When using chrominance subsampling, because libjpeg v8 implements this
   with its DCT/IDCT scaling algorithms rather than with a separate
   downsampling/upsampling algorithm.  In our testing, the subsampled/upsampled
   output of libjpeg v8 is less accurate than that of libjpeg v6b for this
   reason.
-- When decompressing using a scaling factor > 1 and merged (AKA "non-fancy" or
   "non-smooth") chrominance upsampling, because libjpeg v8 does not support
   merged upsampling with scaling factors > 1.

************************************************************************************
**     Performance Pitfalls
************************************************************************************

===============
Restart Markers
===============

The optimized Huffman decoder in libjpeg-turbo does not handle restart markers
in a way that makes the rest of the libjpeg infrastructure happy, so it is
necessary to use the slow Huffman decoder when decompressing a JPEG image that
has restart markers.  This can cause the decompression performance to drop by
as much as 20%, but the performance will still be much greater than that of
libjpeg.  Many consumer packages, such as PhotoShop, use restart markers when
generating JPEG images, so images generated by those programs will experience
this issue.

============================================
Fast Integer Forward DCT at High Quality Levels
============================================

The algorithm used by the SIMD-accelerated quantization function cannot produce
correct results whenever the fast integer forward DCT is used along with a JPEG
quality of 98-100.  Thus, libjpeg-turbo must use the non-SIMD quantization
function in those cases.  This causes performance to drop by as much as 40%.
It is therefore strongly advised that you use the slow integer forward DCT
whenever encoding images with a JPEG quality of 98 or higher.
```

18.2.3.56 pixman

```
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18.2.3.57 Plex86/Bochs LGPL VGABios

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 ==
//
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//
//
 ==
//
// This VGA Bios is specific to the plex86/bochs Emulated VGA card.
// You can NOT drive any physical vga card with it.
//
//
 ==
//
// This file contains code ripped from :

```
//   - rombios.c of plex86
//
//  This VGA Bios contains fonts from :
//   - fntcol16.zip (c) by Joseph Gil avalable at :
//       ftp://ftp.simtel.net/pub/simtelnet/msdos/screen/fntcol16.zip
//     These fonts are public domain
//
//  This VGA Bios is based on information taken from :
//   - Kevin Lawton's vga card emulation for bochs/plex86
//   - Ralf Brown's interrupts list available at http://www.cs.cmu.edu/afs/cs/user/ralf/pub/WWW/files.html
//   - Finn Thogersons' VGADOC4b available at http://home.worldonline.dk/~finth/
//   - Michael Abrash's Graphics Programming Black Book
//   - Francois Gervais' book "programmation des cartes graphiques cga-ega-vga" edited by sybex
//   - DOSEMU 1.0.1 source code for several tables values and formulas
//
// Thanks for patches, comments and ideas to :
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//
//
 ============================================================================================
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18.2.3.58 pulseaudio

pulseaudio

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For:
src/pulsecore/filter/crossover.c
src/pulsecore/filter/biquad.h
src/pulsecore/filter/crossover.h
src/pulsecore/filter/biquad.c

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src/modules/echo-cancel/adrian-aec.c
src/modules/echo-cancel/adrian-aec.h

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For:
src/pulsecore/rtkit.c
src/pulsecore/rtkit.h
src/modules/reserve.c
src/modules/reserve-monitor.c
src/modules/reserve.h
src/modules/reserve-monitor.h

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cdecl.h
channelmap.h
context.h
def.h
direction.h
error.h
ext-device-manager.h
ext-device-restore.h
ext-stream-restore.h
format.h
gccmacro.h
glib-mainloop.h
introspect.h
mainloop-api.h

mainloop.h
mainloop-signal.h
operation.h
proplist.h
pulseaudio.h
rtclock.h
sample.h
scache.h
simple.h
stream.h
subscribe.h
thread-mainloop.h
timeval.h
utf8.h
util.h
version.h
volume.h
xmalloc.h

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18.2.3.59 pylibfdt

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18.2.3.60 Python

url=https://github.com/python/cpython/blob/v3.10.5/LICENSE

A. HISTORY OF THE SOFTWARE
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Python was created in the early 1990s by Guido van Rossum at Stichting
Mathematisch Centrum (CWI, see http://www.cwi.nl) in the Netherlands
as a successor of a language called ABC. Guido remains Python's
principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for
National Research Initiatives (CNRI, see http://www.cnri.reston.va.us)
in Reston, Virginia where he released several versions of the
software.

In May 2000, Guido and the Python core development team moved to
BeOpen.com to form the BeOpen PythonLabs team. In October of the same
year, the PythonLabs team moved to Digital Creations, which became
Zope Corporation. In 2001, the Python Software Foundation (PSF, see
https://www.python.org/psf/) was formed, a non-profit organization
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All Python releases are Open Source (see http://www.opensource.org for
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Release	Derived from	Year	Owner	GPL-compatible? (1)
0.9.0 thru 1.2		1991-1995	CWI	yes
1.3 thru 1.5.2	1.2	1995-1999	CNRI	yes
1.6	1.5.2	2000	CNRI	no
2.0	1.6	2000	BeOpen.com	no
1.6.1	1.6	2001	CNRI	yes (2)
2.1	2.0+1.6.1	2001	PSF	no
2.0.1	2.0+1.6.1	2001	PSF	yes
2.1.1	2.1+2.0.1	2001	PSF	yes
2.1.2	2.1.1	2002	PSF	yes
2.1.3	2.1.2	2002	PSF	yes
2.2 and above	2.1.1	2001-now	PSF	yes

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The _random module includes code based on a download from http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/MT2002/emt19937ar.html. The following are the verbatim comments from the original code:

A C-program for MT19937, with initialization improved 2002/1/26.
Coded by Takuji Nishimura and Makoto Matsumoto.

Before using, initialize the state by using init_genrand(seed)
or init_by_array(init_key, key_length).

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Any feedback is very welcome.
http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/emt.html
email: m-mat @ math.sci.hiroshima-u.ac.jp (remove space)

Sockets

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Modified by Jack Jansen, CWI, July 1995:
- Use binascii module to do the actual line-by-line conversion
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Original location:
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Solution inspired by code from:
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The file Python/dtoa.c, which supplies C functions dtoa and strtod for conversion of C doubles to and from strings, is derived from the file of the same name by David M. Gay, currently available from https://web.archive.org/web/20220517033456/http://www.netlib.org/fp/dtoa.c. The original file, as retrieved on March 16, 2009, contains the following copyright and licensing notice:

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 *
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hw/ps2.c:
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 * QEMU PC keyboard emulation (revision 1.12)
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 * QEMU 8253/8254 interval timer emulation
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 * QEMU 8259 interrupt controller emulation
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 */
================================================================================
hw/pci.c:
```

```
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 * QEMU PCI bus manager
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18.2.3.62 randrproto

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18.2.3.63 Reference Implementations for Intel® Architecture Approximation Instructions VRCP14, VRSQRT14, VRCP28, VRSQRT28, and VEXP2

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2018 January 20

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```
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 *
 */
```

18.2.3.69 Wayland

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18.2.3.71 WiX (Windows Installer XML toolset)

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18.2.3.72 xextproto

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**/

18.2.3.73 xf86-input-mouse

xf86-input-mouse

src/mouse.c
```
/*
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 *
 */
```

```
=========================================================================
```

src/mouse.h:
src/mousePriv.h
```
/*
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 */
```

```
=========================================================================
```

src/pnp.c:
```
/*
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 */
```

18.2.3.74 xf86-video-vesa

```
============================================================
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 *
 * Authors: Paulo César Pereira de Andrade <pcpa@conectiva.com.br>
 *
 * $XFree86: xc/programs/Xserver/hw/xfree86/drivers/vesa/vesa.h,v 1.12 2002/08/06 13:46:27 dawes Exp $
 */

============================================================================
src/vesa.c:
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*
* $XFree86: xc/programs/Xserver/hw/xfree86/drivers/vesa/vesa.c,v 1.40 2003/11/03 05:11:45 tsi Exp $
*/
```

18.2.3.75 xf86driproto

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18.2.3.76 XFree86 -VidMode Extension

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18.2.3.77 xorg-server 1.0.1

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18.2.3.78 xorg-server 1.1.0

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18.2.3.79 xorg-server 1.3.0.0

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18.2.3.80 xorg-server 1.5.3

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18.2.3.81 xorg-server 1.4.2

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18.2.3.82 xorg-server 1.6.5

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18.2.3.84 xorg-server 1.8.0

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18.2.3.85 xorg-server 1.9.0

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18.2.3.86 xorg-server 1.10.0

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18.2.3.87 xorg-server 1.11.0

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18.2.3.88 xorg-server 1.12.0

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18.2.3.89 xorg-server 1.13.0

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18.2.3.90 xorg-server 1.14.0

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18.2.3.91 xorg-server 1.17.1

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18.2.3.92 xorg-server 1.18.0

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18.2.3.93 xorg-server 1.15.0

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18.2.3.94 xorg-server 1.16.0

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18.2.3.95 xproto

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18.3.3.4 QEMU

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 * QEMU ALSA audio driver
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 */
```

```
================================================================================
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 * QEMU Mixing engine
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 * QEMU Mixing engine
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slirp/tftp.c:
/*
 * tftp.c - a simple, read-only tftp server for qemu
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slirp/bootp.c:
/*
 * QEMU BOOTP/DHCP server
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/*
 * AMD PCnet-PCI II (Am79C970A) emulation
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hw/ps2.c:
/ *
 * QEMU PC keyboard emulation (revision 1.12)
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 */
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hw/mc146818rtc.c:
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 * QEMU MC146818 RTC emulation
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hw/i8254.c:
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 * QEMU 8253/8254 interval timer emulation
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/*
 * QEMU Floppy disk emulator (Intel 82078)
 *
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```
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 */
```

==========

hw/vga_int.h:

```
/*
 * QEMU internal VGA defines.
 *
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 */
```

==========

hw/vga_template.h:

```
/*
 * QEMU VGA Emulator templates
 *
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*/
```

18.3.3.5 Zlib Data Compression Library

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