Converting Linux and Windows Physical and Virtual Machines to Oracle VM Virtual Machines

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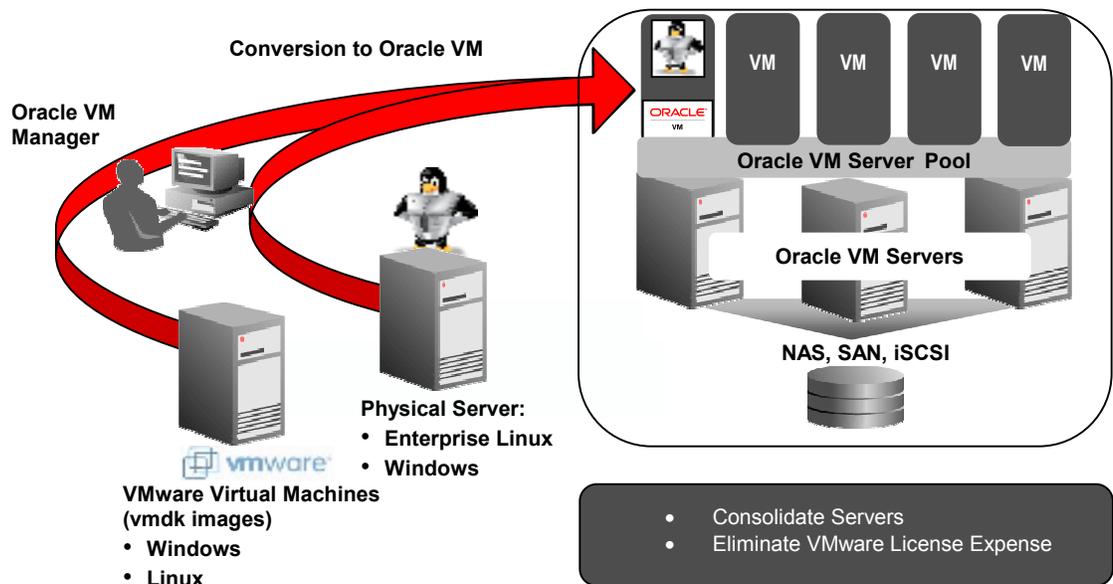
INTRODUCTION

Oracle VM provides functionality to allow customers to easily convert and move Linux and Windows servers to run as guest virtual machines (VM) in Oracle VM Server Pools. This document describes the virtual machine conversion functions built into Oracle VM in Release 2.1.2, and how you can plan and execute the virtual machine conversions using Oracle VM.

The virtual machine conversion functions introduced in Oracle VM 2.1.2 include physical to virtual (P2V) and virtual to virtual (V2V) conversions.

The P2V conversion utility allows administrators to perform an off-line conversion of any physical machine running supported versions of Windows or Linux to an Oracle VM hardware virtualized guest virtual machine. The P2V utility is integrated into the install program on the Oracle VM Server CD. It can be run in interactive mode prompting for necessary parameters, or in an automated fashion using a configuration file with syntax very similar to kickstart install files.

This conversion will create a VM configuration file (vm.cfg) and allow you to make some modifications in terms of sizing the virtual hardware, and then replicate the physical image and transfer it over the network to the resource pool using Oracle VM Manager. The image on your physical server is not changed in any way.

The virtual to virtual (V2V) conversion allows customers to migrate existing VMware (VMDK) images to Oracle VM images. Oracle VM Manager automatically converts a VMware image to an Oracle VM image when you import it into Oracle VM Manager, enabling customers to reduce licensing expense "at the flick of a switch" for Windows and Linux virtual machines.

Conversion to Oracle VM

Oracle VM Manager

Physical Server:
- **Enterprise Linux**
- **Windows**

VMware Virtual Machines (vmdk images)
- **Windows**
- **Linux**

VM VM VM VM

Oracle VM Server Pool

Oracle VM Servers

NAS, SAN, iSCSI

- Consolidate Servers
- Eliminate VMware License Expense

Figure 1: P2V and V2V conversion process.

ABOUT ORACLE VM

Oracle VM is a free, next-generation server virtualization and management solution that makes enterprise applications easier to deploy, manage, and support.

The components of Oracle VM are:

- **Oracle VM Manager**: Provides the web based user interface to manage Oracle VM Servers, guest virtual machines, and resources.

- **Oracle VM Server**: A self-contained virtualization environment designed to provide a lightweight, secure, server-based platform for running guest virtual machines. Oracle VM Server is based on open source technology tailored by Oracle, and includes Oracle VM Agent to communicate with Oracle VM Manager for management of guest virtual machines.
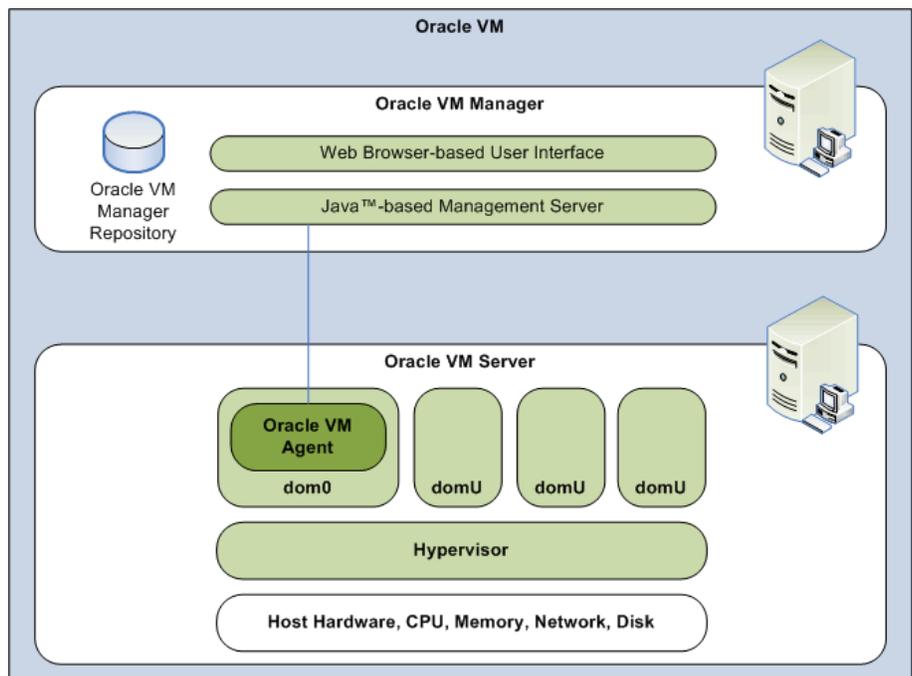
Figure 2: Oracle VM architecture.

Oracle VM software and templates can be downloaded from
http://www.oracle.com/virtualization.

OVERVIEW: PLANNING VIRTUAL MACHINE CONVERSION

The P2V utility is an off-line tool that copies the physical disk to create a virtual disk image. Linux and Windows virtual machines are created as hardware-virtualized (HVM) guests since bare metal kernels are not paravirtualized and the P2V conversion process does not change the kernel. The host computer must have a CPU that supports PAE (Physical Address Extension) in order to boot from the Oracle VM Server install CD. The target computer running Oracle VM Server must be HVM (Intel VT-x or AMD-V) capable.

The operating system must be one of the Oracle VM supported Linux or Windows guest operating systems. See the Oracle VM Server Release Notes for a list of the supported guest operating systems.

The conversion process creates an image of the physical machine. The source host computer is not changed in any way and can continue to be used as a physical server after the conversion process but care should be taken to make sure there are no network or storage conflicts with the new virtual machine when it is deployed. For example, you should confirm that the physical and virtual machines do not have conflicting IP addresses or inappropriately access any shared storage. You can define how big the virtual machine will be during the configuration process, for example the maximum number of virtual CPUs, and the maximum size of memory. The disk size in the image is determined by the size of the guest operating system and its applications. The image is created and transferred over the network to a computer running Oracle VM Manager.

The P2V utility converts disks on the computer to virtual disk images. The virtual disk images are created as virtual IDE disks on the guest regardless of what the original was.

- The first four drives are automatically created and deployed as virtual IDE drives (*hda, hdb, hdc,* and *hdd*).

- The boot drive must always be *hda.*

- Additional drives beyond the first four are converted and added to the guests configuration file (*vm.cfg*), but they are commented.

- To deploy the additional disks in the guest, edit the guest configuration file (*vm.cfg*) to remove the comments from the disk entries, and map the additional disks to SCSI device names, for example, *sda, sdb,* and *sdc.*

- Any files on the guest which contain references to these devices must also be changed, for example, the */etc/fstab* file may contain references to */dev/hda1, /dev/sda1*, and so on.

The hardware virtualized guest created by the P2V utility must have its own network configuration. If you use the same network configuration as the original computer, a network clash may occur as two machines on the network may have the same IP or MAC address. By default the P2V will leave the virtual network interface MAC parameter blank so that a random MAC will be assigned to it when the virtual machine is started. In addition, you can assign a MAC address manually by editing the configuration file or using the Oracle VM Manager interface. When the guest is started, make sure the guest operating system detects the network device and configures the new network device properly.

You can run the P2V utility interactively, or as an automated process using a kickstart configuration file. When you use the P2V utility with a kickstart file, no user intervention is required. Details on how to use the P2V utility with a kickstart file are included later in this paper.

Once you complete the conversion, and deploy the guest virtual machine into a Server Pool using Oracle VM Manager, the first time you boot the guest, it will detect the virtual hardware as provided by the Oracle VM Server software. Since the Oracle VM Server hardware abstracts the network interface from the underlying physical hardware, the virtual network interface is vendor independent and you should not experience any vendor compatibility issues. For example the physical server may have had a Broadcom ethernet card, but the interface provided to the virtual machine is standard enough that no driver re-install will be needed regardless of the vendor of the physical NICs in the Oracle VM Server (whether the guest is Windows or Linux). In other words, it is okay if the vendor of the NICs in the source machine is different from the vendor of the NICs used on the physical Oracle VM Server.

PREPARING PHYSICAL MACHINE FOR CONVERSION

Your physical machine may contain software and utilities that will no longer be relevant in a virtual environment. For example, utilities or agents used exclusively to monitor physical hardware are no longer necessary in the guest virtual machine

image. To minimize the risk of conflicts, these items should be removed from the physical server image prior to conversion. You can stop the services related to agents or unnecessary software components such as RAID, network teaming, and other hardware monitoring. In addition, you can also remove all the hidden hardware devices or applications that won't be used anymore in the virtual environment. Removing unnecessary drivers and applications would reduce the amount of data that will be transferred over the network during the conversion. You should take necessary steps to back up your data if you want to make any changes to your physical server.

RUNNING THE P2V UTILITY INTERACTIVELY

To run the P2V utility manually perform the following steps:

1. Prepare the physical machine to be converted.

2. Insert the Oracle VM Server CD into the CD ROM drive

3. Reboot the physical machine. When the system restarts, choose to boot from the CDROM drive if necessary.

4. At the Oracle VM Server splash screen appears, enter the following at the **boot:** prompt and press **Enter**

```
linux p2v
```


Figure 3: Oracle VM Server splash screen.

5. Choose to verify the CD or skip.

Figure 4: Oracle VM Server CD Found screen.

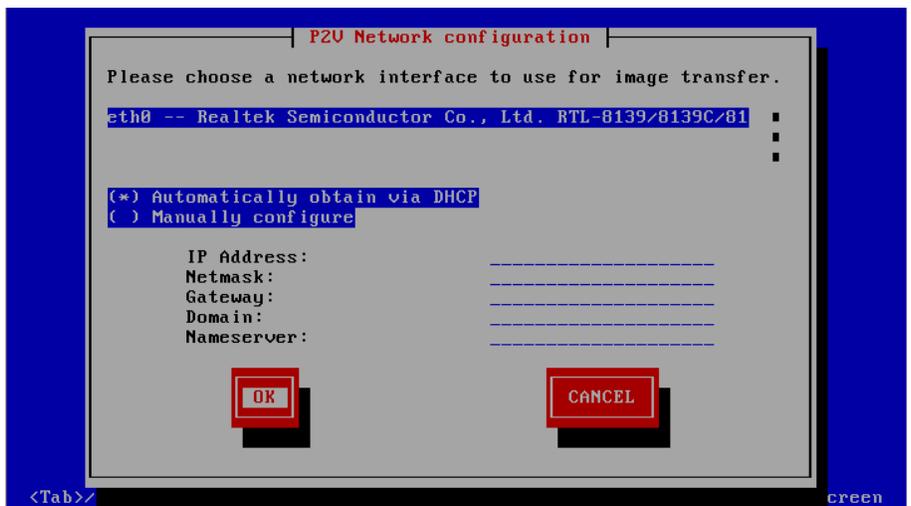6. Choose the network configuration.

Figure 5: Oracle VM Server Network Configuration screen.

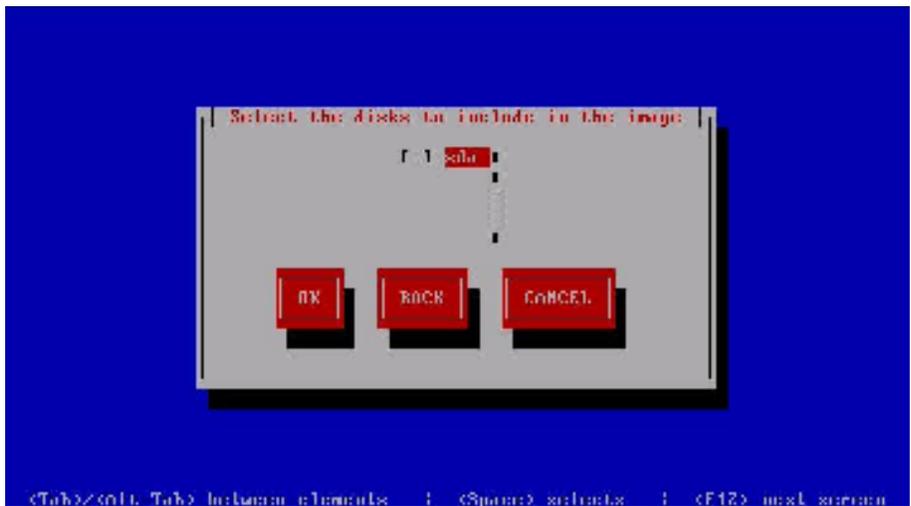7. Select the disk partitions on the computer to include in the guest image.

Figure 6: Oracle VM Server disk selection screen

8. On the Other parameters for VM screen, enter information about the guest image for VM (guest) name, VM (guest) memory, number of virtual CPUs, and console password.

Note:

- The number of guest virtual CPU(s) and the size of memory are the maximum values. These values can be edited later and also can be changed dynamically to reduce the value and/or to increase the value back up to this maximum if the value has been previously decreased from the maximum. You can consult the Oracle VM documentation for details on how to change the guest VM configurations.

- The console password for VNC session (remote display) is saved in the guest configuration file (*vm.cfg*) in clear text.
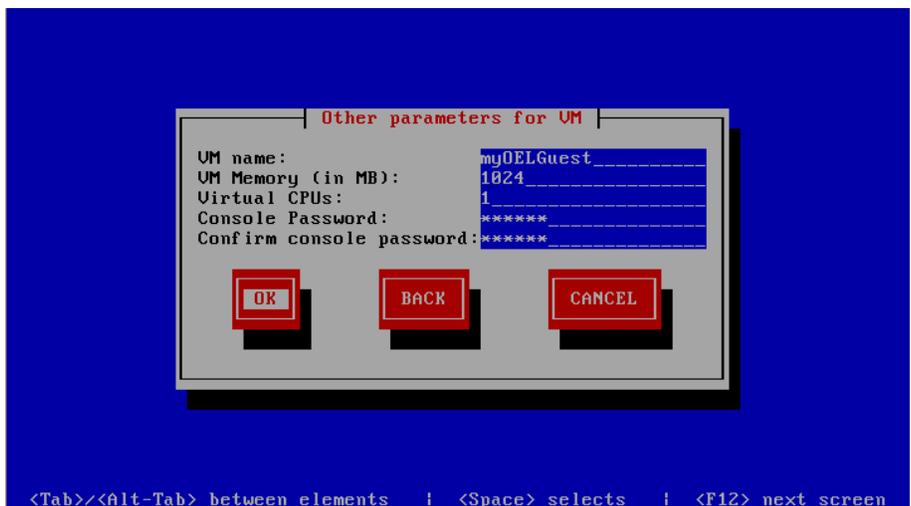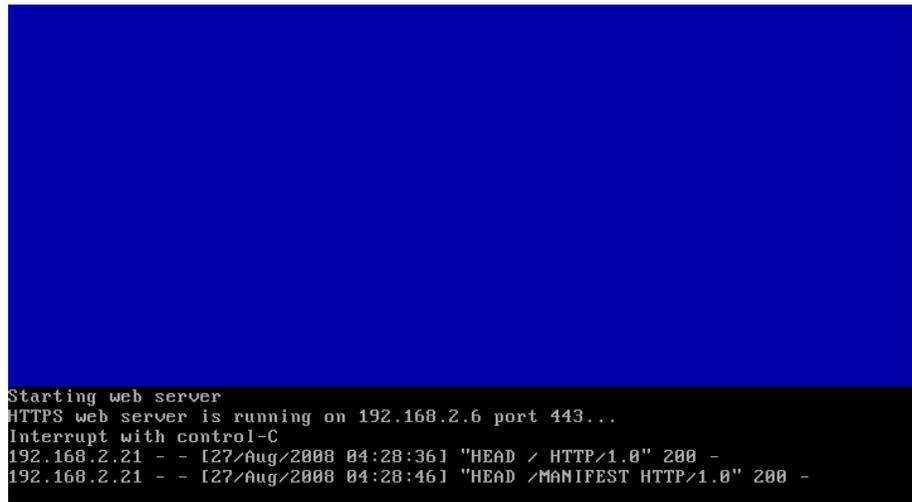

Figure 7: Oracle VM Server Other Parameters screen.

9. A secure web server (HTTPS) is started. Note that the IP address of the machine and the port number are displayed. You will need this to import the image using Oracle VM Manager.


```
Starting web server
HTTPS web server is running on 192.168.2.6 port 443...
Interrupt with control-C
192.168.2.21 - - [27/Aug/2008 04:28:36] "HEAD / HTTP/1.0" 200 -
192.168.2.21 - - [27/Aug/2008 04:28:46] "HEAD /MANIFEST HTTP/1.0" 200 -
```

Figure 8: Oracle VM Server conversion screen.

10. Log in to Oracle VM Manager to import the converted image as an Oracle VM virtual machine template or virtual machine image. The converted image is a hardware virtualized guest image.

Note:

- P2V converted guest virtual machines may be imported either as a template stored in */OVS/seed_pool* directory or as a virtual machine Image stored in */OVS/running_pool* directory.

- V2V converted guest virtual machines can only be imported as a virtual machine image stored in */OVS/running_pool* directory.

USING THE P2V UTILITY WITH A KICKSTART FILE

You can use a kickstart file to automate the creation of a guest image of a physical machine using the P2V utility. When you use the P2V utility with a kickstart file, no user intervention is required. If there are any missing parameters in the kickstart file, you are prompted to enter them. For details, you can check the Oracle VM documentation.
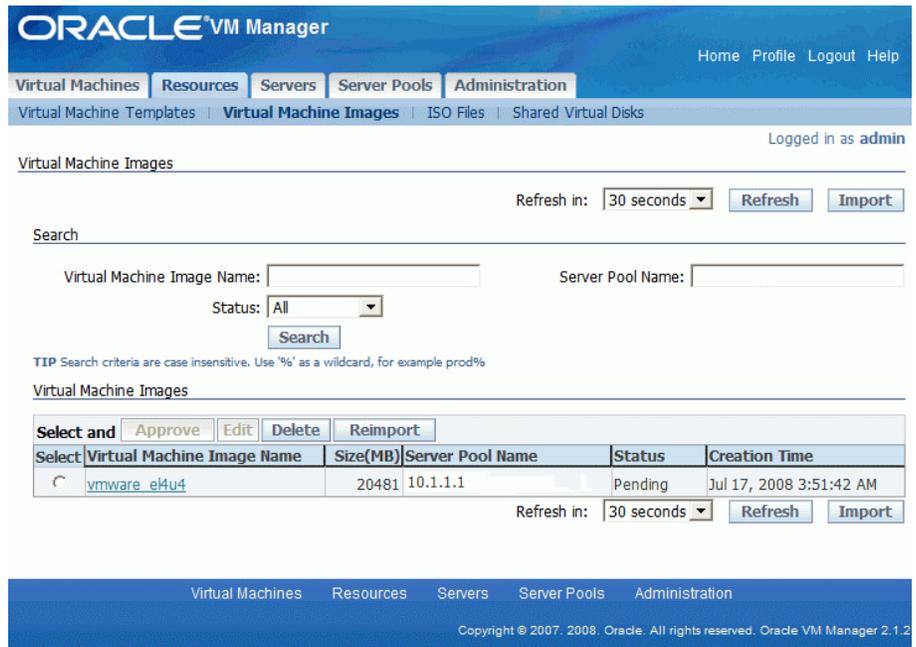
PREPARING A VMWARE IMAGE FOR V2V CONVERSION

Many users have installed VMware Tools on the guest operating system (Windows, Linux, etc.) for a better integration with the host operating system when using VMware products. The main components of the VMware Tools include the VMware Tools service, device drivers (graphics, mouse, shared folders, etc.), user process and control panel. These components will no longer be needed after the conversion. So it's recommended that the VMware Tools service should be disabled in the guest operating system before the conversion, and you can remove the entire VMware Tools software after a successful conversion.

IMPORTING VMWARE VIRTUAL MACHINES USING ORACLE VM MANAGER

Oracle VM Manager allows you to import both Oracle VM virtual machines and VMware virtual machines in the VMDK format. When you import VMware virtual machines, Oracle VM Manager converts them to Oracle VM virtual machines automatically. This is known as a virtual to virtual machine conversion or, "V2V". When importing a VMware virtual machine, make sure you have enough free disk space to convert the VMware virtual machine to an Oracle VM virtual machine. Oracle VM requires at least twice the disk space of the VMware virtual machine under /*OVS*/*running_pool* directory because it will copy the original VMDK image as well as create a new Oracle VM image.

To import VMware VMDK images using Oracle VM Manager, follow the same process you would to import any other virtual machine image resource, generally from an external source (HTTP or FTP location), using the Import wizard. Or you can copy the VMDK image files manually into /*OVS*/*running_pool* directory. Oracle VM will automatically detect that the image is in the VMDK format and convert the image file to an Oracle VM format and deploy it to the specified Server Pool.

Figure 9: Deploying guest virtual machines created from a P2V or V2V conversion.

DEPLOYMENT OF VMS CREATED FROM P2V OR V2V CONVERSION

How the newly converted VMs are deployed and managed in Oracle VM Manager depends on several factors:

- Whether it was a P2V or V2V conversion.

- For P2V conversions only: Whether it was imported as an Oracle VM Template or Oracle VM Image (V2V converted images can only be

imported as Images but then could be saved as Templates. Refer to user documentation on the Save as Template feature in Oracle VM)

After importing, the status of the virtual machine template or virtual machine image is `Pending`. You need to approve it to make it available, and the status will be changed to `Active`. Then the imported virtual machine templates can be used to create virtual machines, while virtual machine images imported to Oracle VM Manager are used directly. You can consult the Oracle VM documentation for details on how to import and manage the virtual machine resources.

OTHER SPECIAL PLANNING CONSIDERATIONS

BIOS and LBA Support Issue

If you have older hardware with large IDE disks (100GB or larger) and a BIOS that doesn't support LBA (Logical Block Addressing), the converted virtual machine will not boot. You would have to import the operating system installation CD (or ISO); then boot from CD for the converted virtual image and reinstall the bootloader onto the converted image.

Cannot Use P2V Utility on Computer With Less Than 512MB RAM

The P2V utility fails to start on a computer with less than 512MB of RAM. The kernel panics with an error similar to:

VFS: Cannot open root device "<NULL>" or unknown block(0,21)
Please append a correct "root=" boot option
Kernel panic - not syncing: VFS: Unable to mount root fs on unknown-block(0,21)

P2V Utility Converts Only Four Disks to Virtual Disk Images

The P2V utility converts disks on the computer to virtual disk images. The virtual disk images are created as IDE disks (hda, hdb, hdc, hdd, and so on) on the guest, using the original disk names. Only the first four disks are included and deployed in the guest configuration file.

If there are more than four virtual disk images, the first four disks are created as IDE devices, and the remaining are created as SCSI devices and commented out in the guest configuration file.

To deploy the additional disks in the guest, edit the guest configuration file (*vm.cfg*), remove the comments from the disk entries, and map the additional disks to SCSI device names, for example, *sda*, *sdb*, and *sdc*. The boot disk must always be mapped to device *hda*. Any files on the guest which contain references to these devices must also be changed, for example, the */etc/fstab* file may contain references to */dev/hda1*, */dev/sda1*, and so on.

Disk Entries Out of Order in Guest Configuration File After Conversion With P2V Utility

After converting a computer with sda as the boot device to a hardware virtualized guest, the guest does not start (Power On). The computer may have a configuration similar to:

- The boot device is *sda*

- The secondary disk is *hda*

The P2V utility creates a guest configuration file entry similar to:

disk =
['file:/OVS/running_pool/myGuest/System-hda.img,hda,w',
'file:/OVS/running_pool/myGuest/System-sda.img,hdb,w',
]

The disk entries in the guest configuration file are not in the correct order.

To correct this, change the disk order in the guest configuration file (*vm.cfg*), for example:

disk =
['file:/OVS/running_pool/myGuest/System-hda.img,hdb,w',
'file:/OVS/running_pool/myGuest/System-sda.img,hda,w',
]

Oracle Enterprise Linux Release 4 Guests With Local SCSI Disks Created With P2V Utility Fail File System Check

An Oracle Enterprise Linux Release 4 guest with a local SCSI disk created with the P2V utility may fail the file system check when the guest is started. This occurs if a non-boot disk is configured as a SCSI disk in the guest configuration file. The error displayed is similar to the following:

Checking filesystems
/boot: clean, 35/130560 files, 31002/522080 blocks
fsck.ext3: Unable to resolve 'LABEL=/export0'
*** An error occurred during the file system check.
*** Dropping you to a shell; the system will reboot
*** when you leave the shell.
*** Warning -- SELinux is active
*** Disabling security enforcement for system recovery.
*** Run 'setenforce 1' to reenable.
Give root password for maintenance

To workaround this, comment out the SCSI disk entry in the */etc/fstab* file.

Alternatively, create a new **initrd** image with the */sbin/mkinitrd* script using the sym53c8xx module. The sym53c8xx module is for the LSI Logic/Symbios Logic 53c895a SCSI controller, which is the SCSI controller used for guests. To create a new **initrd** image on Oracle Enterprise Linux Release 4, Update 7:

 # grep ' /boot ' /proc/mounts > /dev/null 2>&1 || mount /boot
 # mv /boot/initrd-`uname -r`.img /boot/initrd-`uname -r`.img.orig
 # mkinitrd --with sd_mod --with=sym53c8xx /boot/initrd-`uname -r`.img `uname -r`

FREQUENTLY ASKED QUESTIONS

Q. Does the physical Oracle VM Server have to have the same hardware as my physical server?

Answer: No. But the Oracle VM server that hosts the converted images must be HVM capable.

Q. My old server had IDE drives but my new one has SATA so are there any issues?

Answer. No. There won't be any issues. The converted virtual machines are just files, and it doesn't matter what type of storage used by Oracle VM, as long as enough space is configured to store the files.

Q. My physical server used local storage so do I have to reconfigure manually on to shared storage with Oracle VM?

Answer: No. The local disks will be converted to image files that will then be deployed on your shared storage when the guest virtual machine is deployed to an Oracle VM Server Pool.

Q. Can I use P2V utility if my physical server is SAN booted?

Answer: Yes. You can use the P2V utility as long as the Oracle VM Server can see the disk drives when booting from Oracle VM Server install CD, so it doesn't matter whether they are SAN drives or any type of storage devices.

Q. What if my boot device is a SCSI RAID device in my physical server?

Answer: The P2V utility will see it as one disk device and migrate it into a flat file in the same way that it migrates IDE and SATA disk drives.

Q. If I use NFS or iSCSI in my physical server, do I need to change anything?

Answer: No. You should not need to make any changes as long as the system can access the NFS shares and iSCSI LUNs after the network has been reconfigured when you start the P2V process.

Q. Can I use P2V if LVM LUNs in my physical server are used?

Answer: Yes. The current P2V utility only recognizes disks, not LVM volumes. You can still use P2V as long as the disks you migrate contain all of the physical volumes that are part of the LVM volume groups so that your LVM configuration can be maintained through the transfer.

Q. If my internal devices are SATA devices, will they still be mapped as IDE devices and will that cause any problems?

Answer: Yes they will be mapped as IDE drives and it will not cause a problem.

Q. If I convert an Enterprise Linux server, will I get an HVM VM or a Paravirtualized VM?

Answer: It's converted to a hardware virtualized machine (HVM) since creation of a paravirtualized machine would require modifications to the kernel itself. The P2V conversion process does not change the kernel in any way. It only changes the image format and creates the appropriate meta-data configuration file (vm.cfg) for the guest virtual machine

Q. Are my storage devices copied for the P2V process and, if so, do I need to have additional storage capacity on my physical server to temporarily (or permanently) keep the copies?

Answer: No local copy in created: a copy is only created on the remote machine. You do not need any temporary storage on the physical system that you are migrating. The target system (to which

you are migrating the physical machine) needs to have enough storage capacity to hold all the disk drives you want to migrate.

Q. Do we give the guest virtual machine a new MAC address when we deploy it or does it retain the same MAC address as the physical server source?

Answer: By default the P2V will leave the VIF MAC parameter blank that means a random MAC will be assigned to it when the virtual machine is started. In addition, you can assign a MAC address manually by editing the guest configuration file or using the Oracle VM Manager interface.

Q. Is it a problem if the NICs in my source server are different from the NICs in my target Oracle VM Server?

Answer: It's not a problem. Once the system has been migrated it will detect that all the previous "physical" NICs are gone, and a virtual NIC has been added. The guest will not have knowledge about the hardware once it has been migrated.

Q. Once a VMware ESX guest has been V2Ved / imported into Oracle VM should the VMware tools be uninstalled? If yes will Oracle VM PV drivers need to be installed?

Answer: The VMware Tools service should be turned off before the conversion, and the VMware Tools can be removed after the successful conversion. The converted image is a HVM virtual machine. Then you can install PV driver if available for the best performance of the VM.

For Windows guests, the Windows PV driver should be installed if available by following the software installation instructions. For Linux guest, the installation of Xen PV driver is the same as converting a normal HVM format to paravirtualized guest.

1. *Install appropriate Xen kernel in the guest.*

2. *Update /etc/modprobe.conf to use Xen drivers, xennet for network and xenblk for block.*

3. *Re-create ramdisk for newly installed Xen kernel in guest via mkinitrd.*

4. *Configure vm.cfg appropriately on host to use PV directives, for example, pygrub bootloader for the new paravirtualized guest. (May require a re-import into Oracle VM Manager to reflect the guest as a paravirtualized virtual machine.)*

Q. Why do you need twice the space when importing a VMware image?

Answer: The original VMware image (VMDK) is downloaded (via HTTP) or copied to local disk first (/OVS/running_pool) before converting; the converted Oracle VM image is also stored at the same directory (/OVS/running_pool). So you'll need double the space of the original VMware image.

ADDITIONAL RESOURCES

With Oracle VM, Oracle demonstrates its on-going commitment to providing customers with integrated, scalable, and highly available infrastructure while lowering operating costs.

For more information, please visit http://oracle.com/virtualization.

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