Novell Virtualization on SUSE Linux Enterprise Server

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VIRTUALIZATION TECHNOLOGY

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Novell®

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Introduction and Technology Overview

1

Novell® SUSE Linux Enterprise Server® and Xen* hypervisor software combine to deliver Xen VM Server, a server platform that can host virtual machines. A *virtual machine* (*VM*) is an environment which appears to its “guest” operating system as actual computer hardware but is actually simulated by a “host” computer running Xen VM Server. Xen VM Server can host one or more VMs.

1.1 Introduction and Technology Overview

Novell SUSE Linux Enterprise Server and Xen hypervisor software combine to deliver Xen VM Server, a server platform that can host virtual machines. A *virtual machine* (*VM*) is an environment which appears to its “guest” operating system as actual computer hardware but is actually simulated by a “host” computer running Xen VM Server. Xen VM Server can host one or more VMs.

This section explains Xen VM Server, virtual machine technologies, and basic concepts.

1.1.1 Virtualization Terminology

The following clarifications can help you understand this document and virtual machine technology in Novell SUSE products.

- *Virtual machine (VM)* refers to an instance of a virtual hardware environment and the operating system that runs on it. A virtual machine could be running any type of software, such as server, client, or desktop. It is also called a virtual computer, guest, domain U, domU, or unprivileged domain.
- *Virtual Machine Server (VM Server)* refers to the physical computer and the software platform that combine to host VMs. It is also called a host, domain 0, or privileged domain. Much like the concept and usage of the term *Web server*, VM Server can be used to refer to the computer/software combination or just the software.
- *Xen VM Server* refers to the virtual machine server platform based on Xen open source software components.
- *Fully virtual* or *full virtualization* refers to a virtual machine mode that completely emulates all hardware devices.
- *Paravirtual* or *paravirtualized* refers to a virtual machine mode that requires the VM’s operating system to be optimized to run in a Xen VM Server environment. Operating systems that can run in paravirtual mode do not require hardware simulation, but instead use an API to interact with the host virtualization platform. Paravirtual mode delivers better performance than fully virtual mode and does not require special virtualiation technology hardware.

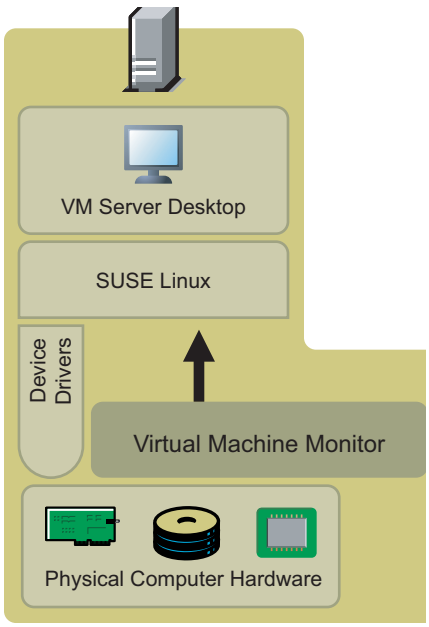
- *Paravirtualized operating system* refers to an operating system that is capable of running in paravirtual mode. It is also called a VM-aware, xen-enabled, modified, or optimized guest.
- *Native operating system* refers to the typical operating system that is not optimized for the virtual machine environment and must run in full virtualization mode. It cannot run in paravirtual mode. This type of operating system is also called shrink-wrapped, out-of-the-box, unmodified, or fully virtualized guest.
- *Virtualization technology (VT) computer* refers to a computer that supports virtualization technology, such as Intel* VT or AMD* Virtualization. VT computers work with Xen software to simulate the complete hardware environment, allowing an operating system to run without being optimized for the VM platform. A VT computer is required for an operating system to run in fully virtual mode.
- *Standard computer* refers to a computer that does not include special support for virtualization technology and cannot run operating systems that require full virtualization mode.
- *Virtual machine monitor (VMM)* and *hypervisor* refer to the software layer developed and maintained by the Xen open source community. This layer provides much of the Xen VM Server functionality.

1.1.2 About Xen Virtual Machine Server

The virtual machine monitor (VMM) runs between the server hardware and the SUSE Linux operating system kernel. When the computer boots, the VMM loads first and then starts Xen VM Server with the ability to create and control virtual machines. It runs in privileged mode, which means it has the ability to create and control other VMs and has direct access to the computer hardware.

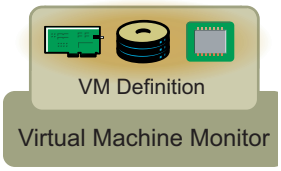
Xen VM Server is configured with native SUSE Linux device drivers that match the actual devices in the computer. For example, if the computer has a physical e1000 network card, Xen VM Server is configured to load and run the SUSE Linux device driver for the e1000.

Figure 1-1 *Virtual Machine Server and Device Drivers*



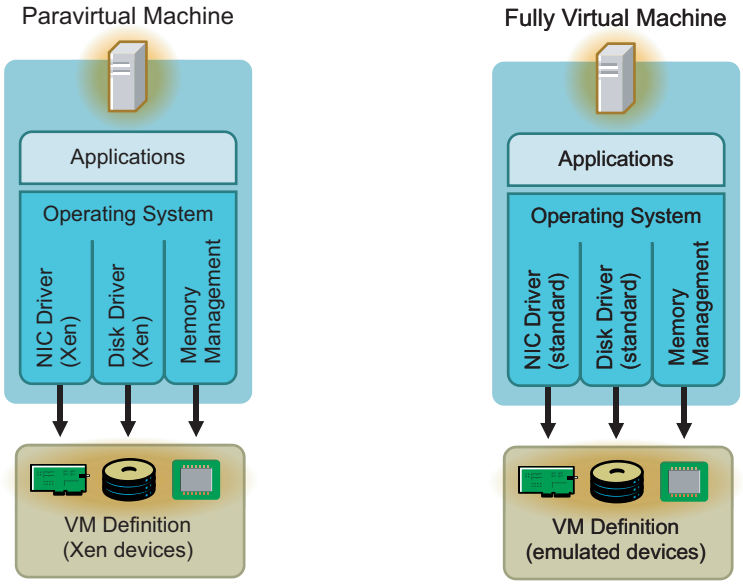
Virtual machines are defined and stored on Xen VM Server. The definitions (called *VM definitions*) are stored in a configuration file located at `/etc/xen/vm/vm_name`. The configuration file defines the virtual resources, such as CPU, memory, network card, and block devices that the operating system sees when it is installed and booted on the VM.

Figure 1-2 *Virtual Machine Definitions and the Virtual Machine Monitor*



In both full virtualization and paravirtual modes, a VM's operating system uses device drivers to interact with the VMM. In full virtualization mode, the operating system uses its native OS device drivers for a standard set of emulated devices, such as an AMD PCnet or NE2000* network card, an IDE disk drive, and a VGA graphics card. In paravirtual mode, the VM-aware operating systems include special device drivers (called *Xen drivers*) to communicate through the VMM and Xen VM Server to the physical devices in the computer.

Figure 1-3 *VM Device Drivers*

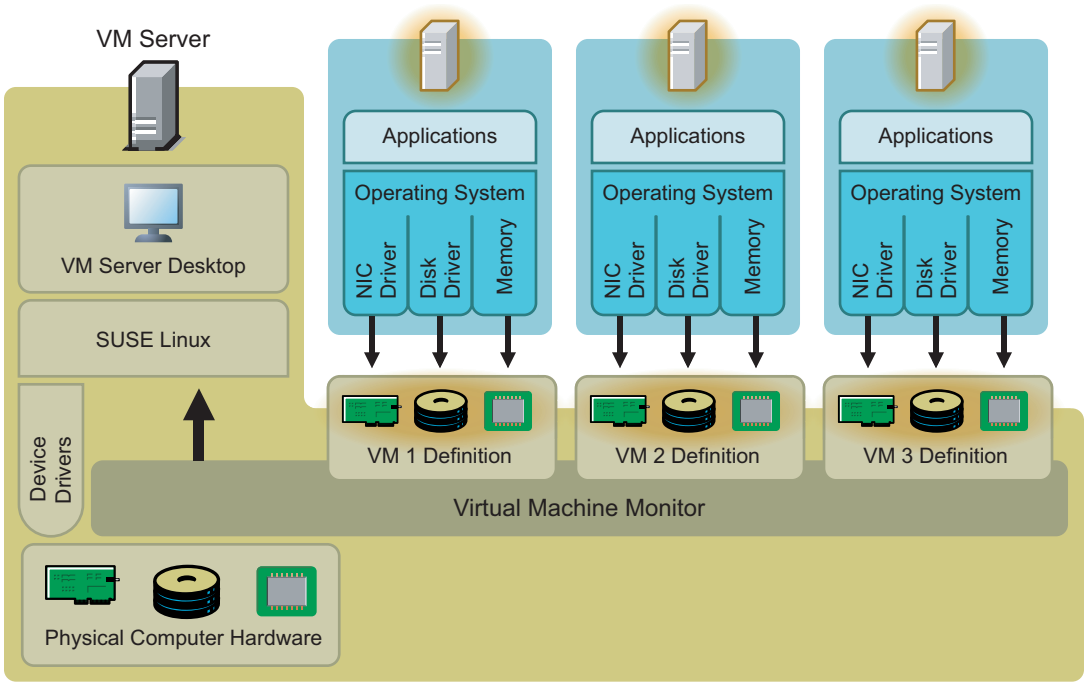


For example, if a VM's operating system running in full-virtualization mode needs to save a file on its virtual 20-GB disk drive, the operating system passes its request through the device driver to the VMM. The VMM understands which portion of the 500-GB physical disk the VM has access to and passes instructions to Xen VM Server. Xen VM Server accesses the disk drive and writes the file to the predefined location on the 500-GB disk.

Depending on your computing needs and available computer resources, any number of VMs can be created and can simultaneously run on Xen VM Server. The operating system of each VM interacts

independently with the VMM and Xen VM Server platform to consume virtual or emulated CPU, memory, block device, and network resources.

Figure 1-4 *Xen VM Server and Virtual Machines*



VMs can be viewed and managed from the VM Server desktop.

Figure 1-5 *Xen VM Server Desktop and Three Virtual Machines*

1.1.3 Comparing Fully Virtual Mode and Paravirtual Mode

VM Server hosts virtual machines running operating systems in one of two modes: *fully virtual* or *paravirtual*.

- **Fully virtual:** Complete emulation of all hardware devices. Although it requires special computer hardware, most operating systems can run in fully virtual mode because the VMM emulates all computer devices so the operating system behaves as if it has exclusive access to an entire computer. This complete emulation of computer hardware demands more CPU resources from VM Server. As a result, an operating system running in full virtualization mode runs slower.
- **Paravirtual:** Selective emulation of hardware devices. A paravirtualized operating system can run in paravirtual mode, which does not require complete emulation and therefore requires less management overhead. For example, VM-aware operating systems do not require an emulated graphics card, so Xen VM Server does not need to emulate video data. As a result, an operating system running in paravirtual mode demands fewer CPU resources and has better performance. It also requires no special computer hardware.

System and Software Requirements

2

This section contains the following information:

2.1 System and Software Requirements

To run virtual machines, you must meet the system and software requirements for Xen VM Server and the type of virtual machine require.

2.1.1 VM Server Requirements

A standard computer that meets the minimum system requirements for SUSE® Linux Enteprise Server 10 can run VM Server software and create VMs to run in paravirtual mode. A VT computer, employing such technology as Intel* VT or AMD* Virtualization to assist virtualization, can host VMs in both paravirtual and full virtualization modes.

System Architecture

Although SUSE Linux Enterprise Server can be installed on several types of computing platforms, Xen VM Server runs only on computers that support the x86-32 bit and x86-64 bit architectures. Currently, it does not run on computers using other architectures, such as Itanium* or IBM* POWER (formerly IBM iSeries and IBM pSeries systems).

VM Server and all VMs must be configured to run physical address extensions (PAE) if the computer running Xen VM Server is an x86-32 bit computer and Xen VM Server or any VM requires access to more than 3 GB of RAM.

The following tables list server system architectures, VM architectures, and the supported VM modes.

Table 2-1 *Standard Server Hardware and Supported VMs*

Server Architecture (standard)	VM Architecture: x86 -32	VM Architecture: x86 -32 with PAE	VM Architecture: x86 - 64
x86 - 32 bit	Paravirtual		
x86 - 32 bit with PAE*		Paravirtual	
x86 - 64 bit			Paravirtual

Table 2-2 *VT Server Hardware and Supported VMs*

Server Architecture (VT)	VM Architecture: x86 -32	VM Architecture: x86 -32 with PAE	VM Architecture: x86 - 64
x86 - 32 bit	Paravirtual, Fully virtual		
x86 - 32 bit with PAE	Fully virtual	Paravirtual only	
x86 - 64 bit	Fully virtual	Fully virtual	Paravirtual, Fully virtual

Disk Space, Memory, and Network Requirements

VM Server requires no additional disk space or memory above the SUSE Linux Enterprise Server 10 operating system requirements. In addition to the resources required for SLES 10, you should add additional memory and disk space for all planned VMs. You should also install at least one network card to use to connect to the network.

Table 2-3 *Disk Space, Memory, and Network Requirements*

Description	Requirement
Memory	In addition to the base amount recommended for SLES 10 (512 MB to 3 GB), add the amount of memory required for the operating systems of all virtual machines planned to run simultaneously.
Disk space	In addition to the 4 GB of disk space required for SUSE Linux, additional disk space might be required depending on the needs of each VM.
Network connectivity and IP addresses	VM Server requires an IP address to be obtained from a DHCP service or manually entered as a static, unchanging address.

In some cases, not all system memory is recognized by the VM Server or VM. The following table lists the theoretical maximums and the amount recognized.

Table 2-4 *Server Types and Recognized System Memory*

Server Type	Theoretical Maximum	Recognized by VM Server	Recognized by VM
x86 - 32 bit	4 GB	4 GB	2 GB
x86 - 32 bit with PAE	64 GB	16 GB	15 GB
x86 - 64 bit	4 TB	30 GB	Amount recognized by VM Server minus 2 GB

Software Requirements

VM Server requires the following software packages and their dependencies.

- `kernel-xen`
- `xen`
- `xen-tools`
- `xen-tools-ioemu` (required for full-virtualization mode)
- `kernel-xenpae` (used instead of `kernel-xen`, this package enables 32-bit computers to use PAE to access memory over 3 GB)
- `yast2-vm` (You should install the newest version available)

2.1.2 Virtual Machine Requirements

Virtual machines have few if any requirements above those required to run the operating system. If the operating system has not been optimized for the VM Server environment, the unmodified OS can run only on VT computer hardware, in full virtualization mode, and requires specific device drivers to be loaded.

This section includes general requirements for VMs. For more information about running specific operating systems on virtual machines, see Chapter 7, “Specific Operating Systems,” on page 43.

VM System Architectures

VM Server creates VMs for the x86-32 bit and x86-64 bit architectures only. It does not create virtual computers of other system architectures such as Itanium, IBM POWER (formerly IBM iSeries and IBM pSeries systems), Commodore* 64, TRS-80*, and Amiga* series computers.

VM Operating Systems

VM Server creates VMs for operating systems that are optimized to run in paravirtual mode. On VT computers, VM Server can create fully virtual VMs capable of hosting most popular operating systems not yet optimized for the VM environment. These not-optimized operating systems, such as Windows* and older versions of SUSE Linux, must run in full virtualization mode.

For requirements for a specific operating system, consult the operating system’s official documentation.

VM Network Card and Device Drivers

In full virtualization mode on VT computers, the VM emulates the following devices and requires the VM’s operating system to install, load, and run its native device drivers.

- Network card: AMD PCnet, NE2000
- Disk drive: IDE
- Graphics card: Cirrus Logic* GD5446, VESA-compliant VGA
- Input: PS/2 mouse and keyboard
- Sound: Creative* Sound Blaster 16, Ensoniq* ES1370

VM Network Connectivity

For each VM, you should obtain a unique IP address from a DHCP service, or manually enter it as a static, unchanging address.

Basic Instructions: Setting Up the VM Server and Virtual Machines

3

This section provides the following information:

3.1 Setting Up the VM Server and Virtual Machines

This section provides basic instructions for setting up and managing a VM Server and virtual machines. It includes the following sections:

3.1.1 Before You Begin

Before you begin setting up the VM server, you should understand the concepts related to virtualization technology in Chapter 1, “Introduction and Technology Overview,” on page 9. You should also review the following information resources that relate to your intended configuration.

Configuration	Resource
VM Server	• Section 2.1.1, “VM Server Requirements,” on page 15 • Chapter 4, “VM Server,” on page 27
VMs running in paravirtual mode	• Section 2.1.2, “Virtual Machine Requirements,” on page 17 • Chapter 5, “Virtual Machines (Paravirtual Mode),” on page 31
VMs running in fully virtual mode	• Chapter 6, “Virtual Machines (Full Virtualization Mode),” on page 39
Specific operating systems running on a VM	• Chapter 7, “Specific Operating Systems,” on page 43

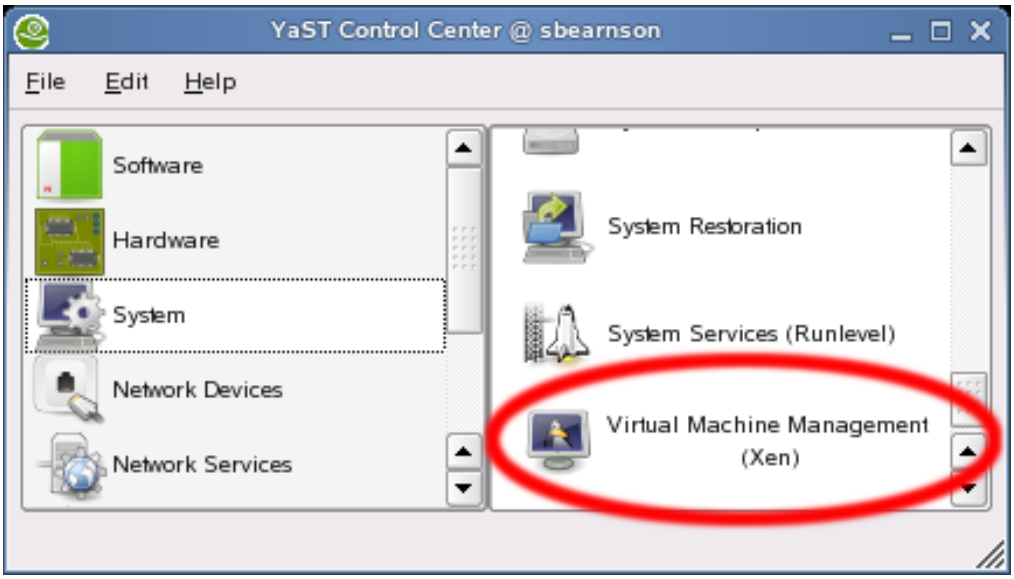
During and after installation, you might need to refer to the resources listed above for advanced configuration and troubleshooting information.

3.1.2 Setting up the Xen VM Server

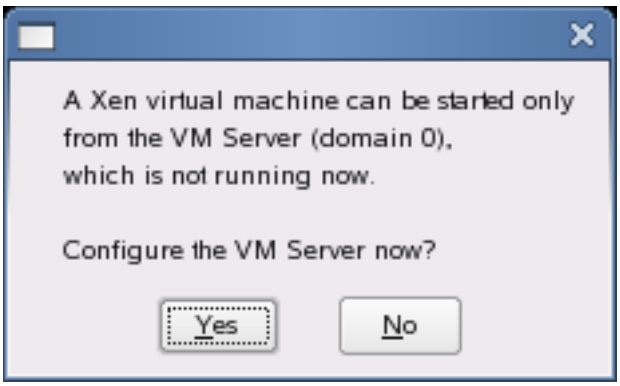
1 Verify that the computer meets the system requirements (see Chapter 2, “System and Software Requirements,” on page 15).

2 Install the VM Server software using one of the following methods:

- During the initial installation of the SLES 10, change the *Software* category to include the *Xen Virtual Machine Host Server* selection.
- After installation, run *YaST* > *System* > *Virtual Machine Management (Xen)*.



Click *Yes* in the following dialog box and complete the on-screen instructions.



- After installation, enter `yast2 xen` from a command line interface. Complete the same instructions as listed above for the GUI version of YaST.

When the Xen packages are correctly installed, the computer must be rebooted for the GRUB boot loader to present *Xen* as a boot option.

NOTE: Do not use other installation methods, such as *YaST* > *Software* > *Software Management* or *Software* > *Installation into Directory* because they do not perform the automatic configuration required to correctly run Xen VM Server.

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3 Restart the computer.

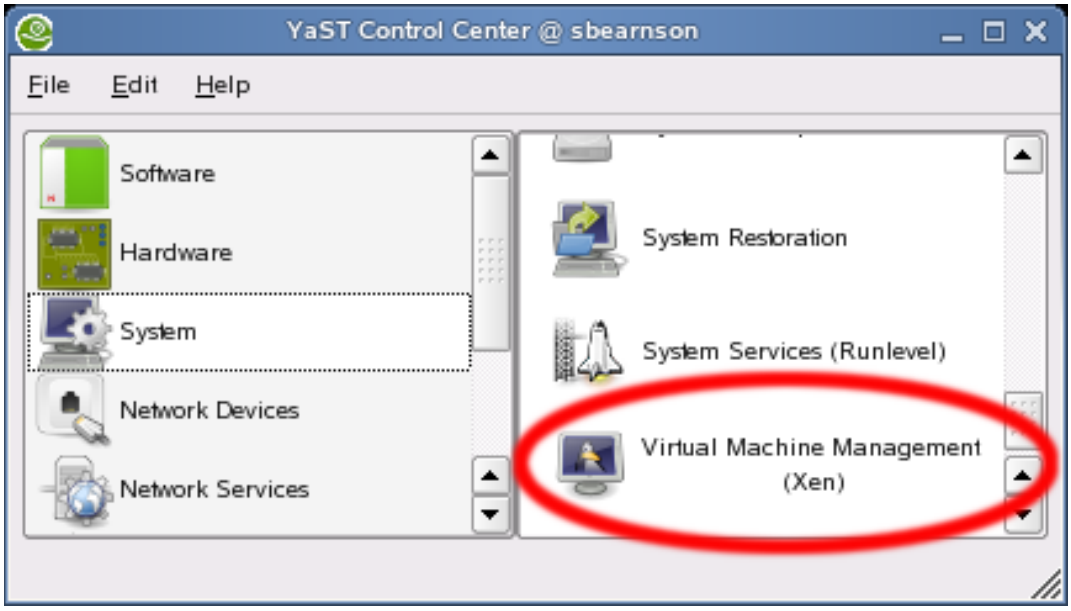
4 During the computer startup, select *SUSE Linux Enterprise Server 10 (Xen)* from the GRUB boot loader menu.

3.1.3 Creating a Virtual Machine (Paravirtual Mode)

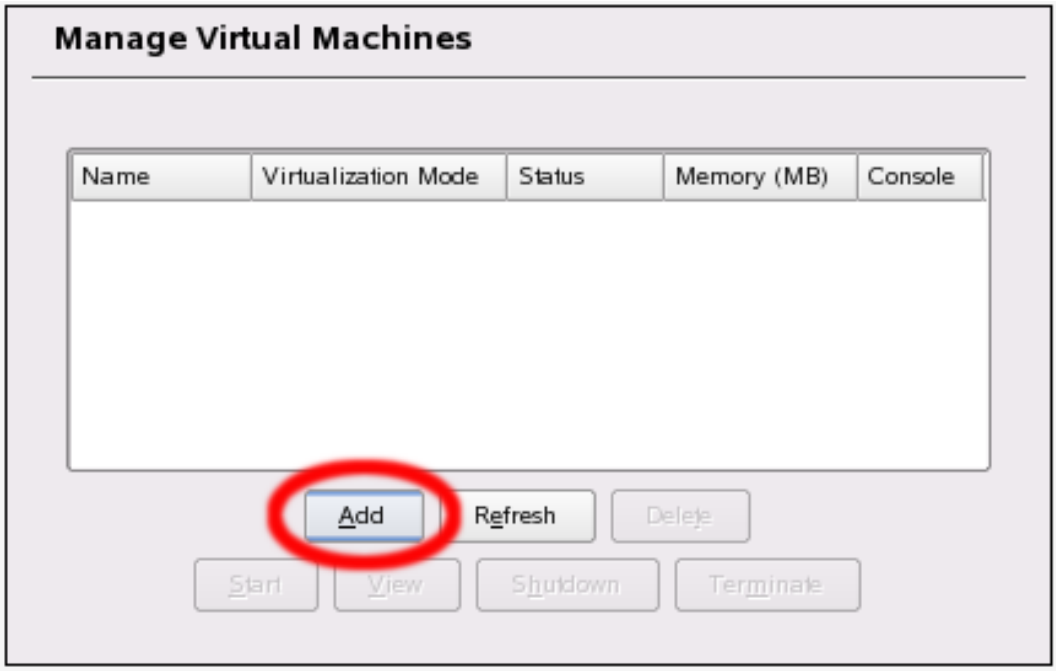
1 Make sure the computer has access to one of the following:

- OS installation program located on CD physical media or ISO image files. Before installing from CD, please review Section 5.1.12, "Working with Virtual CD Readers," on page 34.
- OS installation program configured as an installation source on the network.
- Disk image, partition, disk, or other type of block device with an already-installed operating system.

2 Click *YaST* > *System* > *Virtual Machine Management (Xen)* or enter `yast2 xen` from a command line interface.



The Manage Virtual Machines page displays all defined virtual machines.



3 Click *Add*.

4 Choose the method to set up the VM's operating system, then click *Next*.

- If you choose *Run an OS installation program*, continue to Step 5.
- If you choose *Use a disk image or a physical disk that contains OS boot files*, skip to Step 8.

5 Verify or change settings on the *Virtual Machine (Installation Settings)* page.

TIP: To run the OS installation program in a remote graphical session, change *Operating System Installation* > *Installation Options* to `textmode=0 vnc=1`.

---

6 Click *Next* to start the VM and launch the OS installation program.

- If you chose to run in a remote graphical session, a window displays the IP address and instructions for using the VNC viewer. To continue, open a terminal and enter `vncviewer ip_address:1` where *ip_address* is the IP address of the VM.
- In text mode, a window displays the first screen of the OS installation program.

7 Complete the OS installation program following the onscreen instructions.

The OS installation program prompts for basic installation settings, formats the virtual disk, and copies OS files.

At the conclusion of the file copy, the VM shuts down and waits to be restarted to continue the second portion of the OS installation program (depending on the type of OS).

8 Verify or change settings on the *Virtual Machine (Final Settings)* page. If you ran an OS installation program, some categories are already completed and do not appear.

9 Click *Next* to start the VM from OS files on the virtual disk.

- If you chose to run in a remote graphical session, a window displays the IP address and instructions for using the VNC viewer. To continue, open a terminal and enter `vncviewer ip_address:1` where *ip_address* is the IP address of the VM.
- In text mode, a window displays the text-based user interface of the OS.

If you have just installed the OS, the installation program continues.

10 Log in to the computer or follow the on-screen instructions to complete the OS installation.

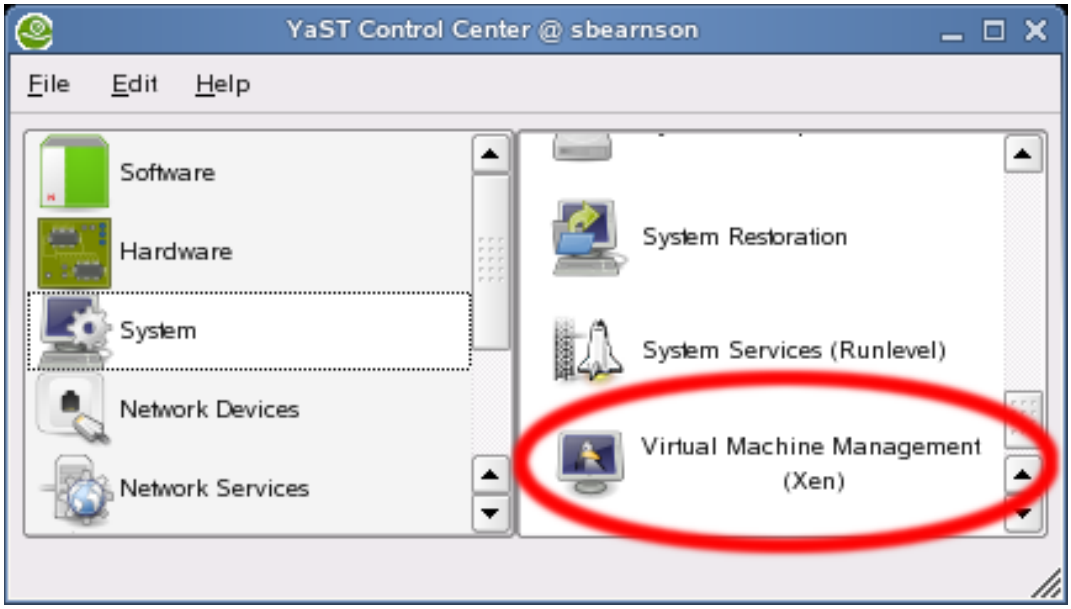
Depending on the OS, the *Manage Virtual Machines* page automatically appears and displays the status of the VM. If the page does not appear, you can view the status of the VM by clicking *YaST > System > Virtual Machine Management (Xen)*.

3.1.4 Creating a Virtual Machine (Full Virtualization Mode)

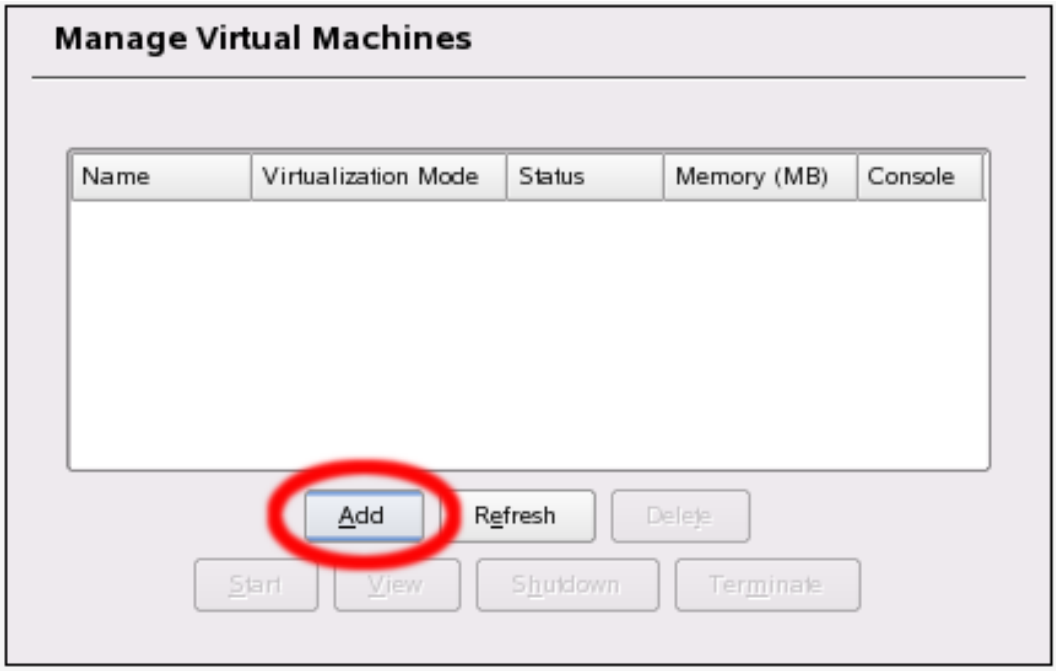
1 Make sure the computer has access to one of the following:

- OS installation program located on CD physical media or ISO image files mounted in the VM server's file system.
- Disk image, partition, disk, or other type of block device with an already-installed operating system.

2 Click *YaST > System > Virtual Machine Management (Xen)* or enter `yast2 xen` from a command line interface.



The Manage Virtual Machines page displays all defined virtual machines.



3 Click *Add*.

4 Choose the method to set up the VM's operating system, then click *Next*.

- If you choose *Run an OS installation program*, continue to Step 5.
- If you choose *Use a disk image or a physical disk that contains OS boot files*, skip to Step 8.

5 Verify or change settings on the *Virtual Machine (Installation Settings)* page.

6 Click *Next* to start the VM and launch the OS installation program.

A window displays the first page of the OS installation program.

7 Complete OS installation program by following the on-screen instructions.

The OS installation program prompts for basic installation settings, formats the virtual disk, and copies OS files.

At the conclusion of the file copy, the VM shuts down and waits to be restarted to continue the second portion of the OS installation program (depending on the type of OS).

TIP: To switch CD ISO images, press Ctrl+Alt+2 to open an HVMXen console. At the HVMXen console command line interface, enter `change cdrom cd2.iso` and replace *cd2.iso* with the name of the next CD ISO image file.

---

8 Verify or change settings on the *Virtual Machine (Final Settings)* page.

These are the settings that the OS recognizes when it boots. If you ran an OS installation program, some categories are already completed and do not appear.

9 Click *Next* to start the VM and boot the OS files on the virtual disk.

The first page of the OS displays. If you have just installed the OS, you might be prompted to continue the second portion of the installation program.

10 Log in to the computer or follow the on-screen instructions to complete the OS installation.

Depending on the OS, the *Manage Virtual Machines* screen automatically appears and displays the status of the VM. If the screen does not appear, you can view the status of the VM by clicking *YaST > System > Virtual Machine Management (Xen)*.

3.1.5 Managing Virtual Machines

The *YasT > System > Virtual Machine Management (Xen)* module lets you perform actions such as adding, viewing, starting, shutting down, and terminating VMs. The following information is also helpful.

File Locations

VM configuration files	`/etc/xen/vm/vm_name` where ***vm_name*** is the name you entered for the VM
Example VM configuration files	`/etc/xen/examples`
File-backed virtual disk images	`/var/lib/xen/images/`*`vm_name`*`/`*`disk_image`* where ***vm_name*** is the VM name and ***disk_image*** is the name of the disk image file

The xm Command

You can perform actions on VMs by using the `xm` command. In a terminal, log in as `root` and enter the desired command.

Command	Result
`xm help`	View a list of subcommands available for the `xm` command
`xm list`	View a list of all running virtual machines
`xm create /etc/xen/vm/`*`vm_name`*` -c`	Start and view a VM (paravirtual)
	(The VM starts and displays in the terminal window)
`xm create /etc/xen/vm/`*`vm_name`*	Start and view a VM (para or fully virtual)
	(A paravirtual VM starts and does not display. A fully virtual VM starts and displays according to the settings in the VM configuration file.)
`xm console `*`vm_name`*	View the console of an already-running VM (paravirtual)
`xm mem-set `*`vm_name MB_Memory`*	Change the memory available to a VM (paravirtual)
`xm shutdown `*`vm_name`*	A normal shutdown of the VM's operating system (paravirtual)
`xm destroy `*`vm_name`*	Terminate a VM immediately

Other Useful Actions

You can perform other useful actions on VMs.

Action	Result
Access the VM's OS console and complete the normal steps to shut down the operating system.	A normal shutdown of the VM's operating system (fully virtual)
Close the SDL viewer window.	Terminate a VM immediately (fully virtual)

VM Server

4

Basic instructions for setting up VM Server are found in Section 3.1.2, “Setting up the Xen VM Server,” on page 20. This document contains additional information to help you set up, run, and troubleshoot Xen VM Server.

4.1 VM Server

Basic instructions for setting up VM Server are found in Section 3.1.2, “Setting up the Xen VM Server,” on page 20. This document contains additional information to help you set up, run, and troubleshoot Xen VM Server.

4.1.1 Obtaining VM Server Software

Xen VM Server software packages are included with SUSE® Linux Enterprise Server 10. The pattern containing this set of packages is named *Xen Virtualization*. Updates are obtained through YaST Online Update.

4.1.2 Module edd Error Message During Installation

When the kernel-xen package is installed, you can ignore messages stating “`Cannot determine dependencies of module edd.`” The message might be repeated two or three times during installation. (179409)

4.1.3 Installing VM Server Software

If you did not install the VM Server software during the initial server installation, make sure to install it using the *YaST > System > Virtual Machine Management (Xen)* module only. Do not use other installation methods, such as *YaST > Software > Software Management* because they do not perform the automatic configuration required to correctly run VM Server.

4.1.4 Setting up the VM Server

Basic instructions for installing software and setting up the VM Server are in Section 3.1.2, “Setting up the Xen VM Server,” on page 20.

4.1.5 Hardware Support Issues

Some computer hardware is not supported by the Xen hypervisor or domain 0 kernel.

- Devices on the ISA or PCMCIA bus tend not to work.
- ISA DMA is not supported by Xen.
- ACPI support in Xen is improving, but might not be up-to-date with respect to Linux.
- Some large-memory machines might not boot with ACPI enabled.

4.1.6 Power Management Features

Power management features, such as the suspend-to-disk feature, are not supported and should be disabled on the VM Server and all VMs.

4.1.7 Verifying that Packages are Installed and Running

There are a few methods you can use to verify that theVM Server is running. Each method requires you to access the command line interface or terminal and log in as the `root` user.

- Enter `rpm -qa | grep xen` and verify that the Xen VM Server packages are installed.
- Enter `xm list`. The command should display Xen VM Server (as Domain-0) and its properties.
- Enter `uname -r` and verify that the kernel version includes the word *xen*.

4.1.8 Checking the GRUB Boot Loader

When the Xen software packages are installed, the GRUB boot loader is automatically updated to present Xen VM Server as a boot option. The GRUB boot loader configuration file is usually saved to `/boot/grub/menu.lst`.

You can compare your GRUB boot loader configuration file with the examples below to confirm that it was updated to correctly boot Xen VM Server. The first example shows a typical GRUB boot loader file updated to load Xen VM Server software. The second example shows a GRUB boot loader file that loads the Xen VM Server PAE-enabled kernel, which allows 32-bit computers to access memory over 3 GB.

Sample GRUB Boot Loader File (Typical)

```
title XEN
 root (hd0,5)
 kernel /boot/xen.gz hyper_parameters
 module /boot/vmlinuz-xen kernel_parameters
 module /boot/initrd-xen
```

Sample GRUB Boot Loader File (PAE)

```
title XEN
 root (hd0,5)
 kernel /boot/xen-pae.gz hyper_parameters
 module /boot/vmlinuz-xenpae kernel_parameters
 module /boot/initrd-xenpae
```

The `title` line specifies the name of the GRUB module. Do not change this line because YaST looks for the word *XEN* to verify that packages are installed.

The `root` line specifies which partition holds the boot partition and `/boot` directory. Replace (`hd0,5`) with the correct partition. For example, if the drive designated as `hda1` holds the `/boot` directory, the entry would be (`hd0,0`).

The `kernel` line specifies the directory and filename of the hypervisor software. Replace *hyper_parameters* with the parameters to pass to the hypervisor. A common parameter is `dom0_mem=`*`amount_of_memory`*, which specifies how much memory to allocate to Xen VM Server. The amount of memory is specified in KB, or you can specify the units, for example 128M. If the amount is not specified, Xen VM Server takes the maximum possible memory for its operations. For more information about hypervisor parameters, see the XenSource Web Site (http://www.xensource.com).

The first `module` line specifies the directory and filename of the Linux kernel to load. Replace *kernel_parameters* with the parameters to pass to the kernel. These parameters are the same parameters as those that can be passed to a standard Linux kernel on physical computer hardware.

The second `module` line specifies the directory and filename of the RAM disk used to boot Xen VM Server.

4.1.9 VM Server Boots in Text Mode

If selecting the Xen option from the GRUB boot loader menu loads the VM server in text mode, the graphics card is probably not configured correctly. To properly configure the graphics card so you can switch to graphical mode, complete the following steps:

1. When the computer boots and loads the GRUB boot loader menu, select the option that includes the word *xen*.

   The computer boots and displays a command prompt.
2. At the command prompt, enter `init 3` to make sure you are in text mode.
3. Enter `sax2` to run the sax graphical configuration module.
4. Configure the GUI as desired.
5. Enter `init 5` to switch to GUI mode.

Virtual Machines (Paravirtual Mode)

5

This section contains the following information:

5.1 Virtual Machines (Paravirtual Mode)

This section contains the latest issues and information common to all operating systems running in paravirtual mode on the VM Server. It contains the following subsections:

5.1.1 Creating a Paravirtual VM

Basic instructions for creating a paravirtual VM are in Section 3.1.3, “Creating a Virtual Machine (Paravirtual Mode),” on page 21.

5.1.2 Working with a Specific Operating System

Information in this section is common to all operating systems running in paravirtual mode. Before creating or running a VM, you should review issues related to its specific operating system in Chapter 7, “Specific Operating Systems,” on page 43 .

5.1.3 Power Management Features

Power management features, such as the suspend-to-disk feature, are not supported and should be disabled on the VM Server and all VMs.

5.1.4 Virtual Disk Performance Settings

For best performance, create each virtual disk from an entire disk or a partition. For next best performance, create an image file but do not create it as a sparse image file. A virtual disk based on a sparse image file delivers the most disk-space flexibility but the slowest installation and disk access speeds. (179409)

5.1.5 File-Backed Virtual Disks and Write Modes

By default, a VM's virtual disk uses asynchronous write mode to write data to the disk. Asynchronous write mode dramatically improves VM system-to-disk performance because the VM Server can buffer data before actually writing to disk. Although it delivers better performance, the asynchronous write mode might corrupt the file system if the VM is using a file-backed virtual disk and the VM server has a system crash or power outage. This is because Xen does not support *write barriers*, which preserve the order of data being written to disk.

A virtual disk using synchronous write mode maintains file system integrity in the event of a system crash, but significantly slows write-to-disk performance by executing each write-to-disk activity before continuing. In synchronous write mode, the VM Server does not cache data.

To change between modes, append or remove the `S` flag to the existing writable flag in the `disk` line in the VM's configuration file. This mode is set per disk.

For example, the first statement specifies asynchronous disk-write mode (no `S`). The second statement specifies synchronous write mode (added `S`).

```
disk = [ 'file:/var/lib/xen/images/vm1/hda,hda,w' , 'phy:/dev/
hdb,hdb,w' ]
```

```
disk = [ 'file:/var/lib/xen/images/vm1/hda,hda,wS', 'phy:/dev/
hdb,hdb,w' ]
```

5.1.6 VM Hardware Clock Settings

If you are installing a paravirtualized Linux OS, you should choose *UTC* as the VM's hardware clock setting. Choose *Local Time* if you are installing a paravirtualized OS that does not recognize the UTC setting, such as NetWare.

5.1.7 Using the Manage Virtual Machine Page

The following commands are available by running the Virtual Machine Management (Xen) module on the VM Server desktop.

1. On the VM Server desktop, click *YaST* > *System* > *Virtual Machine Management (Xen)*.

   The Manage Virtual Machines page displays all VMs.

2. From the Manage Virtual Machines page, you can perform the following actions.
   - *Add* starts the process to create a new VM.
   - *Start* boots the operating system of the selected VM.
   - *Refresh* displays the current status of all VMs.
   - *Delete* completely removes the selected VM.

- *View* displays the command console for the selected VM.
- *Shutdown* performs a normal shutdown of the selected VM.
- *Terminate* acts as if power is shut off to the selected VM.

5.1.8 Useful File Locations

Files	Location
VM configuration files	`/etc/xen/vm/vm_name` where ***vm_name*** is the name you entered for the VM
Example VM configuration files	`/etc/xen/examples`
File-backed virtual disk images	`/var/lib/xen/images/`*`vm_name`*`/`*`disk_image`* where ***vm_name*** is the VM name and ***disk_image*** is the name of the disk image file

5.1.9 Using the xm Command

You can perform actions on VMs by using the `xm` command. In a terminal, log in as `root` and enter the desired command.

Command	Action
`xm help`	View a list of actions available for the `xm` command
`xm list`	View a list of all running virtual machines
`xm create /etc/xen/vm/`*`vm_name`*` -c`	Start and view a VM (paravirtual)
	(The VM starts and displays in the terminal window)
`xm console `*`vm_name`*	View the console of an already-running VM
`xm mem-set `*`vm_name MB_Memory`*	Change the memory available to a VM
`xm shutdown `*`vm_name`*	Perform a normal shutdown of the VM's operating system
`xm destroy `*`vm_name`*	Terminate a VM immediately

5.1.10 Using a Remote Graphical Session to Log In to a VM

You can use a remote graphical session to log into a VM.This procedure describes using the VNC viewer.

1. Start the VM.
2. Make sure remote administration is allowed on the VM. (You only need to do this once for each VM.)
   - **2a** Log in to the VM in text mode.
   - **2b** At the command prompt, enter `yast2` to run the text version of YaST.
   - **2c** Select *Network Services* > *Remote Administration*.

2d Select the box to allow remote administration.

2e Click *Finish* and then exit YaST.

2f At the command prompt, enter `rcxdm restart`.

3 On the Xen VM Server desktop, open a new terminal.

4 In the new terminal, enter `vncviewer ip_address:1` where *ip_address* is the IP address of the VM.

TIP: To get the IP address, select the VM in the Manage Virtual Machines window, click *View*, log in as `root`, and then enter `ifconfig` at the command prompt.

You could also log in to the VM by entering `http://vm_ip_address:5801` in a Web browser running on any network-attached computer.

You can also log in to a VM using other access methods, such as SSH.

5.1.11 Disabling Virtual Hardware Clock Synchronization

A paravirtualized OS gets its clock time by continuously synchronizing with the VM Server clock. If you want the OS to get its clock time from another source, such as an NTP server, you must disable the VM Server clock synchronization.

1 Log in to the VM's OS as `root`.

2 In a terminal, enter `cat /proc/sys/xen/independent_wallclock` to view the VM's current clock synchronization setting.

- `0` means it is being synchronized with Xen VM Server.
- `1` means it is not being synchronized with Xen VM Server.

3 Change the setting.

- To disable synchronization permanently, add `xen.independent_wallclock = 1` to the VM's `/etc/sysctl.conf` file.
- To temporarily disable synchronization until the next reboot, enter `echo "1" > /proc/sys/xen/independent_wallclock` at the VM's command prompt. Replace `1` with `0` to enable synchronization.

5.1.12 Working with Virtual CD Readers

The following information might help resolve issues related to virtual CD readers. All issues relate to both CD and DVD media and readers.

- "About Paravirtual CD Readers" on page 35
- "Ejecting and Switching CDs" on page 35
- "VM CD Reader Cannot Access Installation Media" on page 35
- "Attaching a CD Reader" on page 35
- "Detaching a CD Reader" on page 36
- "Adding a Virtual CD Reader" on page 36
- "Attaching a Virtual CD Drive with a Different Drive Designation" on page 37
- "Using a CD As an Installation Source" on page 37

About Paravirtual CD Readers

A paravirtual VM accesses CD or DVD media by attaching a CD reader as a fixed block device, not as a removable media device. For this reason, typical commands associated with CD readers, such as `eject` or `autorun`, do not work. Writing to the CD is not possible from a paravirtualized VM (even if you specify the block device as -w).

Accessing and ejecting the CD is still possible, but must be done using the VM Server terminal commands `attach` and `detach`. For example, instead of using the eject command (or simply pressing the eject button on the reader) to eject the CD from the reader, you must detach the CD reader from the VM using the detach command. After the CD reader detaches, the CD can then be safely removed from the CD reader. To read another CD, you must insert the CD and reattach the CD reader.

Some applications running are programmed to specifically recognize the CD reader. This type of application might not be able to access the CD media, even though it is attached as a block device.

Ejecting and Switching CDs

You might need to press the eject button twice to eject a CD on a paravirtual VM. When you insert a CD, make sure to pause long enough for the CD to be recognized by the VM Server. If the inserted CD cannot be read, you should detach and reattach the VM to the CD reader.

VM CD Reader Cannot Access Installation Media

When installing software from CD, you might receive a message stating "`Cannot access installation media...`" If inserting the CD and choosing OK does not read the newly inserted CD but returns the same message, you should detach and reattach the VM to the CD reader.

Attaching a CD Reader

To attach a CD reader to a VM:

1. Make sure the CD reader is detached by following the instructions in "Detaching a CD Reader" on page 36.
2. Make sure the desired CD is inserted in the CD reader.

   TIP: Give VM Server enough time to recognize the CD before continuing.

3. Open a VM Server terminal, then enter the following command:

   `xm block-attach` *`vm_id device_type:/path/device_name virtual_device_name rights`*

   where:

   - *`vm_id`* is the ID number of the VM. For example, `1`.
   - *`device_type:/path/device_name`* is the device type, location, and name of the CD reader. For example, `phy:/dev/hdc`
   - *`virtual_device_name`* is the device name to present to the VM. For example, `hdb`.
   - *`rights`* are the access rights to the device, such as `r`.

   For example, the command to attach `hdc` as a CD reader on VM 1 is:

   ```
   xm block-attach 1 phy:/dev/hdc hdb r
   ```

TIP: If you are reattaching a CD reader, you can view the device information by opening the VM Server's file at `/etc/xen/vm/vm_name` where *vm_name* is the name of the VM. The device information is part of the `disk` entry line. It begins with `phy:` and is usually listed near the end of the output string. Remember to use spaces instead of commas between the parameters.

The CD should now be accessible to the VM.

Detaching a CD Reader

To detach a CD reader:

1 Enter `xm block-detach vm_id Vdev_number` in a VM Server terminal.

This command detaches the connection between the VM and the CD reader. For example, `xm block-detach 1 832` detaches the connection between VM with an ID of 1 and the device with a Vdev of 832.

TIP: Get the relevant information for the command by performing the following actions:

- VM ID: Open a terminal on the VM Server desktop and enter `xm list`.
- Vdev number: Enter `xm block-list vm_id` where *vm_id* is the ID number of the VM. The last device displayed in the list usually represents the CD reader, because the first devices are usually disk drives.

Sometimes, even after entering the command, the virtual CD reader does not detach correctly. If this happens, you can attach the virtual CD reader with a new drive designation. (See "Attaching a Virtual CD Drive with a Different Drive Designation" on page 37.)

Adding a Virtual CD Reader

Attaching to a CD reader makes it available until you reboot the VM. To make a CD reader available after rebooting, complete the following instructions.

1 On the VM Server desktop, open the VM's configuration file at /etc/xen/vm/*vm_name* where *vm_name* is the name of the VM.

2 Edit the `disk` entry line to include the CD information using the syntax:

device_type:/path/device_name virtual_device_name rights

where:

- *device_type:/path/device_name* is the device type, location, and name of the CD reader. For example, `phy:/dev/hdc`
- *virtual_device_name* is the device name to present to the VM. For example, `hdb`.
- *rights* are the access rights to the device, such as `r`.

For example, the following string specifies a virtual disk (based on a file) and no CD reader:

```
disk = [ 'file:/var/lib/xen/images/vm1/hda,hda,w' ]
```

The following string adds a CD reader identified as `hdc` and recognized by the VM as `hdb`:

```
disk = [ 'file:/var/lib/xen/images/vm1/hda,hda,w' , 'phy:/dev/
hdc,hdb,r' ]
```

3 Save and close the file.

4 Reboot the VM to make the virtual CD reader available.

Attaching a Virtual CD Drive with a Different Drive Designation

You can temporarily change the virtual CD drive designation using either of the methods described below. This is useful if the existing virtual CD reader is not functioning correctly and will not detach or attach.

The temporary drive designation is available for the current VM session only. When the VM reboots, the former drive designation, as defined in the VM configuration file, returns.

The first method is performed from a terminal on the VM Server desktop. The second method is performed when you receive the message stating, "`Cannot access installation media...`" These methods might also be useful when working with disk drives, partitions, volumes, or other types of block devices.

Attaching From a Terminal

1 Make sure the desired CD is inserted and has spun up in the CD reader.

2 Open a terminal and enter the following command but specify a different virtual drive designation than originally specified.

```
xm block-attach vm_id device_type:/path/device_name
virtual_device_name rights
```

For example, you could specify the drive designation as `hdb` instead of `hdc`, such as changing `phy:/dev/hdc,hdb,r` to `phy:/dev/hdc,hdc,r`.

Attaching from the "Cannot Access Installation Media" Message

1 Insert the CD into the CD reader.

2 Access the CD from the VM.

3 When the "`Cannot Access Installation Media...`" message displays, press Alt+d to view the details.

4 Press Alt+u to change the URL.

5 In the URL field, change the virtual drive designation of the CD reader. For example, you could change the VM to recognize the CD reader as `hdc` instead of `hdb`, such as changing `phy:/dev/hdc,hdb,r` to `phy:/dev/hdc,hdc,r`.

6 Make sure the desired CD is inserted and spinning in the CD reader.

7 Choose *OK* to read the CD.

Using a CD As an Installation Source

The VM does not differentiate between a CD reader and a fixed disk device; therefore, a CD cannot be configured as a CD or DVD installation source, but must be configured as a virtual drive by specifying a URL..

Complete the following instructions to set up and access a CD as an installation source:

1 Make sure the correct CD installation media is in the CD reader.

2 From the VM's desktop, run the *YaST* > *Software* > *Installation Source* module.

3. Press *Add* > *Specify URL*.
4. Specify the URL as `hd:///?device=/path/drive_designation` where *drive_designation* is the drive designation of the physical CD reader.

   For example, for a CD reader with the path and drive designation `/dev/hdc`, enter `hd:///?device=/dev/hdc`
5. Make sure the new installation source is enabled, then choose *Finish*.

The CD installation source is now accessible through the *YaST* > *Software* > *Software Management* module.

Virtual Machines (Full Virtualization Mode)

6

This section contains the following information:

6.1 Virtual Machines (Full Virtualization Mode)

This section contains the latest issues and information common to all operating systems running in full virtualization mode on the VM Server. It contains the following subsections:

6.1.1 Creating a Fully Virtual VM

Basic instructions for creating a fully virtual VM are in Section 3.1.4, “Creating a Virtual Machine (Full Virtualization Mode),” on page 23.

6.1.2 Working with a Specific Operating System

Information in this section is common to all operating systems running in fully virtual mode. Before creating or running a fully virtual VM, you should review issues related to its specific operating system in Chapter 7, “Specific Operating Systems,” on page 43 .

6.1.3 Power Management Features

Power management features, such as the suspend-to-disk feature, are not supported and should be disabled on the VM Server and all VMs.

6.1.4 Virtual Disk Performance Settings

For best performance, create each virtual disk from an entire disk or a partition. For next best performance, create an image file but do not create it as a sparse image file. A virtual disk based on a sparse image file delivers the most disk-space flexibility but the slowest installation and disk access speeds. (179409)

6.1.5 File-Backed Virtual Disks and Write Modes

By default, a VM's virtual disk uses asynchronous write mode to write data to the disk. Asynchronous write mode dramatically improves VM system-to-disk performance because the VM Server can buffer data before actually writing to disk. Although it delivers better performance, the asynchronous write mode might corrupt the file system if the VM is using a file-backed virtual disk and the VM server has a system crash or power outage. This is because Xen does not support *write barriers*, which preserve the order of data being written to disk.

A virtual disk using synchronous write mode maintains file system integrity in the event of a system crash, but significantly slows write-to-disk performance by executing each write-to-disk activity before continuing. In synchronous write mode, the VM Server does not cache data.

To change between modes, append or remove the `S` flag to the existing writable flag in the `disk` line in the VM's configuration file. This mode is set per disk.

For example, the first statement specifies asynchronous disk-write mode (no `S`). The second statement specifies synchronous write mode (added `S`).

```
disk = [ 'file:/var/lib/xen/images/vm1/hda,hda,w' , 'phy:/dev/
hdb,hdb,w' ]
```

```
disk = [ 'file:/var/lib/xen/images/vm1/hda,hda,wS', 'phy:/dev/
hdb,hdb,w' ]
```

6.1.6 Using the Manage Virtual Machines Page

The following commands are available by running the Virtual Machine Management (Xen) module on the Xen VM Server desktop.

1. On the VM Server desktop, click *YaST > System > Virtual Machine Management (Xen)*.

   The Manage Virtual Machines page displays all VMs.

2. From the Manage Virtual Machines page, you can perform the following actions:
   - *Add* starts the process to create a new VM.
   - *Start* boots the operating system of the selected VM and displays it in a new window.
   - *Refresh* displays the current status of all VMs.
   - *Delete* completely removes the selected VM.
   - *View* displays the command console for the selected VM.
   - *Shutdown* performs a normal shutdown of the selected VM.
   - *Terminate* acts as if power is shut off to the selected VM.

6.1.7 Viewing the VM

- To view the VM in the VNC viewer, open a terminal and enter `vncviewer` *`ip_address`*`:`*`vm_id`* where `ip_address` is the IP address of VM Server and `vm_id` is the VM's ID number.
- The TightVNC viewer (used by default) does not automatically resize when the VM's screen size changes. To view the entire screen, close the VNC viewer and start a new VNC viewer session each time you need to resize the screen.
- To view the VM using the VNC viewer instead of text mode, change the `vnc=0` setting to `vnc=1` in the VM's config file (`/etc/xen/vm/vm_name`).
- If you replace the TightVNC viewer with a different VNC viewer, such as Real VNC, the VM window might resize automatically.
- If the VM crashes while the mouse is constrained by the VM window, the mouse might be lost. To restore it, start another VM, then repeatedly press Ctrl+Alt until the mouse reappears. Then move the mouse to the applicable VM window.

6.1.8 Helpful Keystrokes

When running or setting up a VM in full virtualization mode, you can use the following commands and key combinations:

- Ctrl+Alt+1 to view the HVMXen control window
- Ctrl+Alt+2 to get a command line interface to the HVMXen console
- Ctrl+Alt+3 to view output from the virtual serial port; most useful for debugging
- Ctrl+Alt to release mouse from VM window
- `send-key` *`keystrokes`* to enter keystrokes in the HVMXen control window. For example, entering `send-key ctrl+alt+f1` on the command line switches between the VM's text and GUI views. This command is only available when using the command line interface (Ctrl+Alt+2)
- `change cdrom` *`cd2.iso`* to switch to another CD ISO image. Enter the command from the HVMXen console command line interface and replace *cd2.iso* with the name of the CD ISO image file

6.1.9 Useful File Locations

Files	Location
VM configuration files	`/etc/xen/vm/vm_name` where ***vm_name*** is the name you entered for the VM
Example VM configuration files	`/etc/xen/examples`
File-backed virtual disk images	`/var/lib/xen/images/`*`vm_name`*`/`*`disk_image`* where ***vm_name*** is the VM name and ***disk_image*** is the name of the disk image file

6.1.10 Using the xm Command

You can perform actions on VMs by using the `xm` command. In a terminal, log in as `root` and enter the desired command.

Command	Action
`xm help`	View a list of actions available for the `xm` command
`xm list`	View a list of all running virtual machines
`xm create /etc/xen/vm/`*`vm_name`*	To start and view a VM
	(The VM starts and displays in a separate SDL viewer window)
`xm destroy` *`vm_name`*	To terminate a VM immediately

6.1.11 Available Memory

Fully-virtualized VMs can crash, especially when running heavy loads, if not enough free memory is available for Xen. Xen does not yet flush the shadow page cache when memory becomes low, which can result in an artificial out-of-memory condition. As a workaround, manually shrink the Xen VM Server's memory (to leave some amount free for use by Xen) with a command such as `xm mem-set 0 384`

6.1.12 Using VNC Viewer to View Fully Virtual VMs

By default, the VM Server uses the SDL viewer to view fully virtual guests, but you can change the setting to use the VNC viewer. If you change to the VNC viewer, make sure remote administration is disabled on the VM Server. If remote administration is disabled, entering `vncviewer VM_server_ip_address:VM_ID` in a terminal displays the VM (matching the ID) in the VNC viewer. If remote administration is enabled, the VNC viewer displays the VM Server's login prompt, not the intended VM.

TIP: You might need to reboot the VM Server to disable remote administration.

Specific Operating Systems

7

This section contains the following information:

7.1 SLES 10: Paravirtual Mode VM

This platform running on a virtual machine on SUSE Linux Enterprise Server 10 is supported by Novell®. If you discover significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.1.1 Sparse Image File Increases Installation Time

Specifying a sparse image file as the VM’s bootable disk might extend the OS installation time by several hours. Choosing not to use a sparse image file dramatically reduces the installation time.

7.1.2 Direct Access to PCI Devices

A paravirtual-mode VM can be configured to have direct and exclusive access to a physical PCI device, such as a network card. To configure the PCI device, it must be unbound from the backend domain (VM Server) and made available to a VM using the pciback kernel loadable module.

1. Access the VM server's console or open a terminal.
2. Enter `lspci` and note the device ID which is the hexadecimal domain/bus/device/function, such as `0000:02:00.0`, of the device you intend to make available to the VM.

   The device ID might be specified with or without a domain. For example, `0000:02:00.0` uses a domain:bus:device.function syntax and `02:00.0` uses a bus:device.function syntax.
3. List the contents of the `/sys/bus/pci/drivers/`*`driver`* directory to verify that there is a symbolic link to the device ID. Replace *`driver`* with the device directory name, such as `e1000`, of the currently bound PCI device.
4. Write the device ID to the `unbind` file by entering the following command:

   `echo -n `*`device_ID`*` > /sys/bus/pci/drivers/`*`driver`*`/unbind`
5. Enter `modprobe pciback` to load the pciback module and create the `pciback` directory.
6. Enter the following command to assign the device to the pciback module:

   `echo -n `*`device_ID`*` > /sys/bus/pci/drivers/pciback/new_slot`

   The PCI device ID is written to the `new_slot` file so that the pciback module knows to control the device.
7. Enter the following command to write the device ID to the `bind` file so the device is recognized and can be made available to a VM:

   `echo -n `*`device_ID`*` > /sys/bus/pci/drivers/pciback/bind`
8. Make the PCI device available to the appropriate VM using one of the following methods:
   - Modify the VM configuration file to include the following python list entry specifying one or more device IDs.

     `pci=['device_ID_1','device_ID_2']`
   - Start the VM using the following command:

     `xm create -c pci=`*`device_ID VM_config_file`*

You can return the PCI device to general availability by writing the device ID back to the `bind` file and reversing the steps as outlined above.

7.2 SLES 10: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

- Section 7.2.1, "Improving Installation Time," on page 45
- Section 7.2.2, "SMP-Enabled Kernel," on page 45

7.2.1 Improving Installation Time

When installing native SLES 10 OS to run in full virtualization mode, the SLES 10 boot CD might boot to a text version of the first screen (sometimes called the isolinux screen). Entering `linux` as instructed might result in the installation taking a very long time (2-4 hours). Instead, enter `linux vga=0x314`. Computers with graphic cards that do not provide 1024x768 resolution do not present this error. (Bugzilla reference: 179409)

7.2.2 SMP-Enabled Kernel

Xen cannot boot SMP-enabled kernels within fully virtualized VMs. Because all SUSE® PAE-enabled kernels are also SMP-enabled, this configuration is not valid with SLES10.

7.2.3 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.2.4 Erratic Mouse Behavior

When running Linux in fully virtual mode and viewing it with SDL, the mouse pointer might occasionally jump across the screen. This appears to be a bug in the Linux mouse driver.

7.3 SLES 9: Paravirtual Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.3.1 kernel-xen Packages

The kernel-xen packages required to run SLES 9 SP3 as a paravirtualized VM can be downloaded from xen technical preview (http://forge.novell.com/modules/xfcontent/downloads.php/xenpreview/SUSE%20Linux%20Enterprise%20Server/9%20SP3/).

7.3.2 PAE-Enabled Xen Kernel

The PAE-enabled Xen kernel for SLES 9 does not work correctly.

7.3.3 Sparse Image File Increases Installation Time

Specifying a sparse image file as the VM's bootable disk might extend the OS installation time by several hours. Choosing not to use a sparse image file dramatically reduces the installation time.

7.4 SLES 9: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

- Section 7.4.1, "VM Memory and PAE," on page 46
- Section 7.4.2, "SMP-Enabled Kernel," on page 46
- Section 7.4.3, "Erratic Mouse Behavior," on page 46

7.4.1 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.4.2 SMP-Enabled Kernel

Xen cannot boot SMP-enabled kernels within fully virtualized VMs. Because all SUSE® PAE-enabled kernels are also SMP-enabled, this configuration is not valid with SLES 10.

7.4.3 Erratic Mouse Behavior

When running Linux in fully virtual mode and viewing it with SDL, the mouse pointer might occasionally jump across the screen. This appears to be a bug in the Linux mouse driver.

7.5 NetWare: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

- Section 7.5.1, "Status," on page 47
- Section 7.5.2, "VM Memory and PAE," on page 47
- Section 7.5.3, "Device Drivers," on page 47

7.5.1 Status

NetWare® 6.5 does not consistently run as a VM.

7.5.2 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.5.3 Device Drivers

In paravirtual mode, NetWare can recognize and load the following device drivers. These drivers are included as part of Xen VM Server software.

- Network card: `xennet.cad`
- Disk drive: `xenblk.cad`
- Processor: `xenmp.cad`

7.6 Windows Vista: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.6.1 Status

The device model needs additional work before Windows Vista will run on a VM.

7.6.2 64-Bit Versions

Several issues prevent 64-bit versions of Windows operating systems from running on a VM.

7.6.3 Virtual Hardware Clock Settings

Windows operating systems should always use the *Local Time* setting. You can change from the `UTC` setting to the `Local Time` setting by changing the VM’s configuration file entry from `localtime=0` to `localtime=1`. The changes take effect the next time you shut down and restart the VM.

7.6.4 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.7 Windows XP: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.7.1 64-Bit Versions

Several issues prevent 64-bit versions of Windows operating systems from running on a VM.

7.7.2 Virtual Hardware Clock Settings

Windows operating systems should always use the *Local Time* setting. You can change from the `UTC` setting to the `Local Time` setting by changing the VM’s configuration file entry from `localtime=0` to `localtime=1`. The changes take effect the next time you shut down and restart the VM.

7.7.3 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.8 Windows 2003 Server: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.8.1 64-bit Versions

Several issues prevent 64-bit versions of Windows operating systems to run on a VM.

7.8.2 Virtual Hardware Clock Settings

Windows operating systems should always use the *Local Time* setting. You can change from the UTC setting to the Local Time setting by changing the VM's configuration file entry from `localtime=0` to `localtime=1`. The changes will take effect the next time you shutdown and restart the VM.

7.8.3 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.9 Windows 2000 Server: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.9.1 Errors During Installation

Windows 2000 often hangs after displaying the splash screen. After several moments, it will continue and function properly or it entirely stops the boot process.

7.9.2 64-Bit Versions

Several issues prevent 64-bit versions of Windows operating systems from running on a VM.

7.9.3 Virtual Hardware Clock Settings

Windows operating systems should always use the *Local Time* setting. You can change from the `UTC` setting to the `Local Time` setting by changing the VM's configuration file entry from `localtime=0` to `localtime=1`. The changes take effect the next time you shut down and restart the VM.

7.9.4 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.10 Windows NT Server: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.10.1 Errors During Installation

The Windows NT Server installation program often fails in the early stages of the boot/installation process. It results in incomprehensible characters being displayed.

7.10.2 Virtual Hardware Clock Settings

Windows operating systems should always use the *Local Time* setting. You can change from the `UTC` setting to the `Local Time` setting by changing the VM’s configuration file entry from `localtime=0` to `localtime=1`. The changes take effect the next time you shut down and restart the VM.

7.10.3 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.11 Solaris x86: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.11.1 AMD Computers

On AMD computers, the Xen VM Server (domain 0) does not boot.

7.11.2 Intel Computers

On Intel computers, the Solaris x86 installation program hangs when installing on the VM.

7.11.3 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.12 Red Hat Enterprise Linux: Full Virtualization Mode VM (Technical Preview)

This platform running on a virtual machine on SLES 10 is not yet supported by Novell. It is available in technical preview status only. Do not use this configuration in a business-critical computing environment.

If you discover other significant issues, tips, or workarounds that should be included on this page, please submit a comment by clicking *Add Comment* at the bottom of the online page.

7.12.1 VM Memory and PAE

VMs running PAE must be allocated less than 2 GB of memory.

7.12.2 Installation Menu

The installation menu for RHEL 4 is unreadable. The installation can be launched by entering `linux` at the command line.

Documentation Updates

8

This section lists updates to the virtualization information since the initial release of Novell® SUSE Linux Enterprise Server 10.

TIP: If you find incorrect or incomplete documentation, please submit a comment by clicking *Add Comment* at the bottom of the relevant online page. Thank you.

The information is grouped according to the date when the documentation was republished. Within each dated section, the location and description of the update is listed.

8.1 August 15, 2006

Location	Description
Throughout documentation	Renamed chapter titles