

Novell Virtualization Technology

10 SP1

Part Number

VIRTUALIZATION: CONFIGURATION
OPTIONS AND SETTINGS

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An Open Invitation

The documentation in this section, *Configuration Options and Settings*, describes advanced management tasks and configuration options that might help technology innovators implement leading-edge virtualization solutions. It is provided as a courtesy and does not imply that all documented options and tasks are supported by Novell, Inc.

Virtualization technology is being rapidly developed. In an effort to keep you up to date on the most current information, this documentation will be updated more often than traditional Novell product documentation. To create a more dynamic environment, it will quickly include any feedback and new virtualization discoveries made by you and users like you through the User Comments feature at the bottom of each page.

Although a more dynamic documentation environment can be beneficial, there will also be some drawbacks. The information might not have gone through a formal editing cycle before being published. The information might be less authoritative, might not completely cover obvious topics, and could have more typos than traditional product documentation. It might also include untested instructions for virtualization procedures you might want to try.

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We are experimenting with this type of publishing model to provide you with the best information services possible.

Configuration Options and Settings

1

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1.1 xm Commands

The `xm` command provides a command line interface for managing virtual machines. It can be used to create, pause, and shut down virtual machines. It can also be used to list the current domains,

enable or pin virtual CPUs, and attach or detach block devices. For example, the `xm list` command displays the status of all virtual machines.

Figure 1-1 *xm list Command*

```

Terminal
File Edit View Terminal Tabs Help
sbearnsnson:~ # xm list
Name                               ID   Mem VCPUs   State   Time(s)
Domain-0                           0   457    2    r----- 2712.9
oes2l-1                             7   512    1    -b----- 16.3
sb-0-203-sles10                     512    1
sbearnsnson:~ #

```

The syntax of the `xm` command usually follows the format:

```
xm <subcommand> [domain-id] [OPTIONS]
```

where `subcommand` is the `xm` command to run, `domain-id` is the ID number assigned to a domain or the name of the virtual machine, and `OPTIONS` indicates subcommand-specific options.

- ♦ All `xm` operations require that the Xen control daemon, `xend`, be running. For this reason, you should make sure `xend` starts whenever the host boots.
- ♦ Most `xm` commands require root privileges to allow interaction with the Xen hypervisor. Entering the `xm` command as a user other than root returns an error.
- ♦ Some `xm` commands return no information even though the action is completed. In some instances, for example, when shutting down a virtual machine, the action can take several seconds to complete. To verify that the action has completed, you might need to view its status another way, such as, using the `xm list` command.

Table 1-1 *xm Subcommands*

xm Subcommand	Description
help	Displays the list of <code>xm</code> subcommands
console	Attaches to a domain's console (Paravirtual only). Virtual machines do not support more than one console connection at a time.
create	Start a new domain using settings from a configuration file. (Deprecated: use <code>xm new</code>)
new	Add a domain to the <code>xend</code> database. <ul style="list-style-type: none"> ♦ <code>xm new -f</code> to specify a configuration file based on Python*. ♦ <code>xm new -F</code> to specify an <code>.sxp</code> configuration file
delete	Removes a domain from <code>xend</code> domain management.
destroy	Terminates a domain immediately.
domid	Converts a domain name to domain ID.

xm Subcommand	Description
domname	Converts a domain ID to a domain name.
dump-core	Dumps a core for a specific domain.
list	Lists information about some or all domains.
mem-max	Sets the maximum amount of memory to reserve for a domain.
mem-set	Sets the current amount of memory usage for a domain.
migrate	Migrates a domain to another host.
pause	Pauses a domain but maintain its current state in memory.
reboot	Reboots a domain.
rename	Renames a domain.
restore	Restores a domain from a saved state.
resume	Resumes a suspended domain.
save	Saves a domain's entire state, including disk and memory, to a file.
shutdown	Shuts down a domain.
start	Starts a xend managed domain.
suspend	Saves a domain's current state.
sysrq	Sends a sysrq to a domain.
top	Monitors a host and domains in real time.
unpause	Unpauses a paused domain.
uptime	Prints uptime for a domain.
vcpu-list	Lists the virtual CPUs for a domain or all domains.
vcpu-pin	Specifies which CPUs a virtual CPU can use.
vcpu-set	Sets the number of active virtual CPUs allowed for the domain.
dmesg	Reads and/or clears the xend message buffer.
info	Gets information about the Xen host environment.
log	Prints xend log file.
serve	Proxies xend XMLRPC over stdio.
sched-credit	Gets or sets credit scheduler parameters.
sched-sedf	Gets or sets EDF parameters.
block-attach	Creates a new virtual block device.
block-detach	Destroys a domain's virtual block device.
block-list	Lists virtual block devices for a domain.
block-configure	Changes block device configuration.

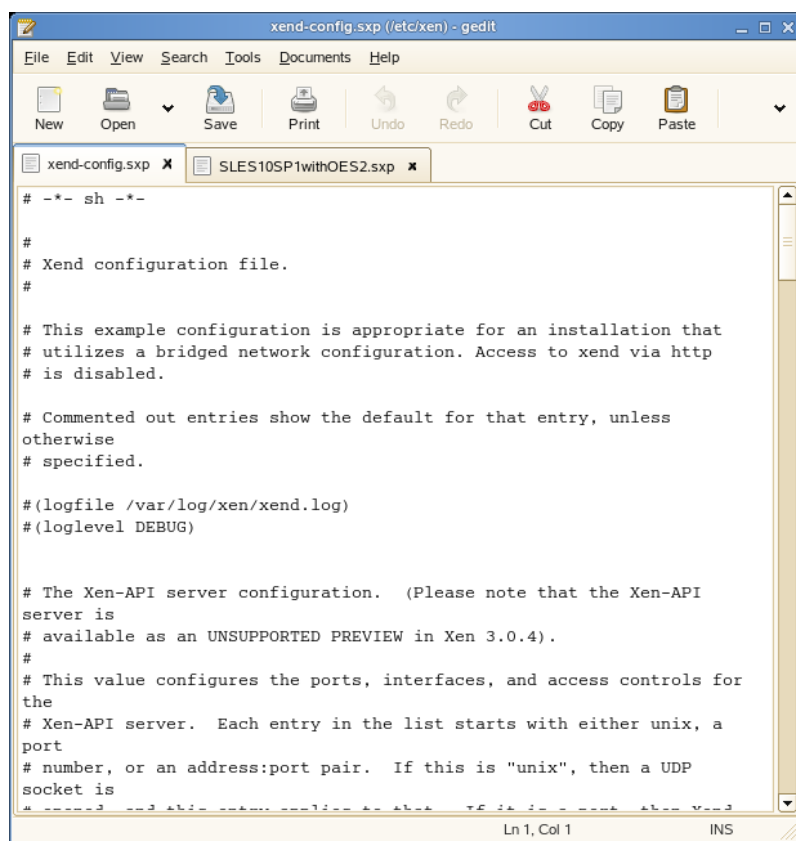
xm Subcommand	Description
<code>network-attach</code>	Creates a new virtual network device and attach to it.
<code>network-detach</code>	Detaches a domain's virtual network device.
<code>network-list</code>	Lists virtual network interfaces for a domain.
<code>vtpm-list</code>	Lists virtual TPM devices.
<code>vnet-list</code>	Lists vnets.
<code>vnet-create</code>	Creates a vnet from a configuration file.
<code>vnet-delete</code>	Deletes a vnet.
<code>labels</code>	Lists <type> labels for (active) policy.
<code>addlabel</code>	Adds a security label for domain or resource.
<code>rmlabel</code>	Removes a security label for domain or resource.
<code>getlabel</code>	Shows a security label for domain or resource.
<code>dry-run</code>	Tests if a domain can access its resources.
<code>resources</code>	Shows information for each labeled resource.
<code>makepolicy</code>	Builds a policy and creates <code>.bin</code> and <code>.map</code> files.
<code>loadpolicy</code>	Loads a binary policy into the hypervisor.
<code>cfgbootpolicy</code>	Adds a policy to the boot configuration.
<code>dumppolicy</code>	Prints hypervisor ACM state information.
<code>shell</code>	Launches an interactive shell.

1.2 xend

The xend daemon is a key component of Xen virtualization. It performs management functions and stores settings that relate to the host environment and each virtual machine. You can customize xend to meet your specific configuration requirements.

- ♦ To specify xend operating parameters, edit the `/etc/xen/xend-config.sxp` file. The settings take effect the next time xend starts.

Figure 1-2 Editing the *xend-config.sxp* File



- ◆ To start the xend daemon, enter `service xend start`.
- ◆ To stop the xend daemon, enter `service xend stop`.
- ◆ To restart the xend daemon, enter `service xend restart`.
- ◆ To check the status of the xend daemon, enter `service xend status`.

1.2.1 xend Parameters

The parameters in the *xend-config.sxp* file can be customized to meet your requirements for virtualization. The following table lists some of the parameters.

Table 1-2 *xend-config.sxp* Parameters

Parameter	Description
console-limit	Sets the memory buffer limit for the host's desktop (domain 0) and assigns values on a per virtual machine basis.
dom0-cpus	Sets the number of CPUs used by the host's desktop.
enable-dump	Determines that a crash occurred and enables a dump. Default is 0.
external-migration-tool	Specifies the script that defines external device migration. Scripts must reside in the <code>/etc/xen/scripts</code> directory.

Parameter	Description
logfile	Specifies the location of the log file. The default is <code>/var/log/xend.log</code> .
loglevel	Sets the level of logging to CRITICAL, DEBUG, ERROR, INFO, or WARNING. The default is DEBUG.
dom0-min-mem	Sets the minimum number of megabytes reserved for the host's desktop (domain 0).
network-script	Specifies the script that defines the networking environment. Scripts must reside in the <code>/etc/xen/scripts</code> directory.
xend-address	Sets the address of xend.
xend-http-server	Enables the HTTP stream packet management server. The default is no.
xend-port	Sets the HTTP management port. The default is 8000.
xend-http-server	Enables the HTTP stream packet management server. The default is no.

1.3 Virtual Machine Settings

You can change a virtual machine's settings by modifying the settings stored in xend. This process requires you to export a virtual machine's settings from the xend database to a text file, edit the settings in the file to meet your configuration requirements, import the file back into xend, and restart the virtual machine.

NOTE: It is no longer recommended that you edit the initial startup files stored in `/etc/xen/vm`, because they are used only during the creation of a new virtual machine.

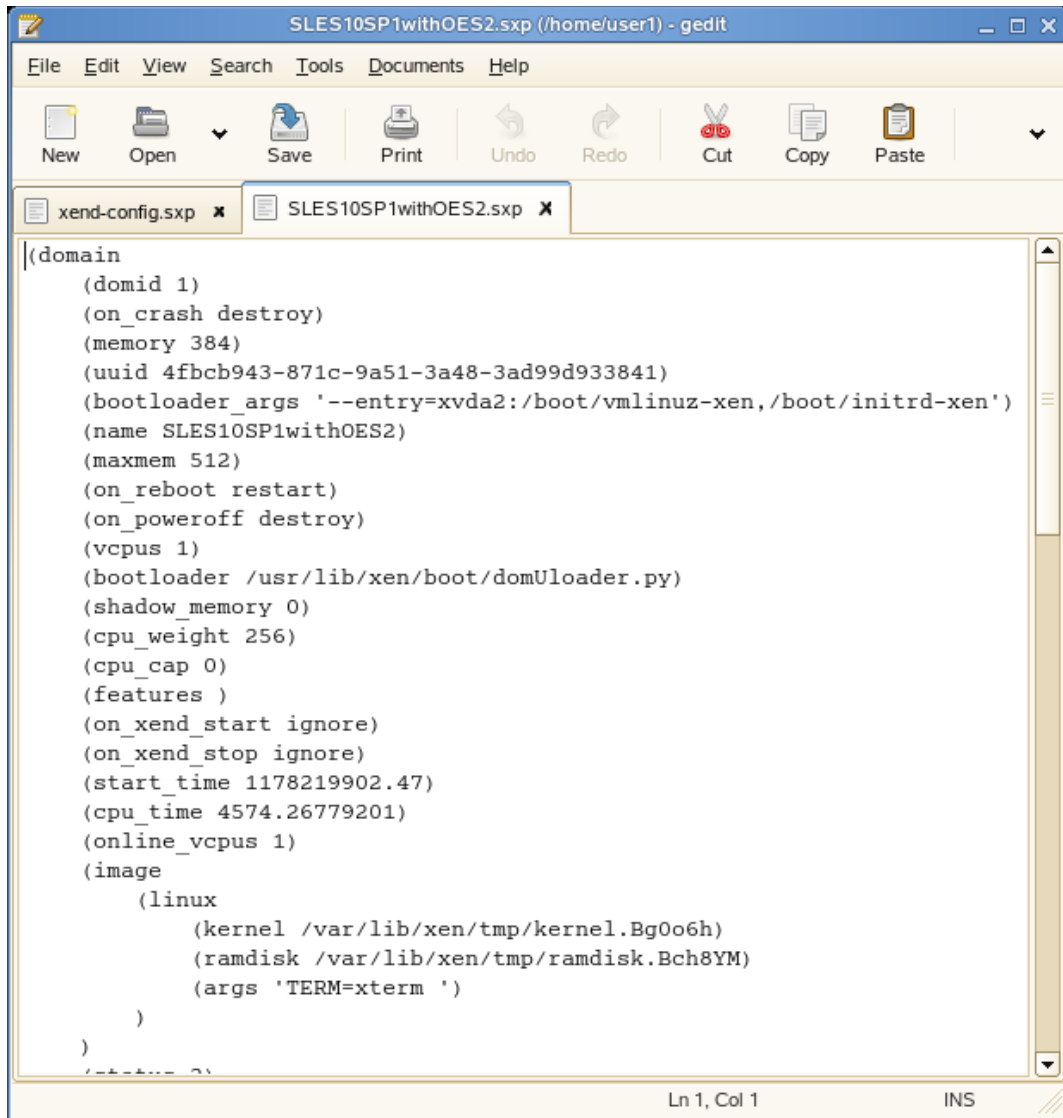
To modify a virtual machine's settings:

- 1 At the host desktop, enter

```
xm list -l vm_name > filename
```

where *vm_name* is the name of the virtual machine you want to modify and *filename* is whatever you want to name the text file.

- 2 Use a text editor to make and save any desired changes.



- 3 Enter `xm new -F filename` to import the virtual machine's new settings into xend.

- 4 Enter `xm start vm_name` to start the virtual machine with its new settings.

You should repeat the entire process of exporting the file each time you want to make changes to a virtual machine's settings.

1.3.1 xend Virtual Machine Settings Example

Virtual machine settings are exported from the xend database in "S expressions" format.

Example: Exported Virtual Machine Settings (Paravirtual)

```
(domain
  (domid 1)
  (on_crash destroy)
```

```

(memory 384)
(uuid 4fbc943-871c-9a51-3a48-3ad99d933841)
(bootloader_args '--entry=xvda2:/boot/vmlinuz-xen,/boot/initrd-
xen')
(name SLES10SP1withOES2)
(maxmem 512)
(on_reboot restart)
(on_poweroff destroy)
(vcpus 1)
(bootloader /usr/lib/xen/boot/domUloader.py)
(shadow_memory 0)
(cpu_weight 256)
(cpu_cap 0)
(features )
(on_xend_start ignore)
(on_xend_stop ignore)
(start_time 1178219902.47)
(cpu_time 4574.26779201)
(online_vcpus 1)
(image
  (linux
    (kernel /var/lib/xen/tmp/kernel.Bg0o6h)
    (ramdisk /var/lib/xen/tmp/ramdisk.Bch8YM)
    (args 'TERM=xterm ')
  )
)
(status 2)
(memory_dynamic_min 512)
(memory_dynamic_max 512)
(state -b----)
(store_mfn 150467)
(console_mfn 150608)
(device
  (vif
    (mac 00:16:3e:16:4f:40)
    (script vif-bridge)
    (uuid 643c21aa-68b8-fb32-7a2d-b9e88884bdd8)
    (backend 0)
  )
)
(device
  (vbd
    (uuid c799784d-930b-7608-4480-10463b3a9433)
    (dev xvda:disk)
    (uname file:/var/lib/xen/images/oes21/disk0)
    (mode w)
    (type disk)
    (backend 0)
  )
)
(device
  (vbd
    (uuid 27543b1c-638f-f3d4-45ba-a7cb9bbe5e59)
    (dev xvdb:disk)
  )
)

```



```

        (uname phy:/dev/cdrom)
        (mode r)
        (type disk)
        (backend 0)
    )
)
(device (vkbd (backend 0)))
(device
    (vfb
        (vncunused 1)
        (uuid 82da21c4-483f-4184-fa5e-55441e0fca11)
        (location localhost:5900)
        (type vnc)
        (display :0.0)
        (xauthority /root/.Xauthority)
    )
)
(device
    (console
        (protocol vt100)
        (location 2)
        (uuid 9c67c00b-8566-84c2-3353-d1809cf534ca)
    )
)
)

```

1.4 Setting Up a 32-Bit Domain 0 on a 64-Bit Hypervisor

A virtual machine host running on a 64-bit platform can access much more memory than one running on a 32-bit platform. However, there might be circumstances where you want to run the 32-bit version of the SUSE® Linux operating system (as domain 0) on the 64-bit Xen hypervisor.

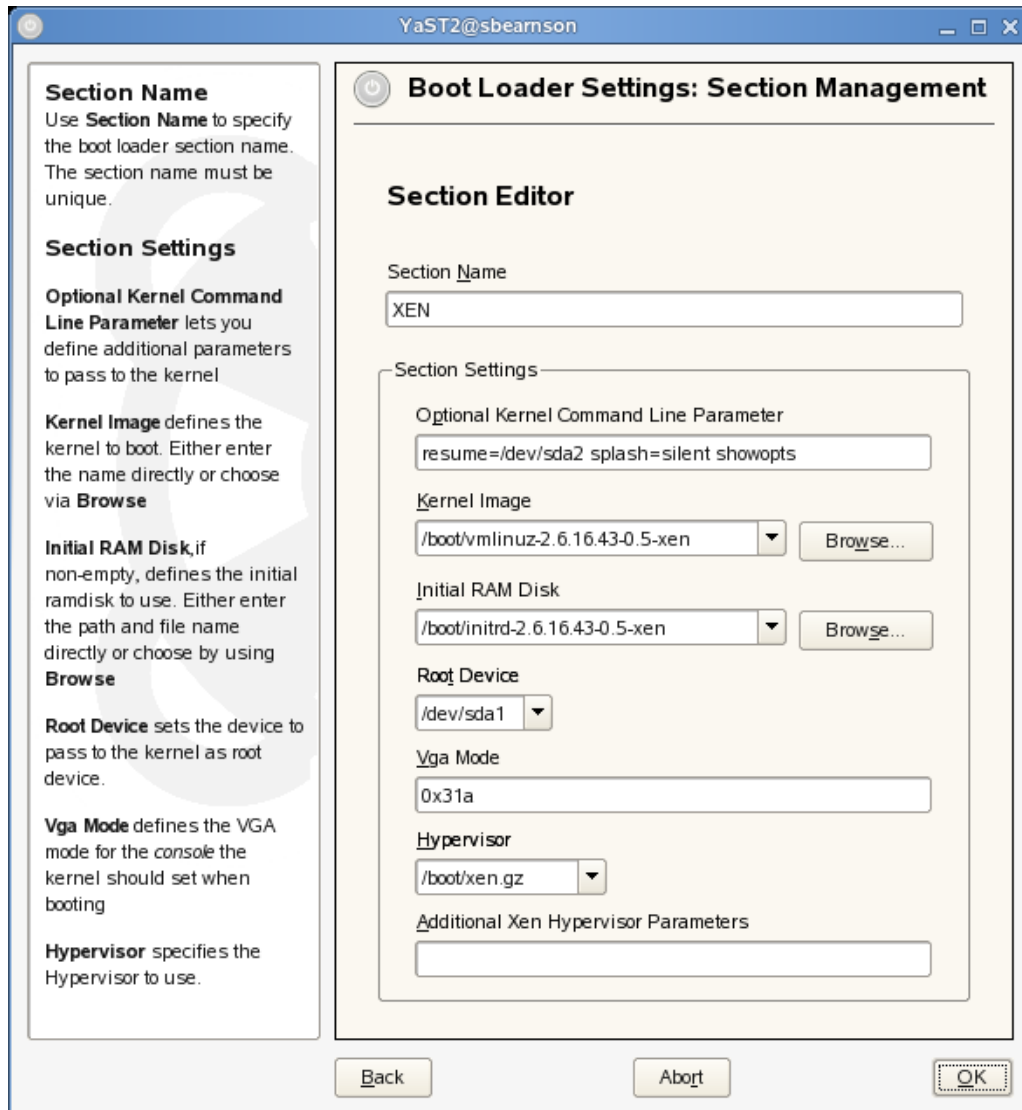
- 1** On 64-bit hardware, start the 32-bit SUSE Linux operating system installation program.
- 2** On the *Installation Settings* screen, edit the *Software* category so it includes the *Xen Virtual Machine Host Server* software package selection.
- 3** On the *Software > Software Selection and System Tasks* screen, click *Details* to view all packages.
- 4** In the *Filter* drop-down list, select *Search*, then search for `kernel-xen`. Make sure that `kernel-xenpae` is selected for installation and that `kernel-xen` is not selected.
- 5** Complete the SUSE Linux installation program.
- 6** After entering the additional setup information, log in to the computer.
- 7** Access the SUSE Linux installation source media.

The installation program copies files, reboots, and prompts you for additional setup information.

The 64-bit Xen hypervisor RPM is included in both 32-bit and 64-bit versions of the SUSE Linux installation media.

- 8 On the SUSE Linux installation source media, find the `x86_64` directory that contains `xen.rpm`.
- 9 Use the following command to install the RPM:

```
rpm -U xen.rpm --ignorearch --force
```
- 10 Edit the GRUB boot loader settings by running *YaST* > *System* > *Boot Loader* or editing the file at `/boot/grub/menu.lst`.



- 11 Change Hypervisor to `/boot/xen.gz`.
 The `xen.gz` hypervisor is the 64-bit hypervisor.
- 12 Reboot the computer.
- 13 During the boot process, select the Xen option from the GRUB boot loader.
- 14 Verify that the computer is running the 32-bit Domain 0 by entering:

```
uname -m
```

 It should report a 32-bit machine name, such as `i686`.

15 Verify that the computer is running the 64-bit hypervisor by entering:

```
xm info | grep xen_caps
```

It should report a 64-bit Xen hypervisor, such as xen-3.0-x86_64.

1.5 Virtual CD Readers

NOTE: Only limited support for virtual machine removable media is available in the original version of SUSE Linux 10 SP1. Much of the following information pertains to functionality available in the maintenance update scheduled for public release in Summer 2007.

If you are installing drivers from the SUSE Linux Enterprise Virtual Machine Driver Pack, proceed by completing one of the following:

- ♦ If you have updated to virt-manager 0.3.1-0.24 or later, complete the instructions in [Section 1.5.3, “Adding Virtual CD Readers,” on page 20](#) to set up the ISO image file as a virtual CD reader.

The most recent virt-manager package is available through the SUSE Linux Enterprise 10 SP1 update channel.

- ♦ If you are running an earlier version of virt-manager, you must set up the ISO image file as a virtual CD reader when you create the virtual machine or add a virtual CD reader based on the ISO image file following the instructions in [Section 1.5.4, “Adding Virtual CD Readers \(Command Line Method\),” on page 21](#).

Virtual CD readers can be set up when a virtual machine is created or added to an existing virtual machine. A virtual CD reader can be based on an physical CD/DVD or based on an ISO image. Virtual CD readers work differently depending on whether they are paravirtual or fully virtual.

- ♦ [Section 1.5.1, “Virtual CD Readers on Paravirtual Machines,” on page 19](#)
- ♦ [Section 1.5.2, “Virtual CD Readers on Fully Virtual Machines,” on page 20](#)
- ♦ [Section 1.5.3, “Adding Virtual CD Readers,” on page 20](#)
- ♦ [Section 1.5.4, “Adding Virtual CD Readers \(Command Line Method\),” on page 21](#)
- ♦ [Section 1.5.5, “Removing Virtual CD Readers,” on page 21](#)
- ♦ [Section 1.5.6, “Switching CDs on a Paravirtual Machine,” on page 21](#)

1.5.1 Virtual CD Readers on Paravirtual Machines

A paravirtual machine can have up to 16 block devices comprised of virtual CD readers and virtual disks. On paravirtual machines, virtual CD readers present the CD as a virtual disk with read-only access. Unless you remove the virtual CD reader, the virtual machine assumes that the originally-inserted CD is still in the CD reader, even if you have ejected it. If it has been ejected, the virtual machine will not be able to access the CD (or any other newly-inserted CD) and will receive I/O errors. Virtual CD readers cannot be used to write data to a CD. They are configured as read-only devices.

After you have finished accessing a CD on a paravirtual machine, it is recommended that you remove the virtual CD reader from the virtual machine.

1.5.2 Virtual CD Readers on Fully Virtual Machines

A fully virtual machine can have up to four block devices comprised of virtual CD readers and virtual disks. A virtual CD reader on a fully virtual machine interacts with the inserted CD in the way you expect a physical CD reader to interact. For example, in a Windows XP virtual machine, the inserted CD appears in the Devices with Removable Storage section of My Computer.

When a CD is inserted in the physical CD reader on the host computer, all virtual machines with virtual CD readers based on the physical CD reader, such as `/dev/cdrom/`, are able to read the inserted CD. Assuming the operating system has automount functionality, the CD should automatically appear in the file system. Virtual CD readers cannot be used to write data to a CD. They are configured as read-only devices.

1.5.3 Adding Virtual CD Readers

Virtual CD readers can be based on a CD inserted into the CD reader or an ISO image file.

- 1 Make sure that the virtual machine is running and the operating system has finished booting.
- 2 Insert the desired CD into the physical CD reader or copy the desired ISO image to a location available to the virtual machine's file system.
- 3 Run Virtual Machine Manager.
- 4 Select the virtual machine, then click *Details*.
- 5 Click *Hardware > Disk*.
- 6 Click *CD-ROM*.
- 7 Specify the path to the physical CD reader, such as `/dev/cdrom`. If you are adding a virtual CD reader based on an ISO, specify the path to the ISO image file.
- 8 Click *OK* to apply the changes.

A new block device, such as `/dev/xvdb`, is added to the virtual machine.

- 9 If the virtual machine is running Linux, complete the following:
 - 9a Open a terminal in the virtual machine and enter `fdisk -l` to verify that the device was properly added. You could also enter `ls /sys/block` to see all disks available to the virtual machine.

The CD is recognized by the virtual machine as a virtual disk with a drive designation, for example,

```
/dev/xvdb
```
 - 9b Enter the command to mount the CD or ISO image using its drive designation. For example, enter

```
mount -o ro /dev/xvdb /cd1
```

mounts the CD to a mount point named `/cd1`.

The CD or ISO image file should be available to the virtual machine at the specified mount point.
- 10 If the virtual machine is running Windows, reboot the virtual machine.

Verify that the virtual CD reader appears in its My Computer section

1.5.4 Adding Virtual CD Readers (Command Line Method)

- 1 Make sure that the virtual machine is running and that the operating system has finished booting.
- 2 Insert the CD into the physical CD reader or copy the ISO image to the host.
- 3 In a terminal on the host, enter the appropriate command
 - ♦ To set up an ISO image file, enter:

```
xm block-attach vm_id file:/mycd.iso hdc:cdrom r
```

where `vm_id` is the virtual machine ID, `mycd.iso` is the path to the ISO image file, and `hdc` is the drive designation presented to the virtual machine.
If the virtual machine is paravirtual, replace the device designation with a `vdbx` device designation, such as

```
xm block-attach vm_id file:/mycd.iso xvdb:cdrom r
```
 - ♦ To set up a physical CD reader, enter:

```
xm block-attach vm_id phy:/dev/cdrom hdc:cdrom r
```

where `vm_id` is the virtual machine ID, `dev/cdrom` is the path to the physical CD reader, `hdc` is the physical drive designation to be presented to the virtual machine, and `cdrom` is the name you specify for the device.
If the virtual machine is paravirtual, replace the `hdc` drive designation with a `vdbx` drive designation, such as

```
xm block-attach vm_id phy:/dev/cdrom xvdb:cdrom r
```
- 4 (Conditional) If running full virtualization mode, reboot the virtual machine.

The CD or ISO image file should appear in the virtual machine's operating system.

1.5.5 Removing Virtual CD Readers

- 1 Make sure that the virtual machine is running and the operating system has finished booting.
- 2 (Conditional) If the virtual CD reader is mounted, unmount it from within the virtual machine.

TIP: You can enter `fdisk -l` in the virtual machine's terminal to view its block devices.

- 3 Run Virtual Machine Manager.
- 4 Select the virtual machine, then click *Details*.
- 5 Click *Hardware > Disk*.
- 6 Select the virtual CD-ROM device to remove.
- 7 Click *Remove* to remove the virtual CD-ROM device.
- 8 Press the hardware eject button to eject the CD.

1.5.6 Switching CDs on a Paravirtual Machine

To switch between CDs or ISO images on a paravirtual machine requires you to remove (detach) the virtual CD reader that contains the original CD or points to the ISO image file and then add (attach) the virtual CD reader with the newly-inserted CD or the location of a new ISO image file.

NOTE: This procedure requires virt-manager version 0.3.1-0.19 or later.

- 1 Make sure that the virtual machine is running and the operating system has finished booting.
- 2 (Conditional) If the virtual CD reader is mounted, unmount it from within the virtual machine.

TIP: You can enter `fdisk -l` in the virtual machine's terminal to view its block devices.

- 3 Run Virtual Machine Manager.
- 4 Select the virtual machine, then click *Details*.
- 5 Click *Hardware > Disk*.
- 6 Select the virtual CD-ROM device that contains the CD or points to the ISO image file that you want to switch.
- 7 Click Edit
- 8 Press the hardware eject button to eject the CD.

1.6 Remote Access Methods

Some configurations, such as those that include rack-mounted servers, require a computer to run without a video monitor, keyboard, or mouse. This type of configuration is often referred to as “headless” and requires the use of remote administration technologies.

Typical configuration scenarios and technologies include:

Graphical Desktop with X Window Server*: If a graphical desktop, such as GNOME* or KDE, is installed on the virtual machine host you can use a remote viewer, such as a VNC viewer, on a remote computer to log in and manage the host environment by using graphical tools, such as Virtual Machine Manager.

Text and Graphical Applications: If neither a graphical desktop nor the X Window Server is installed, but the X Windows libraries are installed on the virtual machine host, you can use the `ssh -X` command from the remote computer to log in and manage the virtualization host environment. You can then use Virtual Machine Manager and the `xm` command to manage virtual machines and the `vm-install` command to create them.

Text Only: You can use the `ssh` command from a remote computer to log in to a virtual machine host and access its text-based console. You can then use the `xm` command to manage virtual machines and the `vm-install` command to create new virtual machines.

1.7 VNC Viewer

By default, Virtual Machine Manager uses the VNC viewer to show the display of a virtual machine. You can also use VNC viewer from the virtual machine host's console (known as local access or on-box access) or from a remote computer.

- ♦ [Section 1.7.1, “Viewing Virtual Machines through the Host IP Address,” on page 23](#)
- ♦ [Section 1.7.2, “Viewing Virtual Machines through the Virtual Machine IP Address,” on page 24](#)
- ♦ [Section 1.7.3, “Assigning VNC Viewer Port Numbers to Virtual Machines,” on page 24](#)
- ♦ [Section 1.7.4, “Using SDL instead of a VNC Viewer,” on page 25](#)

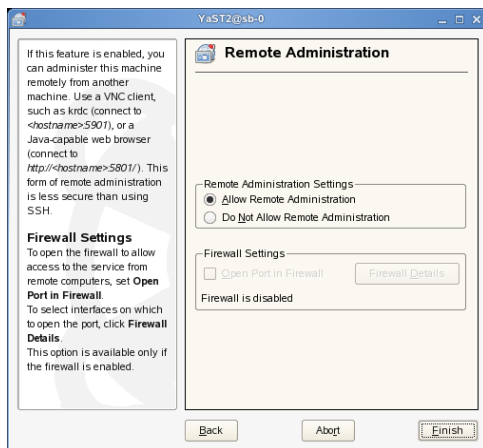
1.7.1 Viewing Virtual Machines through the Host IP Address

You can use the host's IP address and a VNC viewer to view a virtual machine's display. When a virtual machine is running, the VNC server on the host assigns the virtual machine a port number to be used for VNC viewer connections. The assigned port number is the lowest port number available when the virtual machine starts. The number is only available for the virtual machine while it is running. After shutting down, the port number might be assigned to other virtual machines.

For example, if ports 1 and 2 and 4 and 5 are assigned to the running virtual machines, the VNC viewer assigns the lowest available port number, 3. If port number 3 is still in use the next time the virtual machine starts, the VNC server assigns a different port number to the virtual machine.

To use the VNC viewer from a remote computer, remote administration must be enabled on the host. You can use the YaST Remote Administration module.

Figure 1-3 YaST Remote Administration

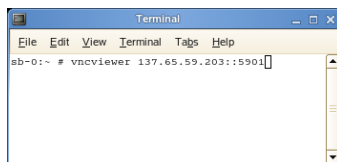


To access the virtual machine from the host's local console or a remote computer running a VNC viewer client, enter one of the following commands:

- ◆ `vncviewer host_ip::590#`
- ◆ `vncviewer host_ip:#`

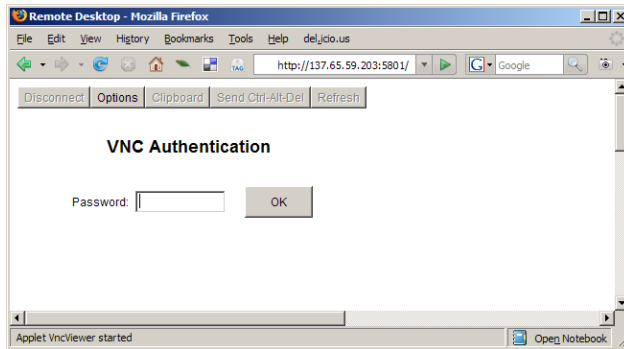
where `host_ip` is the IP address of the virtual machine host and `#` is the VNC viewer port number assigned to the virtual machine.

Figure 1-4 VNC Viewer Command



If you are using the built-in VNC viewer of an Internet browser, such as Internet Explorer or Mozilla* Firefox*, use `580#` as the port number, where `#` is the VNC viewer port number assigned to the virtual machine.

Figure 1-5 Mozilla Firefox VNC Viewer



When successfully connected, the VNC viewer shows the display of the running virtual machine.

1.7.2 Viewing Virtual Machines through the Virtual Machine IP Address

You can use a VNC viewer to directly view a virtual machine's display.

To use a VNC viewer from a remote computer, remote administration must be enabled on the virtual machine.

To access the virtual machine from the virtual machine's local console or a remote computer running a VNC viewer client, enter one of the following commands:

- ♦ `vncviewer vm_ip:590#`
- ♦ `vncviewer vm_ip:#`

where `vm_ip` is the IP address of the virtual machine and `#` is the VNC viewer port number assigned to the virtual machine.

If you are using the built-in VNC viewer of an Internet browser, such as Internet Explorer or Mozilla Firefox, use `580#` as the port number, where `#` is the VNC viewer port number assigned to the virtual machine.

When successfully connected, the VNC viewer shows the display of the running virtual machine.

1.7.3 Assigning VNC Viewer Port Numbers to Virtual Machines

Although the default behavior of VNC viewer is to assign the first available port number, you might want to assign a specific VNC viewer port number to a specific virtual machine.

To assign a specific port number, edit the virtual machine's setting (`/etc/xen/vm_name`) to include the line `(vncdisplay #)` where `#` is the assigned port number.

TIP: Assign higher port numbers to avoid conflict with port numbers assigned by the VNC viewer, which uses the lowest available port number.

1.7.4 Using SDL instead of a VNC Viewer

If you access a virtual machine's display from the virtual machine host console (known as local or on-box access), you might want to use SDL instead of VNC viewer. VNC viewer is faster for viewing desktops over a network, but SDL is faster for viewing desktops from the same computer.

To set the default to use SDL instead of VNC, change the virtual machine's configuration information to the following. For instructions, see [Section 1.3, "Virtual Machine Settings," on page 14](#).

- ♦ If it is a fully virtual machine, use `vnc=0` and `sdl=1`.
- ♦ If it is a paravirtual virtual machine, use `vfb=["type=sdl"]`.

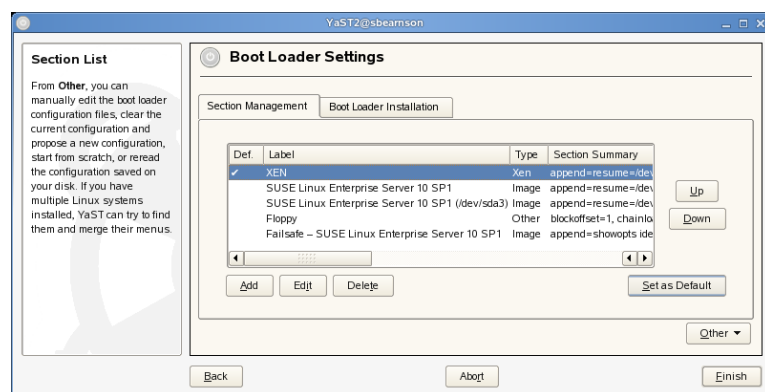
Remember that, unlike a VNC viewer window, closing an SDL window terminates the virtual machine.

1.8 The Boot Loader Program

The boot loader controls how the virtualization software boots and runs. You can modify the boot loader properties by using YaST or by directly editing the boot loader configuration file.

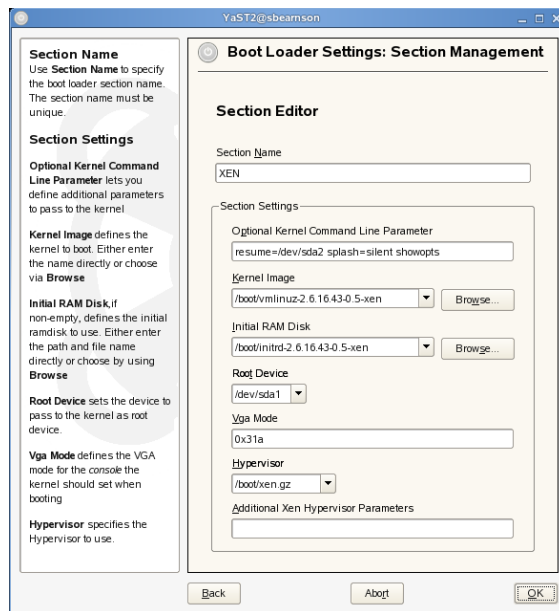
The YaST boot loader program is located at *YaST > System > Boot Loader*. The Boot Loader Settings screen lists the sections that appear as options on the boot menu. From this screen, you can change the boot loader so it auto-selects the virtual machine host option when booting.

Figure 1-6 Boot Loader Settings



Select the *Xen* section, then click *Edit* to manage the way the boot loader and Xen function.

Figure 1-7 *Boot Loader Settings: Section Management*



You can use the Boot Loader program to specify functionality, such as:

- ◆ Pass kernel command line parameters
- ◆ Specify the kernel image and initial RAM disk
- ◆ Select a specific hypervisor
- ◆ Pass additional parameters to the hypervisor (see [Section 1.12, “Xen Boot Parameters,”](#) on [page 30](#))

1.9 Editing the Boot Loader File

You can customize your virtualization environment by editing the `/boot/grub/menu.lst` file.

If the Xen option does not appear on the GRUB boot menu, you can compare your updated GRUB boot loader file with the examples below to confirm that it was updated correctly.

The first example shows a typical GRUB boot loader file updated to load the kernel that supports virtualization software. The second example shows a GRUB boot loader file that loads the PAE-enabled virtualization kernel.

Example: Xen Section in the menu.lst File (Typical)

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

Example: Xen Section in the menu.lst 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 defines sections in the boot loader file. 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. 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 the host desktop. The amount of memory is specified in KB, or you can specify the units with a K, M, or G suffix, for example 128M. If the amount is not specified, the host desktop takes the maximum possible memory for its operations.

For more information about hypervisor parameters, see [Section 1.12, “Xen Boot Parameters,” on page 30](#).

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 the virtual machine host.

1.9.1 Specifying Xen as the Default Boot Option

To set the GRUB boot loader to automatically boot the Xen virtualization software, change the `default` entry from 0 (zero), which means the first `title` entry, to the number that corresponds to the `title XEN` entry. In the example file, Xen is the second `title` line, so to specify it, you would change the value of `default` from 0 to 1.

1.10 Changing the Host’s Desktop from Text Mode to GUI Mode

If selecting the Xen option from the boot loader starts SUSE Linux desktop environment (domain 0) 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 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.

1.11 Managing Domain 0 Memory

When the host is set up, a percentage of system memory is reserved for the hypervisor, and all remaining memory is automatically allocated to the host's desktop environment (domain 0).

A better solution is to set a minimum amount and a maximum amount of memory for domain 0 so that memory is more appropriately allocated to the hypervisor. A good maximum amount is 20 percent of total system memory up to 2 GB. A good minimum amount is at least 256 MB.

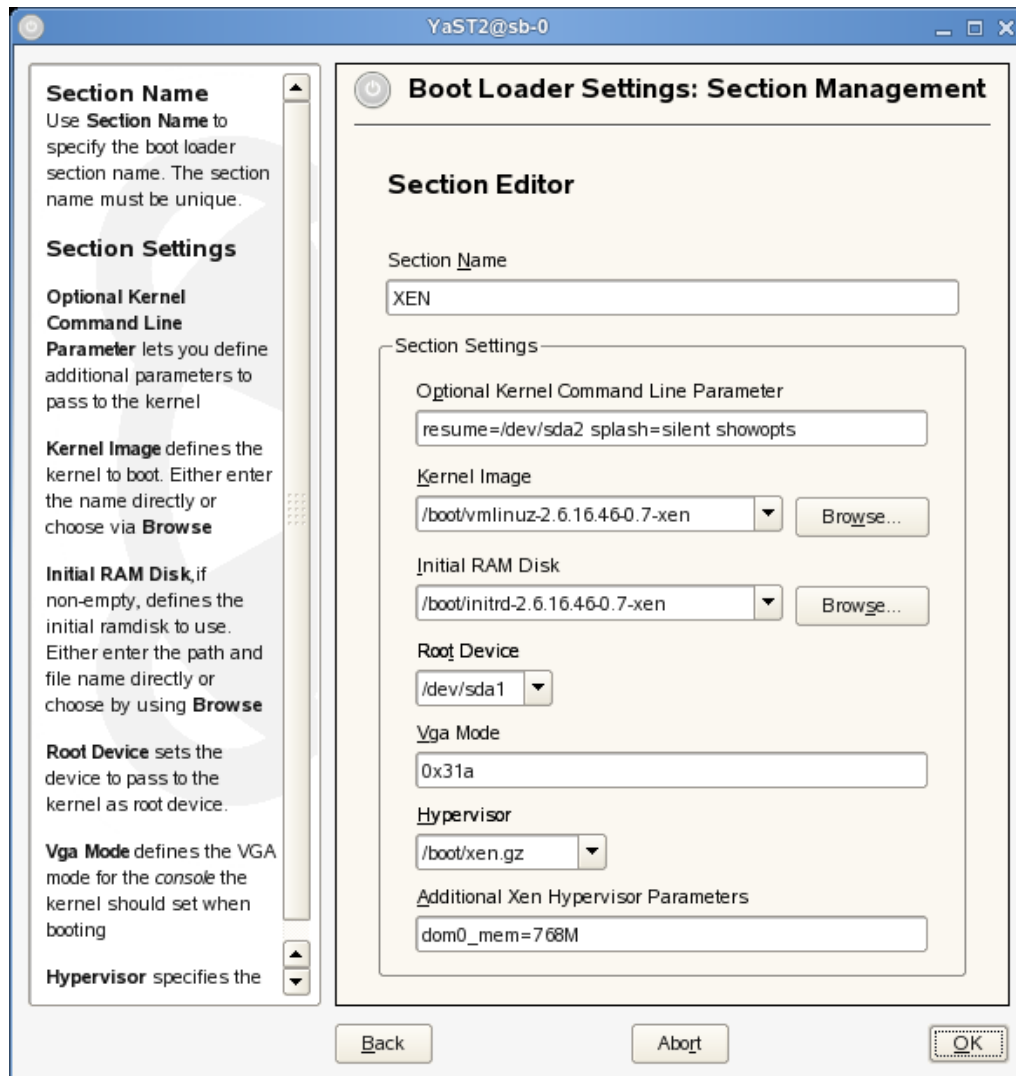
- ♦ [Section 1.11.1, “Setting a Maximum Amount of Memory,” on page 28](#)
- ♦ [Section 1.11.2, “Setting a Minimum Amount of Memory,” on page 29](#)

1.11.1 Setting a Maximum Amount of Memory

- 1 Determine the amount of memory to set for domain 0.
- 2 At the host desktop, type `xm list` to view the currently allocated memory.
- 3 Run YaST > Boot Loader.

- 4 Select the Xen section.

Figure 1-8 Boot Loader Settings: Section Management



- 5 In *Additional Xen Hypervisor Parameters*, add `dom0_mem=mem_amount` where `mem_amount` is the maximum amount of memory to allocate to the host desktop (domain 0). Add K, M, or G, to specify the size, for example, `dom0_mem=768M`.
- 6 Restart the computer to apply the changes.

1.11.2 Setting a Minimum Amount of Memory

To set a minimum amount of memory for the host desktop (domain 0), edit the `dom0-min-mem` parameter in the `xend-config.sxp` file and restart xend. For more information, see [Section 1.2, “xend,” on page 12](#).

1.12 Xen Boot Parameters

You can pass the following parameters to the Xen hypervisor. They can be appended to Xen's command line by using the Boot Loader program in YaST. For more information, see [Section 1.8, “The Boot Loader Program,”](#) on page 25.

NOTE: All parameters must be entered on a single line and be separated by a single space between each parameter.

Table 1-3 *Xen Boot Parameters*

Parameter	Description
noreboot	Do not automatically reboot the host when an error occurs. This parameter is useful to catch debug output if console messages via the serial line are not being caught.
nosmp	Disable SMP support. This parameter is implied by <code>ignorebiostables</code> .
watchdog	Enable NMI watchdog support, which can report certain types of failures.
noirqbalance	Disable software IRQ balancing and affinity. This can be used on systems such as Dell 1850/2850 that have workarounds in hardware for IRQ-routing issues.
badpage=<pagenum>, [pagenum], ...	Specify a list of pages not to be allocated because they contain bad bytes. For example, if byte 0x12345678 is bad, use the parameter <code>badpage=0x12345</code> .
com1=<baud>, DPS, <io_base>, <irq>	<p>Xen supports up to two 16550-compatible serial ports. For example: <code>com1=9600, 8n1, 0x408, 5</code> maps COM1 to a 9600-baud port, 8 data bits, no parity, 1 stop bit, I/O port base 0x408, IRQ 5.</p> <p>Standard configuration options, such as I/O base and IRQ, only require a prefix of the full configuration string. If the baud rate is already configured, for example, by the boot loader, then <code>auto</code> can be specified in place of a numeric baud rate.</p>
console=<item>, [item] ...	<p>Specify the destination for Xen console I/O. The default option is <code>com1, vga</code>.</p> <ul style="list-style-type: none">♦ <code>vga</code> - Use a VGA console and allow keyboard input.♦ <code>com1</code> - User COM1 serial port.♦ <code>com2H</code> - Use COM2 serial port. Transmitted characters have the MSB set. Received characters must also have the MSB set.♦ <code>com2L</code> - Use COM2 serial port. Transmitted characters have the MSB cleared. Received characters must also have the MSB cleared. <p>The last two examples allow a single port to be shared by two subsystems, such as a console and debugger. Sharing is controlled by the MSB of each transmitted/received character.</p>

Parameter	Description
<code>sync_console</code>	Force synchronous console output. This parameter is useful if the system fails unexpectedly before all available output is sent to the console. In most cases, Xen automatically enters synchronous mode when an exceptional event occurs, but this parameter provides an additional manual fallback.
<code>conswitch=<switch-char><auto-switch-char></code>	<p>Specify how to switch serial-console input between Xen and domain 0.</p> <p>The required sequence is <code>CTRL-<switch-char></code> pressed three times. Specifying the backtick (<code>`</code>) character disables switching. The <code><auto-switch-char></code> specifies whether Xen should auto-switch input to domain 0 when it boots . If it is set to <code>x</code>, auto-switching is disabled. If any other character is entered or if the character is omitted, auto-switching is enabled.</p> <p>The default switch-char is <code>a</code>.</p>
<code>nmi=<action></code>	<p>Specify what action to perform when an NMI parity or I/O error occurs.</p> <ul style="list-style-type: none"> ♦ fatal - Xen prints a diagnostic and then hangs. ♦ dom0 - Inform domain 0 of the NMI. ♦ ignore - Ignore the NMI.
<code>mem=<kilobytes></code>	<p>Set the physical RAM address limit. Any RAM appearing beyond this address in the memory map is ignored.</p> <p>A suffix, such as <code>B</code>, <code>K</code>, <code>M</code>, or <code>G</code> can be appended to specify bytes, kilobytes, megabytes, or gigabytes.</p>
<code>dom0_mem=<kilobytes></code>	<p>Set the amount of RAM to be allocated to domain 0.</p> <p>A suffix, such as <code>B</code>, <code>K</code>, <code>M</code>, or <code>G</code> can be appended to specify bytes, kilobytes, megabytes, or gigabytes.</p>
<code>tbuf_size=<size></code>	Set the size of the per-CPU trace buffers in pages. The trace buffers are only enabled in debug builds, so most users can ignore this parameter.
<code>sched=<scheduler></code>	Select which CPU scheduler Xen uses. Current schedulers include <code>sedf</code> , <code>bvt</code> , and <code>credit scheduler</code> (default).
<code>apic_verbosity=debug,verbose</code>	Print more detailed information about local APIC and IOAPIC configurations.
<code>lapic</code>	Force the use of local APIC even when it is disabled by a uniprocessor BIOS.
<code>nolapic</code>	Ignore the local APIC in a uniprocessor system, even if it is enabled by the BIOS.
<code>apic=bigsmpt, default, es7000, summit</code>	Specify the NUMA platform. This information can usually be probed automatically.
<code>apic=off, force, strict, halt, noirq, ...</code>	<p>Modify how Xen and domain 0 parse the BIOS ACPI tables.</p> <p>This parameter is automatically passed to the Linux kernel running on domain 0.</p>

Parameter	Description
<code>apci_skip_timer_override</code>	<p>Instruct Xen and domain 0 to ignore timer-interrupt override instructions specified by the BIOS ACPI tables.</p> <p>This parameter is automatically passed to the Linux kernel running on domain 0.</p>
<code>noapic</code>	<p>Instruct Xen and domain 0 to use the legacy PIC and ignore any IOAPICs that are present in the system.</p> <p>This parameter is automatically passed to the Linux kernel running on domain 0.</p>

1.13 Paravirtual Mode and Journaling File Systems

It is recommended that operating systems running in paravirtual mode set up their kernel on a separate partition that uses a non-journaling file system, such as ext2.

Before a paravirtualized operating system can boot, the management domain must construct a virtual machine and place the paravirtualized kernel in it. Then, the paravirtualized operating system boots. To retrieve the kernel during the bootstrapping process, the virtual machine's boot disk is mounted in read-only mode, the kernel is copied to the virtual machine's memory, and then the boot disk is unmounted.

When a virtual machine's operating system crashes, its disks are not shut down in an orderly manner. This should not pose a problem to a virtual machine running in full virtualization mode because the pending disk entries are checked and corrected the next time the operating system starts. If the disk is using a journaling file system, the journal is replayed to update and coordinate any pending disk entries.

This type of system crash poses a potential problem for paravirtualized operating systems. If a paravirtualized operating system using a journaled file system crashes, any pending disk entries cannot be updated and coordinated because the file system is initially mounted in read-only mode.

Therefore, it is recommended that you set virtual machine boot files, such as the kernel and ramdisk, on a separate partition that is formatted with a non-journaling file system, such as ext2.

1.14 Virtual Machine Initial Startup Files

During the process of creating a new virtual machine, initial startup settings are written to a file created at `/etc/xen/vm/`. During the creation process, the virtual machine starts according to settings in this file, but the settings are then transferred and stored in `xend` for ongoing operations.

IMPORTANT: Modifying the initial startup file to create or make changes to a virtual machine is not recommended. The preferred method for changing a virtual machine's settings is to use Virtual Machine Manager or to use follow the instructions in [Section 1.3, “Virtual Machine Settings,” on page 14](#).

When a virtual machine's settings are stored in `xend`, it is referred to as a “xen-managed domain” or “xen-managed virtual machine.” Whenever the xen-managed virtual machine starts, it takes its settings from information stored in the `xend` database—not from settings in the initial startup file.

Although it is not recommended, you might need to start an existing virtual machine based on settings in the initial startup file. If you do, any xend settings stored for the virtual machine are overwritten by the startup file settings. Initial startup files are save to `/etc/xen/vm/vm_name`. Values must be enclosed in single quotes, such as `localtime = '0'`.

Table 1-4 Initial Startup File Entries and Descriptions

Entry	Description
<code>disk =</code>	<p>Virtual disks for the virtual machine.</p> <p>For example:</p> <pre>disk = ['file:/var/lib/xen/images/VM1_SLES10/hda,hda,w']</pre> <p>This entry specifies a virtual disk based on a file (<code>file:</code>) named <code>hda</code> located at <code>/var/lib/xen/images/VM1_SLES10/</code>. It presents itself as the first drive (<code>hda</code>) and has read/write access (<code>w</code>).</p> <p>Disks can also be based on a block device.</p>
<code>memory =</code>	Virtual memory in megabytes.
<code>vcpus =</code>	Number of virtual CPUs.
<code>builder =</code>	Specifies paravirtual mode (<code>linux</code>) or full virtualization mode (<code>hvm</code>).
<code>name =</code>	Name of the virtual machine.
<code>vif =</code>	Randomly-assigned MAC addresses and bridges assigned to use the virtual machine's network addresses.
<code>localtime =</code>	Specifies a localtime (0) or UTC (1) time setting.
<code>on_poweroff =</code>	Specifies the action that the virtual machine performs when the operating system is powered off.
<code>on_reboot =</code>	Specifies the action that the virtual machine performs when the operating system reboots.
<code>on_crash =</code>	Specifies the action that the virtual machine performs when the operating system crashes.
<code>extra =</code>	Parameters passed to the kernel.
<code>bootloader =</code>	Location and filename of the domU boot loader.
<code>bootentry =</code>	Location of the kernel and initial ramdisk.
<code>ostype =</code>	Type of operating system.
<code>uuid =</code>	Identification number for a virtual drive.

1.15 Virtual Machine Clock Settings

When booting, virtual machines get their initial clock time from the host. After getting their initial clock time, fully virtual machines manage their time independently from the host. Paravirtual machines manage clock time according to their independent wallclock setting. If the independent wallclock is enabled, the virtual machine manages its time independently and does not synchronize

with the host. If the independent wallclock is disabled, the virtual machine periodically synchronizes its time with the host clock.

NOTE: OES 2 NetWare virtual machines manage clock time independently after boot up. They do not synchronize with the host clock time.

If a guest operating system is configured for NTP and the virtual machine's independent wallclock setting is disabled, it will still periodically synchronize its time with the host time. This dual type of configuration can result in time drift between virtual machines that need to be synchronized. To effectively use an external time source, such as NTP, for time synchronization on a virtual machine, the virtual machine's independent wallclock setting must be enabled (set to 1). Otherwise, it will continue to synchronize its time with its host.

Viewing the Independent Wallclock Setting

- 1 Log in to the virtual machine's operating system as `root`.
- 2 In the virtual machine environment, enter

```
cat /proc/sys/xen/independent_wallclock
```

 - ♦ 0 means that the virtual machine is getting time from the host and not using independent wallclock.
 - ♦ 1 means that the virtual machine is using independent wallclock and managing its time independent from the host.

Permanently Changing the Independent Wallclock Setting

- 1 Log in to the virtual machine environment as `root`.
- 2 Edit the virtual machine's `/etc/sysctl.conf` file.
- 3 Add or change the following entry:

```
xen.independent_wallclock=1
```

Enter 1 to enable or 0 to disable the wall clock setting.
- 4 Save the file and reboot the virtual machine operating system.

When it boots, a virtual machine gets its initial clock time from the host. Then, if the wallclock setting is set to 1 in the `sysctl.conf` file, it manages its clock time independently and does not synchronize with the host clock time.

Temporarily Changing the Independent Wallclock Setting

- 1 Log in to the virtual machine environment as `root`.
- 2 Enter the following command:

```
echo "1" > /proc/sys/xen/independent_wallclock
```

Enter 1 to enable or 0 to disable the wall clock setting.
- 3 Add or change the following entry:

```
xen.independent_wallclock=1
```

Enter 1 to enable or 0 to disable the wall clock setting.

Although the current status of the independent wallclock changes immediately, its clock time might not be immediately synchronized. It might take a long time to sync. The setting persists

until the virtual machine reboots. Then, it gets its initial clock time from the host and uses the independent wallclock according to setting specified in the `sysctl.conf` file.

1.16 Uninstalling Virtualization Software

Virtualization software can be removed by using `rpm` commands or software management tools, but the Xen entry in the GRUB boot loader is not automatically removed. Edit the boot loader file to remove the entries or simply choose another option from the GRUB boot loader menu when the computer boots.

1.17 Mouse Pointer on the Host Desktop

If the mouse pointer on the host's desktop stops functioning properly, you might need to restart the graphical desktop by entering `rcxdm restart`.

1.18 Sparse Image Files and Disk Space

If the host's physical disk reaches a state where it has no available space, a virtual machine using a virtual disk based on a sparse image file is unable to write to its disk. Consequently, it reports input/output errors.

The Reiser file system, perceiving a corrupt disk environment, automatically sets the file system to read-only. If this situation happens, you should free up available space on the physical disk, remount the virtual machine's file system, and set the file system back to read-write.

For more information, see [Section 1.13, "Paravirtual Mode and Journaling File Systems,"](#) on [page 32](#).

1.19 Virtual Keyboards

When a virtual machine is started, the host creates a virtual keyboard that matches the `keymap` entry according to the virtual machine's settings. If there is no `keymap` entry in the virtual machine's settings, the host uses the `keymap` entry specified in host's `xend` file (`xend-config.sxp`). If there is no `keymap` entry in either the host's `xend` file or the virtual machine's settings the virtual machine's keyboard defaults to English (US).

Unless you manually specify it, a `keymap` entry is not specified in the host's `xend` file or for any virtual machine. Therefore, by default, all virtual machine settings use the English (US) virtual keyboard. It is recommended that you specify a `keymap` setting for `xend` and for each virtual machine, especially if you want to migrate virtual machines to different hosts

To view a virtual machine's current `keymap` entry (if any), enter the following command on the host desktop:

```
xm list -l vm_name | grep keymap
```

You can specify a `keymap` entry to be used for all virtual machines and `keymap` entries for specific machines.

- ♦ To specify a global `keymap` entry for virtual machines on the host, edit the host's `xend-config.sxp` file.
- ♦ To specify a `keymap` entry for a specific virtual machine, edit the virtual machine's settings by following instructions in [Section 1.3, "Virtual Machine Settings,"](#) on [page 14](#).

In the `device > vfb` section, add the desired `keymap` entry to the file. For example, to specify a German keyboard, add a `(keymap de)` entry. Make sure the virtual machine's operating system is set to use the specified keyboard. After you specify the host's `keymap` setting, all virtual machines created by using the Create Virtual Machine Wizard on the host add the host's `keymap` entry to their virtual machine settings.

Virtual machines created before a host's `keymap` entry is specified are not automatically updated. These virtual machines start with the keyboard specified by the host, but the `keymap` entry is not a permanent part of the virtual machine's settings. For the entry to be permanent, it must be explicitly stated in the virtual machine's settings.

Table 1-5 *Language and Keymap Settings*

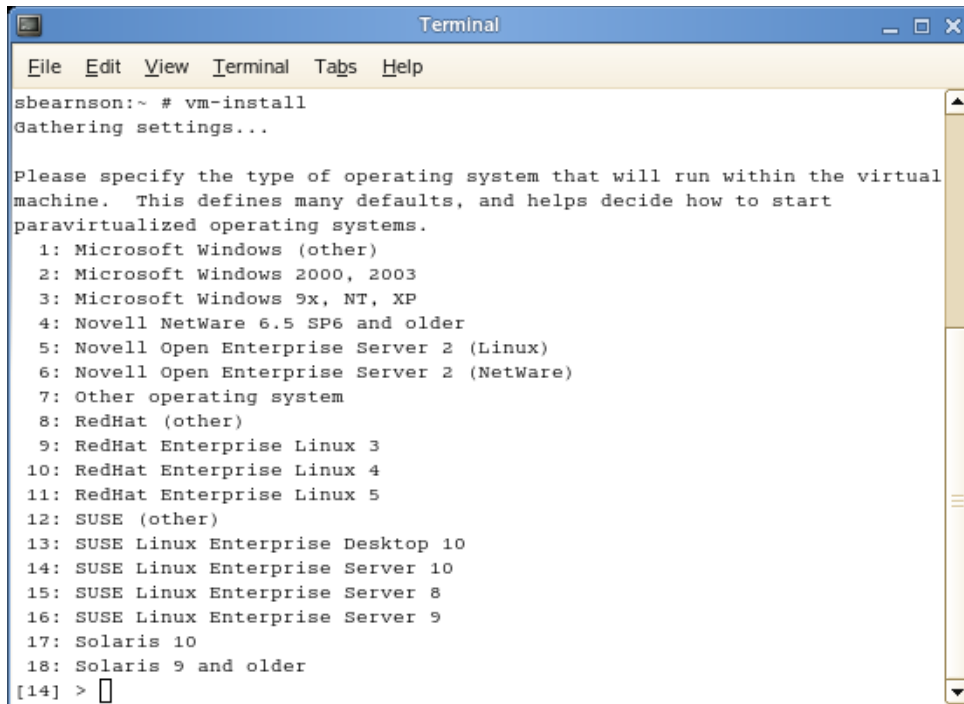
Language	Keymap Setting
Danish	da
German	de
Swiss-German	de-ch
English (UK)	en-gb
English (US)	en-us
Spanish	es
Finnish	fi
French	fr
French - Belgium	fr-be
French - Canada	fr-ca
French - Switzerland	fr-ch
Hungarian	hu
Icelandic	is
Italian	it
Japanese	ja
Dutch	nl
Dutch - Belgium	nl-be
Norwiegen	no
Polish	pl
Portuguese	pt
Portuguese - Brazil	pt-br
Russian	ru
Swedish	sv

1.20 Using the Command Line to Create Virtual Machines

From the command line, you can enter `vm-install` to run a text version of the Create Virtual Machine Wizard. The text version of the wizard is helpful in environments without a graphical user interface.

For information on scripting a virtual machine installation, see the man pages of `vm-install` and `vm-install-jobs`.

Figure 1-9 Command Line Interface



1.21 Mapping Physical Storage to Virtual Disks

To specify a mapping between physical storage and the virtual disk, you might need to edit the virtual machine's disk information. Follow the instructions in [Section 1.3, "Virtual Machine Settings," on page 14](#), to change the device's `uname` entry to the desired setting.

Example: Virtual Machine Output from Xend

```
(vbd
  (dev xvda:disk)
  (uname file:/var/lib/xen/images/oes21/disk0)
  (mode w)
  (type disk)
  (backend 0)
)
```

Table 1-6 *uname Settings*

Protocol	Description	Example
phy:	Block devices, such as a physical disk, in domain 0	phy:/dev/hda
file:	Raw disk images accessed by using loopback	file:/path/file
tap:aio:	Raw disk images accessed by using blktap. Similar to loopback but with better performance	tap:aio:/path/file
tap:vmrk:	VMware disk images accessed by using blktap	tap:vmrk:/path/file
nbd:	Raw disk images accessed by using NBD	nbd: ip_port
tap:qcow:	QEMU disk images accessed by using blktap	tap:qcow/path/file
iscsi:	iSCSI targets using connections initiated from domain 0	iscsi:IQN,LUN
npiv:	Fibre Channel connections initiated from domain 0	npiv:NPIV,LUN

1.22 Virtual Disks

Virtual disks can be based on the following types of physical devices and files. Each type includes an example statement.

- ♦ A physical disk device, such as a DVD, that is accessible as a device to the host.
phy:/dev/cdrom
- ♦ A file that contains a disk image accessible from the file system of the host. Disk images can be encoded as raw, QEMU, or VMware.
file:/mnt/disks/sles10sp1.iso
tap:aio:/mnt/disks/sles10sp1.iso specifies a raw disk that mi
tap:qcow:/mnt/disks/sles10sp1.iso.qcow
tap:vmrk:/mnt/disks/sles10sp1.iso.vmrk
- ♦ A remote storage device specified using the Internet SCSI (iSCSI) protocol.
iscsi:iqn.2001-04.com.acme@0ac47ee2-216e-452a-a341-a12624cd0225
- ♦ A remote storage device specified using a Fibre Channel (NPIV) protocol.
npiv:210400e08b80c40f

1.23 Types of Installation Sources

When installing an operating system on a virtual machine, you must specify a valid installation source. A valid installation source depends on the combination of the operating system being installed and on the virtual machine's virtualization mode.

- ♦ [Section 1.23.1, "Installation Sources for Full Virtualization Mode," on page 39](#)
- ♦ [Section 1.23.2, "SUSE Linux Installation Sources for Paravirtual Mode," on page 39](#)
- ♦ [Section 1.23.3, "Red Hat Installation Sources for Paravirtual Mode," on page 39](#)
- ♦ [Section 1.23.4, "NetWare Installation Sources," on page 40](#)

1.23.1 Installation Sources for Full Virtualization Mode

The following types of installation sources are valid for installing guest operating systems on virtual machines running full virtualization mode. Each type includes an example statement.

- ♦ A physical disk device, such as a DVD, that is accessible as a device to the host.
`/dev/cdrom`
- ♦ A disk image, such as an ISO file, that is accessible from the local file system of the machine performing the installation.
`/mnt/install_ISOs/sles10sp1.iso`
- ♦ A remote storage device specified by using the Internet SCSI (iSCSI) protocol.
`iscsi:iqn.2001-04.com.acme@0ac47ee2-216e-452a-a341-a12624cd0225`
- ♦ A remote storage device specified by using a Fibre Channel (NPIV) protocol.
`npiv:210400e08b80c40f`

1.23.2 SUSE Linux Installation Sources for Paravirtual Mode

In addition to the types of installation sources listed for full virtualization mode, the following types of installation sources are valid for installing the SUSE Linux operating system on virtual machines running paravirtual mode. Each type includes an example statement.

- ♦ A remote directory containing the install files specified by using the HTTP protocol. HTTPS is not supported.
`http://www.domain.com/install_sources/sles10sp1/`
- ♦ A remote directory containing installation files specified by using the FTP protocol.
`ftp://www.domain.com/install_sources/sles10sp1/`
- ♦ A remote directory containing installation files specified by using the NFS protocol.
`nfs://www.domain.com/install_sources/sles10sp1/`
- ♦ A remote directory containing installation files specified by using the SMB protocol.
`smb://www.domain.com/install_sources/sles10sp1/`

1.23.3 Red Hat Installation Sources for Paravirtual Mode

In addition to the types of installation sources listed for fully virtual machines, the following types of installation sources are valid for installing the Red Hat* operating system on virtual machines running paravirtual mode. Each type includes an example statement.

- ♦ A remote directory containing installation files specified by using the HTTP protocol. HTTPS is not supported.
`http://www.domain.com/install_sources/rhel5/`
- ♦ A remote directory containing installation files specified by using the FTP protocol.
`ftp://www.domain.com/install_sources/rhel5/`
- ♦ A remote directory containing installation files specified by using the NFS protocol.
`nfs:www.domain.com/install_sources/rhel5/`

NOTE: The SMB protocol cannot be used to specify a Red Hat installation source.

1.23.4 NetWare Installation Sources

A paravirtualized NetWare[®] operating system, such as OES 2 NetWare, runs in paravirtual mode and can be installed by using the same type of installation sources as those used to install on virtual machines running full virtualization mode.

1.24 Deleting Virtual Machines

When you use Virtual Machine Manager or the `xm` command to delete a virtual machine, it no longer appears as a virtual machine, but its initial startup file and virtual disks are not automatically deleted.

To delete all components of a virtual machine configured with a file-backed virtual disk, you must manually delete its virtual disk image file (`/var/lib/xen/images/`) and its initial startup file (`/etc/xen/vm`).

1.25 Migrating Virtual Machines

A running virtual machine can be migrated from its source virtual machine host to another virtual machine host. This functionality is referred to as *live migration*. For live migration to work, the virtual machine being migrated must have access to its storage in exactly the same location on both source and destination host platforms.

Live migration only works when every entity involved is the same architecture. For example, a 64-bit paravirtualized guest running on a 64-bit hypervisor can be migrated a host running a 64-bit hypervisor. If any one of the pieces does not match exactly, migration will fail.

The following `xend` options, which are located in the `/etc/xen/xend-config.sxp` file, need to be set on both hosts in order for live migration to work.

```
(xend-relocation-server yes)
(xend-relocation-port 8002)
(xend-relocation-address "")
(xend-relocation-hosts-allow "")
```

For information on modifying `xend` settings, see [Section 1.2, “xend,” on page 12](#).

1.26 Passing Key Combinations to Virtual Machines

When in a virtual machine window, some key combinations, such as `Ctrl+Alt+F1`, are recognized by the virtual machine host and are not passed to the virtual machine. To bypass the virtual machine host, Virtual Machine Manager provides sticky key functionality. Pressing `Ctrl`, `Alt`, or `Shift` three times makes the key sticky, then you can press the remaining keys to pass the combination to the virtual machine.

For example, to pass `Ctrl+Alt+F2` to a Linux virtual machine, press `Ctrl` three times, then press `Alt+F2`. You could also press `Alt` three times, then press `Ctrl+F2`.

The sticky key functionality is available in Virtual Machine Manager during and after installing a virtual machine.

1.27 xm block-list Device Numbers

Virtual devices are named internally in Xen using the Linux-style major and minor numbers. This is true even for non-Linux virtual machines. The number returned from `xm block-list` is a decimal representation of the combined major and minor numbers.

For example, if a virtual machine's virtual disk is designated as `hda`, the number returned from `xm block-list` is 768. `hda` has major number 3 and minor number 0. The major number is stored as a high-order byte; the minor is the lower byte. A decimal representation is $(3*256)+0 = 768$. Another example, `sda3` has major number 8 and minor number 3, so its decimal representation is $(8*256)+3 = 2051$.

Of course, it is possible to manually work backwards from a number to discover the human-readable device name. For your reference, some common mappings listed in the following table.

/dev/hda	768
/dev/hdb	832
/dev/hdc	5632
/dev/hdd	5696
/dev/sda	2048
/dev/sdb	2064
/dev/sdc	2080
/dev/sdd	2096
/dev/xvda	51712
/dev/xvdb	51728
/dev/xvdc	51744
/dev/hdd	51760

1.28 File-Backed Virtual Disks and Loopback Devices

When a virtual machine is running, each of its file-backed virtual disks consumes a loopback device on the host. By default, the host allows up to eight loopback devices to be consumed.

To simultaneously run more file-backed virtual disks on a host, you can increase the number of available loopback devices by adding the following option to the host's `/etc/modprobe.conf.local` file.

```
options loop max_loop=x
```

where `x` is the maximum number of loopback devices to create.

Changes take effect after the module is reloaded.

TIP: Enter `rmmod loop` and `modprobe loop` to unload and reload the module.

Documentation Updates

A

This section contains information about content changes and additions made to the Configuration Options and Settings Guide. If you have read through the documentation previously, you should review the change entries to identify what content was modified.

In this section, content changes appear in chronological order, according to the publication date. Within a dated entry, changes are grouped and sequenced, according to where they appear in the document itself. Each change entry provides a link to the related topic and a brief description of the change.

This document was updated on the following dates:

- ♦ [Section A.1, “July 27, 2007,” on page 43](#)
- ♦ [Section A.2, “August 22, 2007,” on page 43](#)
- ♦ [Section A.3, “September 24, 2007,” on page 43](#)

A.1 July 27, 2007

Added [Section 1.25, “Migrating Virtual Machines,” on page 40](#).

Added [Section 1.26, “Passing Key Combinations to Virtual Machines,” on page 40](#).

A.2 August 22, 2007

Added [Section 1.27, “xm block-list Device Numbers,” on page 41](#).

A.3 September 24, 2007

Updated [Section 1.15, “Virtual Machine Clock Settings,” on page 33](#).

Added [Section 1.28, “File-Backed Virtual Disks and Loopback Devices,” on page 41](#).