

Xen to KVM Migration Guide

SUSE Linux Enterprise Server 11 SP4

As the KVM virtualization solution is becoming more and more popular among server administrators, many of them need a path to migrate their existing Xen based environments to KVM. As of now, there are no mature tools to automatically convert Xen VMs to KVM. There is, however, a technical solution that helps convert Xen virtual machines to KVM. Information and procedures introduced in this helps you smooth the migration.

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Important

The migration procedure described in this document is not fully supported by SUSE. We provide it as a guidance only.

1 Xen to KVM Manual Migration

1.1 General Outline

The preferred solution to manage virtual machines is based on libvirt (See <http://libvirt.org/>  for more details). It has several notable advantages over the manual way of defining/running virtual machines — libvirt is cross-platform, supports many hypervisors, secure remote management, virtual networking, and, most of all, provides a unified abstract layer to manage virtual machines. Therefore the main focus of this article is on the libvirt solution.

Generally, the Xen to KVM migration runs in the following basic steps:

1. Make a backup copy of the original Xen VM Guest.
2. OPTIONAL: Apply changes specific to paravirtualized guests.
3. Obtain information about the original Xen VM Guest and update it to KVM equivalents.
4. Shut down the guest on the Xen host, and run the new one under the KVM hypervisor.



Warning: No Live Migration

The Xen to KVM migration cannot be done live while the source VM Guest is running. Before running the new KVM-ready VM Guest, you are advised to shut down the original Xen VM Guest.

1.2 Back Up the Xen VM Guest

To back up your Xen VM Guest, follow these steps:

1. Identify the relevant Xen guest you want to migrate, and remember its ID/name.

```
# virsh list --all
Id Name                               State
-----
 0 Domain-0                           running
 1 SLES11SP3                          running
[...]
```

2. Shut down the guest. You can do this either by shutting down the guest OS, or with virsh:

```
# virsh shutdown SLES11SP3
```

3. Backup its configuration to an XML file.

```
# virsh dumpxml SLES11SP3 > sles11sp3.xml
```

4. Backup its disk image file. Use the cp or rsync commands to create the backup copy. Remember that it is always a good idea to check the copy with the md5sum command.
5. After the image file is backed up, you can start the guest again with

```
# virsh start SLES11SP3
```

1.3 Changes Specific to Paravirtualized Guests

Apply the following changes if you are migrating a paravirtualized Xen guest. You can do it either on the running guest, or on the stopped guest using guestfs-tools.



Important

After applying the changes described in this section, the image file related to the migrated VM Guest will not be usable under Xen anymore.

1.3.1 Install the Default Kernel



Warning

After you install the default Kernel, do not try to boot the Xen guest with it, the system will not boot.

Before cloning the Xen guest disk image for use under the KVM hypervisor, make sure it is bootable *without* the Xen hypervisor. This is very important for paravirtualized Xen guests as they usually contain a special Xen Kernel, and often do not have a complete GRUB boot loader installed.

1. Update the `/etc/sysconfig/kernel` file. Change the `INITRD_MODULES` parameter by removing all Xen drivers and replacing the with virtio drivers. Replace

```
INITRD_MODULES="xenblk xennet"
```

with

```
INITRD_MODULES="virtio_blk virtio_pci virtio_net virtio_balloon"
```

2. Paravirtualized Xen guests are running a specific Xen Kernel. To run the guest under KVM, you need to install the default Kernel.



Note

You do not need to install the default Kernel for a fully virtualized guests as it is already installed.

Enter `rpm -q kernel-default` on the Xen guest to find out if the default Kernel is installed. If not, install it with `zypper in kernel-default`.

The Kernel we are going to use to boot the guest under KVM must have *virtio* (paravirtualized) drivers available. Run the following command to find out. Do not forget to replace `3.8.9-4` with your Kernel version:

```
# find /lib/modules/3.8.9-4-default/kernel/drivers/ -name virtio*
/lib/modules/3.8.9-4-default/kernel/drivers/net/virtio_net.ko
/lib/modules/3.8.9-4-default/kernel/drivers/scsi/virtio_scsi.ko
/lib/modules/3.8.9-4-default/kernel/drivers/block/virtio_blk.ko
/lib/modules/3.8.9-4-default/kernel/drivers/char/virtio_console.ko
/lib/modules/3.8.9-4-default/kernel/drivers/char/hw_random/virtio_rng.ko
/lib/modules/3.8.9-4-default/kernel/drivers/virtio
/lib/modules/3.8.9-4-default/kernel/drivers/virtio/virtio.ko
/lib/modules/3.8.9-4-default/kernel/drivers/virtio/virtio_pci.ko
/lib/modules/3.8.9-4-default/kernel/drivers/virtio/virtio_balloon.ko
/lib/modules/3.8.9-4-default/kernel/drivers/virtio/virtio_ring.ko
/lib/modules/3.8.9-4-default/kernel/drivers/virtio/virtio_mmio.ko
```

3. Update `/etc/fstab`. Change any storage devices from `xvda` to `vda`.
4. Update the boot loader configuration. Enter `rpm -q grub` on the Xen guest to find out if GRUB is already installed. If not, install it with `zypper in grub`.

Now make the newly installed default Kernel the default for booting the OS. Also remove/update the Kernel command line options that may refer to Xen-specific devices. You can do it either with YaST (*System > Boot Loader*), or manually:

- In your favorite text editor, open `/boot/grub/menu.lst`.
- Find the boot menu entry (entries start with `title`) containing the default non-Xen Kernel to boot, and set the global GRUB's `default` option to the number of the entry (counted from zero).
- From the same menu entry's Kernel command line, remove/update any reference to Xen-specific devices. In the following example, you can replace

```
root=/dev/xvda1 disk=/dev/xvda console=xvc
```

with

```
root=/dev/vda1 disk=/dev/vda
```

Note that you need to remove all references to `xvc`-type consoles (such as `xvc0`).

5. Update `device.map` in one of the `/boot/grub`, `/boot/grub2`, or `/boot/grub2-efi` directory. Change any storage device from `xvda` to `vda`.

1.3.2 Update the Guest for Boot under KVM

1. Update the `/etc/inittab` file to use default serial console:
 - Comment the line containing `xvc0`.
 - OPTIONAL. Uncomment the line containing `S0` if you are using a serial port.
2. Update the `/etc/securetty` file. Replace `xvc0` with `ttyS0`.

1.4 Update the Xen VM Guest Configuration

This section describes how to export the configuration of the original Xen VM Guest, and what particular changes to apply to it to be able to import it as a KVM guest into libvirt.

1.4.1 Export the Xen VM Guest Configuration

First export the configuration of the guest and save it to a file. A typical one may look like this:

```
# virsh dumpxml SLES11SP3
<domain type='xen'>
  <name>SLES11SP3</name>
  <uuid>fa9ea4d7-8f95-30c0-bce9-9e58ffcabeb2</uuid>
  <memory>524288</memory>
  <currentMemory>524288</currentMemory>
  <vcpu>1</vcpu>
  <bootloader>/usr/bin/pygrub</bootloader>
  <os>
    <type>linux</type>
  </os>
  <clock offset='utc' />
  <on_poweroff>destroy</on_poweroff>
  <on_reboot>restart</on_reboot>
  <on_crash>restart</on_crash>
  <devices>
    <emulator>/usr/lib/xen/bin/qemu-dm</emulator>
    <disk type='file' device='disk'>
      <driver name='file' />
      <source file='/var/lib/libvirt/images/SLES_11_SP2_JeOS.x86_64-0.0.2_para.raw' />
      <target dev='xvda' bus='xen' />
    </disk>
    <interface type='bridge'>
      <mac address='00:16:3e:2d:91:c3' />
      <source bridge='br0' />
      <script path='vif-bridge' />
    </interface>
    <console type='pty'>
      <target type='xen' port='0' />
    </console>
    <input type='mouse' bus='xen' />
    <graphics type='vnc' port='-1' autoport='yes' keymap='en-us' />
  </devices>
</domain>
```



Tip

You can find detailed information on the libvirt XML format for VM Guest description at <http://libvirt.org/formatdomain.html>.

1.4.2 General Changes to the Guest Configuration

You have to make a few general changes to the exported Xen guest XML configuration in order to run it under the KVM hypervisor. The following applies to both fully virtualized and paravirtualized guests. Note that not all of the following XML elements need to be present in your specific configuration.



Tip: Conventions Used

To refer to a node in the XML configuration file, an XPath syntax will be used throughout this document. For example, to refer to a `<name>` inside the `<domain>` tag

```
<domain>
  <name>sles11sp3</name>
</domain>
```

an XPath equivalent `/domain/name` will be used.

1. Change the `type` attribute of the `/domain` element from `xen` to `kvm`.
2. Remove the `/domain/bootloader` element section.
3. Remove the `/domain/bootloader_args` element section.
4. Change the `/domain/os/type` element value from `linux` to `hvm`.
5. Add `<boot dev="hd"/>` under the `/domain/os` element.
6. Add the `arch` attribute to the `/domain/os/type` element. Acceptable values are `arch="x86_64"` or `arch="i686"`
7. Change the `/domain/devices/emulator` element from `/usr/lib/xen/bin/qemu-dm'` to `/usr/bin/qemu-kvm`.

8. For each disk associated with the paravirtualized (PV) guest, change the following:

- Change the `name` attribute of the `/domain/devices/disk/driver` element from `file` to `qemu`, and add a `type` attribute for the disk type. For example, valid options include `raw` or `qcow2`.
- Change the `dev` attribute of the `/domain/devices/disk/target` element from `xvda` to `vda`.
- Change the `bus` attribute of the `/domain/devices/disk/target` element from `xen` to `virtio`.

9. For each network interface card, do the following changes:

- If there is `model` defined in `/domain/devices/interface`, change its `type` attribute value to `virtio`

```
<model type="virtio">
```

- Delete all `/domain/devices/interface/script` sections.
- Delete all `/domain/devices/interface/target` elements if the `dev` attribute starts with `vif` or `vnet` or `veth`. If using a custom network then change the `dev` value to that target.

10. Remove the `/domain/devices/console` element section if it exists.

11. Remove the `/domain/devices/serial` element section if it exists.

12. Change the `bus` attribute on the `/domain/devices/input` element from `xen` to `ps2`.

13. Add the following element for memory ballooning features under the `/domain/devices` element.

```
<memballoon model="virtio"/>
```



Tip

`<target dev='hda' bus='ide' />` controls the device under which the disk is exposed to the guest OS. The `dev` attribute indicates the "logical" device name. The actual device name specified is not guaranteed to map to the device name in the guest OS. Therefore

you may need to change the disk mapping on the boot loader command line. For example if the boot loader expects a root disk to be hda2 but KVM still sees it as sda2, change the boot loader command line from

```
[...] root=/dev/hda2 resume=/dev/hda1 [...]
```

to

```
[...] root=/dev/sda2 resume=/dev/sda1 [...]
```

or to

```
[...] root=/dev/vda2 resume=/dev/vda1 [...]
```

in the case of paravirtualized xvda devices.

Otherwise the VM Guest will refuse to boot in the KVM environment.

1.4.3 The Target KVM Guest Configuration

After having applied all the modifications mentioned above, you end up with the following configuration for your KVM guest:

```
<domain type='kvm'>
  <name>SLES11SP3</name>
  <uuid>fa9ea4d7-8f95-30c0-bce9-9e58ffcabeb2</uuid>
  <memory>524288</memory>
  <currentMemory>524288</currentMemory>
  <vcpu cpuset='0-3'>1</vcpu>
  <os>
    <type arch="x86_64">hvm</type>
    <boot dev="hd"/>
  </os>
  <clock offset='utc' />
  <on_poweroff>destroy</on_poweroff>
  <on_reboot>restart</on_reboot>
  <on_crash>restart</on_crash>
  <devices>
    <emulator>/usr/bin/qemu-kvm</emulator>
    <disk type='file' device='disk'>
      <driver name='qemu' type="raw"/>
      <source file='/var/lib/libvirt/images/SLES_11_SP2_JeOS.x86_64-0.0.2_para.raw' />
      <target dev='vda' bus='virtio' />
    </disk>
```

```

<interface type='bridge'>
  <mac address='00:16:3e:2d:91:c3' />
  <source bridge='br0' />
</interface>
<input type='mouse' bus='usb' />
<graphics type='vnc' port='5900' autoport='yes' keymap='en-us' />
<memballoon model="virtio"/>
</devices>
</domain>

```

Save the configuration to a file in your home directory. After you later import it, it will be copied to the default `/etc/libvirt/qemu`. Suppose you save the file as `SLES11SP3.xml`.

1.5 Migrate the VM Guest

After you updated the VM Guest configuration, and applied necessary changes to the guest OS, it is time to shut down the original Xen guest, and run its clone under the KVM hypervisor.

1. Shut down the guest on the Xen host by running `shutdown -h now` as `root` from the console.
2. Copy the disk files associated with the VM Guest if needed. A default configuration will require the Xen disk files to be copied from `/var/lib/xen/images` to `/var/lib/kvm/images`. The `/var/lib/kvm/images` directory may need to be created (as `root`) if you have not previously created a VM Guest.
3. Create the new domain, and register it with `libvirt`:

```

# virsh define SLES11SP3.xml
Domain SLES11SP3 defined from SLES11SP3.xml

```

4. Verify that the new guest is seen in the KVM configuration:

```
virsh list --all
```

5. Once the domain is created, you can start it:

```

# virsh start SLES11SP3
Domain SLES11SP3 started

```

2 For more information

For more information on libvirt, see <http://libvirt.org>.

You can find more details on libvirt XML format at <http://libvirt.org/formatdomain.html>.

For more information on Xen administration, see https://www.suse.com/documentation/sles11/book_xen/data/book_xen.html.

For more information on virtualization with KVM, see https://www.suse.com/documentation/sles11/book_kvm/data/book_kvm.html.

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