

Virtualization with SUSE Linux Enterprise 11 SP2 Lab

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Novell, Inc.
404 Wyman Street, Suite 500
Waltham, MA 02451
U.S.A.
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Section 1 Introduction to Virtualization with KVM

This section gives an introduction to the KVM virtualization environment.

1.1 Install a Virtualization Host Server on SUSE Linux Enterprise

In this exercise you will install the packages required for SLES to run as a KVM vHost.

Objectives:

Task I: Install Virtualization Software

Special Instructions and Notes:

(none)

Task I: Install Virtualization Software

1. Launch the YaST Software Management module:
YaST > Virtualization > Install Hypervisor and Tools
2. When prompted to select the virtualization platform to install, select **KVM** and then click **Accept**
3. When prompted that packages need to be installed, click **Continue** to install packages
4. When prompted to create a default network bridge, click **Yes**
5. When prompted to reboot, click **OK**
6. Reboot the machine.

(End of Exercise)

Section 2 Introduction to Virtual Machines

This section provides an introduction to the anatomy and configuration fo virtual machines

(No Lab Exercises)

Section 3 Introduction to Open Source Virtualization Management

This section covers utilities used to manage Xen and KVM virtualization platforms.

3.1 Install a SLES11 KVM Virtual Machine

In this exercise you use the `vm-install` utility to install a new SLES11 KVM virtual machine.

Objectives:

Task I: Install a KVM Virtual Machine

Special Instructions and Notes:

Perform the following Lab on the VM Server (Host Machine).

`INSTALL_URL=_____`

Task I: Install a KVM Virtual Machine

7. Launch the Virtual Machine Installation utility:
YaST > Virtualization > Create Virtual Machines
8. Begin Installation in the `vm-install` utility by clicking the **Forward** button
9. Click **I need to install an operating system** and then click **Forward**
10. Select **SUSE Linux Enterprise Server 11** from the list of OSes and then click **Forward**
11. Use the following initial settings to configure the VM installation:

NOTE: To install from a network install server do not add a CDROM drive in the Drives section and add the install URL optionally recorded above as the Install Source in the Operating System Installation section.
(Hint: Select the blue text title of an entry to change its parameters)

Name of Virtual Machine

vm1

Hardware

Initial Memory: 256 MB
Maximum Memory: <accept the default>
Virtual Processors: 1

Perhipheral Devices:

Graphics Adapter: Cirrus Logic GD5446 VGA
Keymap: en-us

Sound Card: None

Disks

1: 8.0 GB Hard Disk (/var/lib/xen/images/vm1/disk0)

Network Adapters

1: QEMU Virtualized NIC Card: Randomly generated MAC address

Operating System Installation

Operating System: SUSE Linux Enterprise Server 11

Installation Source: *INSTALL_URL*

Automated Installation:

Additional Arguments:

NOTE: If you wish to install from CD/DVD, add a CD-ROM/DVD as an installation source select the following (DO NOT do this if your are installing form the network):

DISKS:

CD-Rom

OK

Apply

You should now see a new CD-ROM entry under Disks:

Under the Operating System Installation section you should also see the Installation Source entry populated with the CD/DVD as the source.

12. Click **OK** to start the installation:
13. Continue with the SLES 11 installation as normal in the VNC installation window that appears.

Notes on install:

Select all defaults for the installation with the following exceptions:

-Server Base Scenario: Physical Machine (or full virtual machine)

-root password = linux

-hostname = vm1.site

-Skip the Internet test

-Do not create a local user

-Do not clone the system for AutoYaST

- You must click inside the installation window to give it focus. To release focus from the window in which the installation is happening you must press **ctrl+alt**
- If you cannot move the mouse cursor to a part of the VMs screen release the cursor, move the cursor to the top left hand corner of the VM and then click inside the VM window. This should resynchronize the mouse cursors.

(End of Exercise)

Section 4 Manage Virtualization Platforms with Libvirt

This section covers Libvirt and Libvirt based utilities used to manage Xen and KVM virtualization platforms.

4.1 Use Common virsh Commands with KVM

In this exercise you will use common virsh commands to work with KVM VMs.

Objectives:

Task I: Work with Unmanaged VMs

Task II: Work with Managed VMs

Special Instructions and Notes:

You must have KVM installed to perform this exercise.

VM1_NAME= _____

VM2_NAME= _____

Task I: Work with Unmanaged VMs

In this task you will use common virsh command to work with an unmanaged KVM VM.

1. If you are not already logged in as the root user, open a terminal window and use the **su -** command to become root
2. Enter the following command s to launch the **VM1_NAME** VM using only it's configuration:

```
cd /vmstore/VM1_NAME
```

```
virsh create VM1_NAME.xml
```

3. View that the VM is running by entering the following:

```
virsh list
```

You should see that the vm is running on your machine

4. Shutdown the VM by entering the following:

```
virsh shutdown VM1_NAME
```

NOTE: You may need to connect to the VM's virtual framebuffer (GUI console) and enter the root user's password for the VM to shut down.

5. See that the VM is no longer running:

```
virsh list
```

Task II: Work with Managed VMs

In this task you will use common virsh commands to work with a managed KVM VM.

1. List the existing managed and currently running VMs by entering the following:

```
virsh list
```

You should not see information about the *VM1_NAME* vm.

- To make the *VM1_NAME* VM a managed VM, enter the following command:

```
cd /vmstore/VM1_NAME
virsh define VM1_NAME.xml
cd /vmstore/VM2_NAME
virsh create VM2_NAME.xml
```

- To see that the VM1 and VM2 are now “managed VMs” enter the following command:

```
virsh dominfo VM1_NAME
virsh dominfo VM2_NAME
```

You should see information about the VMs.

- Launch the VM1 VM by entering the following command:

```
virsh start VM1_NAME
```

- To see that the VM is running enter the following command:

```
virsh list
```

You should see that the *VM1_NAME* VM is now running

Record the *VM1_NAME*'s VM1 ID number here: *VM1_ID*=_____

- Shut down the *VM1_NAME* VM using it's VM ID number by entering the following command:

```
virsh shutdown VM1_ID
```

- Export the *VM1_NAME*'s configuration out of the managed VM database into a file by entering the following (with no line wraps):

```
virsh dumpxml VM1_NAME > /tmp/VM1_NAME-test.xml
```

- View the contents of the xml file you just exported by entering the following:

```
less /tmp/VM1_NAME-test.xml
```

- Remove the *VM1_NAME* VM's configuration from the managed VM database by entering the following:

```
virsh undefine VM1_NAME
```

- To see that the *VM1_NAME*'s configuration is no longer being stored in the managed VM database enter the following command:

```
virsh dominfo VM1_NAME
```

You should not see information about the *VM1_NAME* VM.

- To re-import the *VM1_NAME*'s configuration into the managed VM database using the exported configuration information enter the following command:

```
virsh define /tmp/VM1_NAME-test.xml
```

12. To see that the *VM1_NAME* VM is now managed again enter the following command:

```
virsh dominfo VM1_NAME
```

You should see information about the VM.

(End of Exercise)

4.2 Use virt-viewer to Connect to a Running KVM VM

In this exercise you will use the virt-viewer utility to connect to the GUI console of a running KVM VM.

Objectives:

Task I: Launch a KVM Virtual Machine

Task II: Connect to a KVM Virtual Machine with virt-viewer

Special Instructions and Notes:

This exercise assumes that you are logged in as the root user.

VM1_NAME: _____

VM1_CONFIG: _____

Task I: Launch a KVM Virtual Machine

In this part you will launch a KVM virtual machine to connect to with virt-viewer

1. If not already logged in as the root user, enter **su -** to become root.
2. If one is not already running, launch a KVM paravirtual machine:

for an unmanaged vm:

```
virsh create VM1_CONFIG
```

Task II: Connect to a KVM Virtual Machine with virt-viewer

In this section you will use virt-viewer to connect to the GUI console of a running KVM virtual machine.

1. To connect to the running virtual machine with virt-viewer, enter the following command:

```
virt-viewer VM1_NAME
```

You should now see the GUI console of the virtual machine.

2. Select the following from the menu bar to switch to virtual terminal 1:

```
Send Key > Ctrl+Alt+F1
```

You should now see the login prompt at virtual terminal 1

3. Select the following from the menu bar to switch back to the GUI:

```
Send Key > Ctrl+Alt+F7
```

You should now see the GUI

4. Login to the virtual machine as the root user

5. Close the virt-viewer window
6. Re-connect to the virtual machine with virt-viewer:
Alt+F2
virt-viewer *VM1_NAME*
You should see that you are still logged in
7. Shutdown the virtual machine.

(End of Exercise)

4.3 Use virt-manager to Manage Local KVM Virtual Machines

In this exercise, you use the virt-manager utility to manage local virtual machines.

Objectives:

Task I: Launch virt-manager

Task II: Manage Local VMs with virt-manager

Task III: Edit VM Configuration with virt-manager

Special Instructions and Notes:

You must have at least one virtual machine's configuration uploaded into the manage VM database to perform this exercise. If you do not, use the **virsh define** command to import a VM's configuration into the managed database

KVM_VM1_NAME=_____

KVM_VM1_CONFIG=_____

KVM_VM2_NAME=_____

KVM_VM2_CONFIG=_____

Task I: Launch virt-manager

1. If not logged in as the root user, enter **su -** to become root.
2. Enter the following commands to make 2 virtual machines managed:

```
virsh define KVM_VM1_CONFIG
```

```
virsh define KVM_VM2_CONFIG
```

3. Launch virt-manager:

```
Alt+F2
```

```
gnomesu virt-manager
```

NOTE: If you launch virt-manager outside of YaST, you must double-click on the **localhost (QEMU)** entry to connect to the local instance of libvirt

4. You should see all running and managed virtual machines on the local system

Task II: Manage Local VMs with virt-manager

1. To launch a virtual machine, right-click a non-running VM in the list and select

Run

The virtual machine should start

NOTE: If the VM fails to start, an error message will appear describing the reason the VM failed to start.

2. To view the virtual frame buffer (GUI console) of the running VM, either double-click on the VM or highlight the VM and click the **Open** button
The virtual frame buffer or GUI console of the VM should now be visible
3. To stop the VM, either right-click on the VM in the main virt-manager window and select **shutdown** or if the GUI console is open, click on the **Shutdown** button at the top of the window
The VM should now be shutting down

Task III: Edit VM Configuration with virt-manager

1. From the main virt-manager window, either right-click on a VM and select **Open** (or just double-click on the VM in the list). On the Virtual Machine window that appears click the **Details** button
You should now see the virtual machine's details window.
2. Change the virtual machine's hardware configuration by selecting **Memory**, and using the **Change allocation** field to change the amount of memory assigned to the virtual machine.
You may also start/stop/pause a virtual machine from this window as well
3. Close the virtual machine's details window and close virt-manager

(End of Exercise)

4.4 Configure Key Based Authentication in OpenSSH

In this exercise, you practice using SSH with public key authentication.

First, you create an ssh-key pair on your vHost. Then you add the public key to the `/root/.ssh/authorized_keys` file on your lab partner's server and note the difference between logging in with and without a public key.

You may wish to perform these same tasks for the `geeko` user as well (using the `geeko` user's home directory and credentials in place of `root`'s)

Objectives:

Task I: Generate an SSH Key Pair

Task II: Upload the Public Key to a Remote Server

Task III: Verify Key Based Login

Special Instructions and Notes:

Use the following value(s) in this exercise:

REMOTE_IP=_____

Task I: Generate an SSH Key Pair

1. Log in to your machine as **root**
2. Open a terminal window and enter the following command to generate an SSH key pair:

```
ssh-keygen -t rsa
```
3. Accept the default location for the key (`/root/.ssh/id_rsa`)
4. Press **Enter** twice to set an empty passphrase on the keypair

Information about your key pair, such as the location of your identification and the public key, is displayed

Task II: Upload the Public Key to a Remote Server

1. On your machine, enter the following command to upload your public key to `root` on your lab partner's machine:

```
ssh-copy-id -i ~/.ssh/id_rsa.pub root@REMOTE_IP
```

After authentication you should see a message that the key was uploaded successfully

Note: The longer way to do this would be to `scp` the key to the remote server:

```
scp ~/.ssh/id_rsa.pub root@REMOTE_IP:/root/
```

SSH into the remote server:

```
ssh root@REMOTE_IP
```

Append the key to the known_hosts file:

```
cat ~/id_rsa.pub >> ~/.ssh/known_hosts
```

Task III: Verify Key Based Login

1. Enter the following command to connect to the remote host via ssh as root:

```
ssh root@REMOTE_IP
```

You should be logged into the remote server without being prompted for a password or passphrase

(End of Exercise)

4.5 Use virsh to Connect to a Remote System via SSH

In this exercise, you use the virsh utility to connect to a remote system via SSH.

Objectives:

Task I: Use virsh to Connect to a Remote System via SSH

Special Instructions and Notes:

You must have the server and client certificates installed before you perform this exercise

Task I: Use virsh to Connect to a Remote System via SSH

1. Log into the machine designated as the **client** as the **root** user with the password **novell**
2. Enter the following command to connect to the remote machine:

```
virsh -c qemu+ssh://USERNAME@LIBVIRT_SRVR_FQDN/system
```

Note: If you are using Xen enter the following URI instead:

```
xen+ssh:// USERNAME@LIBVIRT_SRVR_FQDN
```

When prompted for the password, enter the password for ***USERNAME***

You should be at a **virsh #** prompt on the remote machine

3. Enter the following command to view information about the vHost:

```
nodeinfo
```
4. Enter the following command to view a list of the VMs that the vHost knows about:

```
list --all
```
5. Enter the following command to view a list of the Libvirt virtual networks configured on the vHost:

```
net-list --all
```
6. Enter the following command to disconnect from the remote machine:

```
quit
```

You should now be back to the command prompt on your machine

(End of Exercise)

4.6 Use virt-viewer to Connect to a Remote KVM VM

In this exercise you will use the virt-viewer utility to connect to the GUI console of a running remote KVM VM.

Objectives:

Task I: Launch a KVM VM on a Remote vHost

Task II: Connect to a Remote KVM VM with virt-viewer

Special Instructions and Notes:

REMOTE_IP: _____
VM_NAME: _____
VM_CONFIG_FILE: _____

Task I: Launch a KVM VM on a Remote vHost

In this task you will launch a KVM virtual machine on a remote vHost.

1. On the remote vHost, if one is not already running, launch a KVM virtual machine:

Note: These commands are each a single line with no line wraps

for a managed vm:

```
virsh -c qemu+ssh://root@REMOTE_IP/system start  
VM_NAME
```

for an unmanaged vm:

```
virsh -c qemu+ssh://root@REMOTE_IP/system create  
VM_CONFIG_FILE
```

If prompted for the root user's password, enter **novell**

Task II: Connect to a Remote KVM VM with virt-viewer

In this section you will use virt-viewer to connect to the GUI console of a running remote virtual machine.

1. To connect to the running virtual machine with virt-viewer, on a different machine enter the following command:

Note: These 2 commands are each on single lines with no line wraps

Alt+F2

```
virt-viewer -c qemu+ssh://root@REMOTE_IP/system  
VM_NAME
```

2. If prompted for a password, enter the root users password on the machine where

the VMs are running

You should now see the GUI console of the virtual machine.

3. To switch to virtual terminal 1 select the following:

Send Key > Ctrl+Alt+F1

You should now see the login prompt at virtual terminal 1

4. To switch back to the GUI select the following:

Send Key > Ctrl+Alt+F7

You should now see the GUI

5. To lock the pointer in the VM's virt-viewer window select the window with the mouse pointer and then enter the following:

Ctrl+Alt

You should no longer be able to move the mouse pointer out of the VM's virt-viewer window. All input will be grabbed only by the VM.

TIP: The title bar of the VM's virt-viewer window will show you when the mouse pointer has been grabbed by that windows and the key stroke used to release the pointer.

6. To release the pointer form the VM's virt-viewer window, enter the following:

Ctrl+Alt

You should now be able to move the mouse pointer out of the VM's virt-viewer window.

7. Close the virt-viewer window to disconnect from the remote VM

(End of Exercise)

4.7 Manage VMs on a Remote vHost with virt-manager

In this exercise you will use the virt-manager utility to connect to and manage a remote vHost.

Objectives:

Task I: Connect to a Remote vHost with virt-manager

Task II: Launch a VM on a Remote vHost

Special Instructions and Notes:

VMHOST_IP: _____

This exercise was written based on virt-manager 0.9.x. If you are using a different version, the exercise will still work but the steps might be slightly different.

Task I: Connect to a Remote vHost with virt-manager

In this section you will use virt-manager to connect to a remote VM server..

1. While logged in as the gecko user, launch the virt-manager utility as follows:

Alt+F2

virt-manager

2. Select from the menu bar: **File > Add Connection**
3. Select **Connect to remote host** and then select the following:

Method: **SSH**

Username: **root**

Hostname: **VHOST_IP**

Selecting Autoconnect is optional

4. Click the **Connect** button
5. If you are prompted for a ssh password, enter the password of the root user on the remote machine

TIP: The “accept ssh host key” and “ssh password” prompts may appear behind the virt-viewer window. You must type “yes” and then click **OK** to accept the host key. If you do not see them after clicking **Connect**, move the windows around to find them.

If the connection fails and you don't see a ssh askpass prompt, you will need to generate a ssh key and then copy it to the remote machine:

```
ssh-keygen -t rsa
```

```
ssh-copy-id -i ~/.ssh/id_rsa.pub root@VHOST_IP
```

You should now see a list of VMs that are on your teammates VM server.

Task II: Launch a VM on a Remote vHost

In this task you will launch a KVM Virtual machine on a remote vHost.

1. Double-click one of the non-running VMs on the remote vHost
2. In the Virtual Machine Console window that appears, click **Run**

If you are prompted for a ssh password, enter the password of the root user on the remote machine

You should now see the console of the VM running on the remote VM server

3. In the Virtual Machine Console window, click **Shutdown**

You should see the VM running on the remote VM server shut down

If you are prompted for an ssh password, enter the password of the root user on the remote machine

(End of Exercise)

Section 5 Pause, Save and Automatically Boot KVM VMs

This section covers other virtualization administration tasks such as pausing, saving and restoring virtual machines.

5.1 Pause and Save KVM VMs

In this exercise, you pause/unpause and save/restore a KVM VM.

Objectives:

Task I: Pause and Unpause a Running VM with Virt-Manager

Task II: Suspend and Resume a Running VM with virsh

Task III: Save and Restore a Running VM

Task IV: Managedsave and Start a Running VM

Special Instructions and Notes:

`VM_NAME=` _____

`VM_DIR=` _____

Task I: Pause and Unpause a Running VM with Virt-Manager

1. If you are not already logged in as the root user, enter `su -` to become root.
2. Using either `virt-manager` or the `virsh` command, launch a virtual machine
3. If not already running, launch `virt-manager` and open the graphical console of the virtual machine (using built-in `virt-manager` VNC viewer).
4. Open a terminal window. In the terminal window run the following command:

```
watch virsh list --all
```

Arrange the windows so that you can see the terminal window, the graphical console and the `virt-manager` window at the same time.
5. In the VM's graphical console, click the **Pause** button to pause the virtual machine. You should see that the virtual machine is paused in the `virt-manager` window.
6. In the terminal window running the `virsh list` command, you should see the state of the virtual machine is paused
7. To unpause the VM, click the **Restore** button in the `virt-manager` graphical console. You should see that the virtual machine is running again

Task II: Suspend and Resume a Running VM with virsh

1. If it is not already running launch the virtual machine
2. If not already running launch `virt-manager` and open the graphical console (built-in `virt-manager` VNC viewer) of the virtual machine
3. Open a terminal window. In the terminal window run the following command:

```
watch virsh list --all
```

4. At the command line of the VM server run the following command to suspend (pause) the virtual machine:

```
virsh suspend VM_NAME
```

5. You should see in both the virt-manager window and the terminal window running **virsh list** that the virtual machine is paused

6. To resume (unpause) the saved virtual machine enter the following command at the command line of the VM server:

```
virsh resume VM_NAME
```

You should see that the virtual machine is now running again

Task III: Save and Restore a Running VM

1. If it is not already running launch the virtual machine
2. If not already running launch virt-manager and open the graphical console (built-in virt-manager VNC viewer) of the virtual machine

3. Open a terminal window. In the terminal window run the following command:

```
watch virsh list --all
```

4. At the command line of the VM server run the following command to save the virtual machine:

```
virsh save VM_NAME VM_DIR/checkpoint.chk
```

5. You should see in both the virt-manager window and the terminal window running **virsh list** that the virtual machine is no longer running

6. To view the saved memory image “checkpoint” file enter the following command at the command line of the VM server:

```
ls -l VM_DIR
```

You should see that a new memory image “checkpoint” file named checkpoint.chk exists in that directory

7. To restore the saved virtual machine enter the following command at the command line of the VM server:

```
virsh restore VM_DIR/checkpoint.chk
```

8. You should see that the virtual machine is now running again and in the same state it was in when it was saved

Task IV: Managedsave and Start a Running VM

1. If it is not already running launch the virtual machine
2. If not already running launch virt-manager and open the graphical console (built-in

- virt-manager VNC viewer) of the virtual machine
3. Open a terminal window. In the terminal window run the following command:
watch virsh list --all
 4. At the command line of the VM server run the following command to save the virtual machine:
virsh managedsave *VM_NAME*
 5. You should see in both the virt-manager window and the terminal window running **virsh list** that the virtual machine is no longer running
 6. To view the saved memory image “checkpoint” file enter the following command at the command line of the VM server:
ls -l /var/lib/libvirt/qemu/save/
You should see that a new memory image file named ***VM_NAME.save*** exists in that directory
 7. To restore the saved virtual machine enter the following command at the command line of the VM server:
virsh start *VM_NAME*
 8. You should see that the virtual machine is now running again and in the same state it was in when it was saved

(End of Exercise)

5.2 Automatically Boot KVM VMs with libvirt-guests

In this exercise, you use the libvirt-guests script to automatically start and stop/save KVM VMs when the vHost starts and stops.

Objectives:

Task I: Enabling VM Automatic Booting

Task II: Simulate a Shutdown and Restart of the vHost and VMs

Special Instructions and Notes:

Before performing this exercise ensure that all Xen VMs on VM Server are not running.

VM_NAME= _____

VM_CONFIG= _____

Task I: Enabling VM Automatic Booting

1. Verify that the libvirt-guests script starts automatically by entering the following at the command line:

```
insserv libvirt-guests
```

```
chkconfig -l libvirt-guests
```

You should see that the libvirt-guests script is set to start in runlevels 3 and 5

2. Enter the following command to make a VM “managed” by Libvirt:

```
virsh define VM_CONFIG
```

3. Enter the following command to start the VM:

```
virsh start VM_NAME
```

Task II: Simulate a Shutdown and Restart of the vHost and VMs

1. To simulate a shutdown of the vHost, enter the following command:

```
rclibvirt-guests stop
```

2. Verify that the VM(s) are not running:

```
virsh list --all
```

3. View the memory image checkpoint file for the VM(s):

```
ls -l /var/lib/libvirt/qemu/save/
```

4. To simulate a startup of the vHost, enter the following command:

```
rclibvirt-guests start
```

5. After the libvirt-guests script finishes, check to see if the VM(s) are started by

either using virt-manager or the `virh list` command.

6. Shutdown the VM and remove it from being managed by Libvirt:

```
virsh shutdown VM_NAME
```

```
virsh undefine VM_NAME
```

(End of Exercise)

Section 6 Delegate Virtualization Administration

This section covers the delegation of virtualization administration and configuration of virtual machine security with Libvirt.

6.1 Use Unix Group Membership to Delegate Libvirt Administration

In this exercise you configure the Libvirt daemon to allow administration by anyone that is a member of the libvirt UNIX group. You then create a virtualization admin user that is a member of that group and test it.

Objectives:

Task I: Create a Virtualization Admin User

Task II: Edit the libvirtd.conf File

Task III: Use virsh to Connect to the Local System

Special Instructions and Notes:

The libvirt group must exist in the /etc/group file before this exercise can be performed.

Task I: Create a Virtualization Admin User

1. In a terminal, enter the following commands create a group and a user for virtualization administration:

```
groupadd -r virtadmins
```

```
useradd -m -c "Virt Admin" -g virtadmins virtadmin
```

```
passwd virtadmin
```

Enter **linux** for the password

2. Log out and then back in as the virtadmin user

Task II: Edit the libvirtd.conf File

1. While logged in as the root user, in the text editor of your choice, open the `/etc/libvirt/libvirtd.conf` file to be edited
2. In the **UNIX socket access controls** section uncomment and edit the following line(s) to match:

```
unix_sock_group = "virtadmins"
```

```
unix_sock_ro_perms = "0777"
```

```
unix_sock_rw_perms = "0770"
```

3. To disable local authentication by PolicyKit so the authorization can be handled by local UNIX group membership:

In the **Authentication** section, uncomment and edit the following lines to match:

```
auth_unix_ro = "none"
```

```
auth_unix_rw = "none"
```

4. Save the file and close the text editor
5. Enter the following command to restart the libvirt daemon:

```
rclibvirtd restart
```

Task III: Use virsh to Connect to the Local System

1. Enter the following command to connect to the local machine:

for Xen:

```
virsh
```

For KVM:

```
virsh -c qemu:///system
```

You should be at a **virsh #** prompt on the local machine

2. Enter the following command to view information about the vHost:

```
nodeinfo
```

3. Enter the following command to view a list of the VMs that the vHost knows about:

```
list --all
```

4. Enter the following command to view a list of the Libvirt virtual networks configured on the vHost:

```
net-list --all
```

5. Enter the following command to disconnect from the **virsh #** prompt:

```
quit
```

You should now be back to the command prompt on your machine

(End of Exercise)

6.2 Use SASL+Digest-md5 to Delegate Libvirt Administration

In this exercise you configure the Libvirt daemon to only allow users authenticated via SASL with digest-md5 to gain access.

Objectives:

Task I: Edit the `sasl2/libvirt.conf` File

Task II: Create an SASL User

Task III: Enable SASL for the Libvirt Daemon

Task IV: Enable SASL for the QEMU Libvirt Driver

Task V: Use `virsh` to Connect to the Local System

Special Instructions and Notes:

(none)

Task I: Edit the `sasl2/libvirt.conf` File

1. While logged in as the **root** user, in the text editor of your choice, open the `/etc/sasl2/libvirt.conf` file to be edited
2. Locate and uncomment the **`mech_list: digest-md5`** line as follows:
`mech_list: digest-md5`
3. Save the file

Task II: Create an SASL User

1. In a terminal, enter the following command to create a SASL user for Libvirt
`saslpasswd2 -a libvirt libvirtadmin`
Enter **linux** for the password
2. Enter the following command to verify the user was added:
`sasldblistusers2 -f /etc/libvirt/passwd.db`
You should see the `virtadmin` user listed

Task III: Enable SASL for the Libvirt Daemon

In this task you enable Libvirt itself to require SASL authentication.

1. In the text editor of your choice, open the `/etc/libvirt/libvirtd.conf` file to be edited
2. In the **Authentication** section uncomment and edit the following line(s) to match:
`auth_unix_ro = "sasl"`

```
auth_unix_rw = "sas1"
```

3. Save the file and close the text editor
4. Enter the following command to restart the libvirt daemon:

```
rclibvirtd restart
```

Task IV: Enable SASL for the QEMU Libvirt Driver

In this task you enable VNC via TCP+SASL for the QEMU Libvirt driver.

1. In the text editor of your choice, open the `/etc/libvirt/qemu.conf` file to be edited
2. Locate and uncomment the following lines:

```
vnc_listen = "0.0.0.0"
```

```
vnc_sasl=1
```

3. Save the file

Note: You must stop and then restart any running VMs for this to take effect

Task V: Use virsh to Connect to the Local System

1. Log out and then back in as the `virtadmin` user
2. Enter the following command to connect to the local machine:

For Xen:

```
virsh
```

For KVM:

```
virsh -c qemu:///system
```

You should be at a `virsh #` prompt on the local machine

3. Enter the following command to view information about the vHost:

```
nodeinfo
```

You should be prompted to authenticate. Enter the username and password for the `libvirtadmin` user created above

4. Enter the following command to view a list of the VMs that the vHost knows about:

```
list --all
```

You should not be prompted to authenticate again because your previous authentication is sufficient

5. Enter the following command to view a list of the Libvirt virtual networks configured on the vHost:

```
net-list --all
```

6. Enter the following command to disconnect from the `virsh #` prompt:

quit

You should now be back to the command prompt on your machine

7. Log out and then back in as the **geeko** user

8. Enter the following command to connect to the local machine:

For Xen:

virsh

For KVM:

virsh -c qemu:///system

9. Enter the following command to view information about the vHost:

nodeinfo

You should be rejected because the **geeko** user is not part of the **virtadmins** UNIX group that was previously configured to grant authorization to administer Libvirt.

10. Enter the following command to add the **geeko** user to the **virtadmins** group:

su -

(enter root password)

groupmod -A geeko virtadmins

exit

11. Enter the following command to reload the **geeko** user's groups memberships:

newgrp -l

12. Enter the following command to verify membership of the **virtadmins** group:

groups

13. Now enter the following command to connect to the local machine:

For Xen:

virsh

For KVM:

virsh -c qemu:///system

14. Enter the following command to view information about the vHost:

nodeinfo

You should now be prompted to authenticate. Enter the username and password for the **libvirtadmin** user created above

(End of Exercise)

6.3 Use virt-manager as a Non-root User on the Local System

In this exercise, you use the virt-manager utility to connect to the local system as a non-root user that is a member of the libvirt group.

Objectives:

Task I: Launch virt-manager as a Non-root User

Special Instructions and Notes:

You must have the virtadmin user created in the LDAP directory to perform this exercise.

Task I: Launch virt-manager as a Non-root User

1. Log into the Libvirt server as the **virtadmin** user
2. Launch virt-manager:
Alt+F2
virt-manager
3. Double-click on the **localhost (QEMU)** instance
You should see any running and managed virtual machines on the local system
4. Right-click on the **localhost (QEMU)** instance and select **Details**
You should see information about the local system
5. If desired you may try connecting to the virtual console of, launching or stopping any VMs on the system

(End of Exercise)

Section 7 Manage Virtual Networks

This section covers how to configure virtual networks in virtual machines.

7.1 Configure a Virtual Network with libvirt

In this exercise, you use libvirt to configure a virtual network to start automatically when the libvirt daemon starts.

Objectives:

Task I: Create a Virtual Network Definition File

Task II: Activate a Virtual Network with virsh

Task III: Enable the Virtual Network to Start Automatically

Special Instructions and Notes:

(none)

Task I: Create a Virtual Network Definition File

1. If not already logged in as root, open a terminal window and enter **su -** to become root. When prompted for the root user's password, enter **novell**
2. Change to the **/etc/libvirt/qemu/networks/** directory
3. In the text editor of your choice (as root) open or create the **/etc/libvirt/qemu/networks/default** file to be edited.
4. Type the following into the file:

```
<network>
  <name>default</name>
  <bridge name='virbr0' stp='off' forwardDelay='0' />
  <forward mode='nat' />
  <ip address='192.168.1.1' netmask='255.255.255.0'>
    <dhcp>
      <range start='192.168.1.128'
end='192.168.1.254' />
    </dhcp>
  </ip>
</network>
```

5. Save the file and close the text editor

Task II: Activate a Virtual Network with virsh

1. In a terminal window, while logged in as root, enter the following command to view the existing virtual networks:

```
virsh net-list
```

You should not see the network defined in the configuration file

2. Enter the following command to view the active network bridges:

```
brctl show
```

You should not see the virtual network here either.

3. Enter the following command in the terminal windows to activate the virtual network:

```
virsh net-start default
```

You should see a message stating that the virtual network named default was started

4. Enter the following command to verify that the virtual network was created:

```
virsh net-list
```

You should see a network named **default** in the list

5. Enter the following command to view the active network bridges:

```
brctl show
```

You should see a new bridge named **virbr0** in the list

6. Enter the following command to deactivate the virtual network:

```
virsh net-destroy default
```

7. Enter the following commands to see that the network is gone:

```
virsh net-list
```

```
brctl show
```

You should no longer see the virtual network or bridge

Task III: Enable the Virtual Network to Start Automatically

1. View the contents of the `/etc/libvirt/qemu/networks/autostart` by entering the following command:

```
ls -l /etc/libvirt/qemu/networks/autostart
```

You should see that the directory is empty

2. Enter the following command at the command line to enable the network named default to start automatically:

```
virsh net-autostart default
```

3. Again, view the contents of the `/etc/libvirt/qemu/networks/autostart` directory:

```
ls -l /etc/libvirt/qemu/networks/autostart
```

You should see a symbolic link to the **default.xml** file in the parent directory.

When the libvirt daemon starts, this network will be activated automatically.

NOTE: You could have also manually created the symbolic link as well.

4. Restart the libvirt daemon:

```
rclibvirtd restart
```

5. Enter the following commands to see that the network was activated:

```
virsh net-list
```

```
brctl show
```

You should see that the virtual network and bridge are now active.

(End of Exercise)

Section 8 Work with Virtual Hardware in KVM

This section covers working with virtual hardware such as serial consoles, watchdog devices, snapshotting virtual disks, etc. in KVM virtual machines.

8.1 Install VMDP Drivers into a KVM VM

In this exercise, you install the VMDP containing the VirtIO drivers into Windows KVM VM.

Objectives:

Task I: Add a VirtIO Disk to the VM

Task I: Install VMDP Drivers

Task II: Update the KVM Virtual Disks and NICs

Special Instructions and Notes:

KVM_VM2_NAME= _____

KVM_VM2_CONFIG= _____

Task I: Add a VirtIO Disk to the VM

1. While logged in as the root user, launch Virt manager:
Alt+F2
virt-manager
2. Select the Windows VM and click **Open**
3. Select **Show virtual hardware details** (the blue button with an **i**)
4. Click **Add Hardware**
5. In the left pane select **Storage**
6. In the right pane select **Create a disk on the computer's hard drive**, enter/select the following values and then click **Finish**:
Size: **0.1 GB**
Device type: **Virtio Disk**
Cache mode: **default**
Storage format: **raw**

Task I: Install VMDP Drivers

Note: If the VMDP installer has not been previously downloaded into the VM you will need to download it before performing step 2

1. Power on the VM and when booted, log into the VM using the following credentials:
Username = **Administrator**
Password = **p@ssw0rd**

2. Browse to the **Downloads** directory and execute the VMDP installer to extract the drivers
3. Browse into the expanded driver directory and run the **setup.exe** program to install the drivers
Follow the prompts during the install
4. When the driver installer is finished, reboot the VM

Task II: Update the KVM Virtual Disks and NICs

1. Power off the VM
2. In Virt-manmager, select **Show virtual hardware details**
3. Select the VirtIO disk added above and click **Remove** (clicking **Yes** when prompted for confirmation)
4. Close the virtual machine window in Virt-manager
5. Enter the following command to undefine the VM:
virsh undefine KVM_VM2_NAME
6. In the text editor of your choice, open the **KVM_VM2_CONFIG** file to be edited
7. Locate the **<target .../>** tag in the virtual disk and edit the **dev** and **bus** values as follows:
<target dev='vda' bus='virtio' />
8. Locate the **<model .../>** tag in the network interface and edit the **type** value as follows:
<model type='virtio' />
9. Save the file and close the text editor
10. Enter the following command to re-define the VM:
virsh define KVM_VM2_CONFIG
11. Power on the VM, log in as Administrator, open Device Manager
Under Disk Drives see that a VirtIO Virtual disk device is listed
Under Network cards see that a VirtIO network card is installed
12. Power off the VM when finished

Note: You can also make these changes in Virt-manager.

For disks, you must remove the disks (including the CDROM drive) and then re-add the disks with the new parameters. It is important to remove **all** disks and then re-add each disk **in the proper order** or the VM may be rendered unbootable.

For network cards yo can simply change their type in s drop-down list without having to remove and re-add them.

(End of Exercise)

8.2 Enable Linux Control Groups

In this exercise you install and enable Linux control groups (cgroups).

Objectives:

Task I: Install and Enable cgroups

Special Instructions and Notes:

(none)

Task I: Install and Enable cgroups

1. Log in as the root user
2. Enter the following command to install the cgroups package(s)

```
zypper in -y libcgroup1
```
3. In the text editor of your choice, create/open the `/etc/cgconfig.conf` file to be edited:
4. Add the following:

```
mount {  
    cpu = /dev/cgroups/cpu;  
    cpuacct = /dev/cgroups/cpu;  
    cpuset = /dev/cpuset;  
    memory = /dev/cgroups/memory;  
    devices = /dev/cgroups/devices;  
}
```
5. Save the file and close the text editor
6. Enter the following command to create an empty rules daemon config file in case one doesn't already exist:

```
echo " " > /etc/cgrules.conf
```
7. Enter the following commands to enable cgroups to start at boot time and to start it now:

```
insserv cgconfig  
insserv cgreg  
/etc/init.d/cgconfig start  
/etc/init.d/cgreg start
```

8. Enter the following command to see that cgroups are enabled:

```
ls -s /dev/cgroups
```

```
ls -l /dev/cpuset
```

You should see “controller” directories for cpu, devices and memory

(End of Exercise)

8.3 Configure a Virtual Serial Console

In this exercise you configure a virtual serial console for a full virtual machine

Objectives:

Task I: Configure a Virtual Serial Device

Task II: Configure Access to the Serial Console in the VM

Task III: Connect to the Virtual Serial Console

Special Instructions and Notes:

Use the following value(s) in this exercise:

VM_NAME=_____

Task I: Configure a Virtual Serial Device

1. Launch Virt-manager:
Alt+F2
virt-manager
2. Connect to the **localhost**, select the **VM_NAME** virtual machine and click **Open**:
3. On the virtual machine window click Show virtual hardware details (blue circle with an i)
4. Click **Add Hardware**
5. On the New Virtual Hardware screen, in the left pane, select **Serial**
6. In the right pane, from the **Device Type** drop-down list select **Pseudo TTY (pty)** and then click **Finish**

You should see a new serial device listed in the left pane

Task II: Configure Access to the Serial Console in the VM

1. Launch the **VM_NAME** virtual machine
2. When it is booted up log in as the root user
3. In the text editor of your choice open the **/etc/inittab** file
4. Locate the virtual terminal section and uncomment the **S0** line as follows:
S0:12345:respawn:/sbin/agetty -L 9600 ttyS0 vt102
5. Save the file
6. Open the **/etc/securetty** file
7. Add the following to the end of the file to allow the root user to log in to the serial

console on ttyS0:

ttyS0

8. Save the file and close the text editor
9. Enter the following command to have init reread its configuration file and enable the serial console:

```
init q
```

Task III: Connect to the Virtual Serial Console

1. Back in the vHost, open a terminal and if not already logged in as the root user use **su -** to become root
2. Enter the following command to connect to the virtual serial console of the virtual machine:

```
virsh console VM_NAME
```
3. Press **Enter** to have the serial console present you with a login prompt:
4. Log in to the VM as the root user
5. Press the following key combination to disconnect from the virtual serial console:

Ctrl+] (Ctrl + right square bracket)

You should now be back at a terminal prompt in the vHost

(End of Exercise)

8.4 Configure a Virtual Watchdog Device

In this exercise you configure a virtual watchdog device in a KVM virtual machine.

Objectives:

Task I: Configure a Virtual Watchdog Device

Task II: Verify the Watchdog Device in the VM

Special Instructions and Notes:

Use the following value(s) in this exercise:

VM_NAME=_____

Task I: Configure a Virtual Watchdog Device

1. Launch Virt-manager:
Alt+F2
virt-manager
2. Connect to the **localhost**, select the **VM_NAME** virtual machine and click **Open**:
3. On the virtual machine window click Show virtual hardware details (blue circle with an i)
4. Click **Add Hardware**
5. On the New Virtual Hardware screen, in the left pane, select **Watchdog**
6. In the right pane, select the following values from their respective drop-down lists and then click **Finish** :
Model: **default**
Action: **Forcefully power off the guest**
You should see a new watchdog device listed in the left pane

Task II: Verify the Watchdog Device in the VM

1. Power on the VM and log in as the root user
2. open a terminal and enter the following command to see that the watchdog device kernel module is loaded:
lsmod | grep i6300esb
You should see that the kernel module for the watchdog device is loaded

(End of Exercise)

8.5 Snapshot a QCOW2 Virtual Disk

In this exercise you use the `vm-snapshot-disk` command to create a copy on write (COW) snapshot of a QCOW2 disk image.

Objectives:

Task I: Create Snapshots of a QCOW2 Disk

Task II: Revert to and Delete Snapshots

Special Instructions and Notes:

(none)

Task I: Create Snapshots of a QCOW2 Disk

1. While logged in as the root user, open a terminal and `cd` into the LVM virtual machine directory
2. Enter the `ls -l` command to view the current files in the virtual machine directory
You should see some configuration files and a single disk image name `disk0.qcow2`
3. Enter the following command to create a snapshot of the disk image:
`vm-snapshot-disk create disk=disk0.qcow2`
4. Enter the `ls -l` command again to see the new current list of files in the virtual machine directory
You should see the original disk images now named **`disk0.qcow2.base`**, a hard link to that disk named **`disk0.qcow2.base.snap1`** and the new COW snapshot disk named **`disk0.qcow2.base.snap1._working`**
5. Power on the VM and create a file named `/root/file1`
6. Power off the VM
7. Enter the following command to create a new snapshot of the disk:
`vm-snapshot-disk create disk=disk0.qcow2`
8. Enter the `ls -l` command again
You should see the previous `_working` snapshot is now named **`disk0.qcow2.base.snap1`** and a new working snapshot file was created
9. Enter the following command to view the relationship of the new working snapshot:
`qemu-img info disk0.qcow2.base.snap1.snap2._working`

You should see that its backing disk is the **disk0.qcow2.base.snap1.snap2** file

10. Power on the VM and create another file named **/root/file2**
11. Power off the VM
12. Enter the following command to create a third snapshot:

```
vm-snapshot-disk create disk=disk0.qcow2
```
13. Power on the VM and create a new file named **/root/file3**
14. Power off the VM
15. Enter the following command to create a new snapshot branch:

```
vm-snapshot-disk branch disk=disk0.qcow2 snapname=snap1
```
16. Enter the **ls -l** command again to see the new current list of files in the virtual machine directory
You should see a new snapshot file with **snap1-1** in the name
17. Power on the VM and create a new file named **/root/file4**
Note which of the previously created files exist
18. Power off the VM

Task II: Revert to and Delete Snapshots

1. Enter the following command to revert the a previous snapshot:

```
vm-snapshot-disk create disk=disk0.qcow2 snapname=snap1
```
2. Enter **ls -l** command to see the new current list of files in the virtual machine directory:
You should see the previous snapshot files that were based on snpashot1 are now gone
3. Enter the following command to remove the snapshots form the disk0.qcow2

```
vm-snapshot-disk remove disk=disk0.qcow2
```
4. Enter **ls -l** command to see the new current list of files in the virtual machine directory:
You should see all of the snapshot files are gone

(End of Exercise)

8.6 Configure a Shared Filesystem with VirtFS

In this exercise, you share a directory in the vHost with a KVM virtual machine using VirtFS.

Objectives:

Task I: Create a Shared Filesystem for VirtFS

Task II: Mount the VirtFS Filesystem in the KVM Virtual Machine

Special Instructions and Notes:

(none)

Task I: Create a Shared Filesystem for VirtFS

1. While logged into the vHost as the root user, open a terminal and enter the following commands:

```
mkdir -p /home/virtfs-shared
```

```
echo "Host data" >> /home/virtfs-shared/host_file.txt
```

```
chmod -R 777 /home/virtfs-shared
```

2. Launch Virt-manager, connect to the **localhost**
3. Select the KVM virtual machine, click **Open** and then select **Show virtual hardware details** (i.e. the blue button with an i)
4. Click **Add Hardware**
5. On the Add Hardware screen, from the left pane, select **Filesystem**
6. On the right, enter/select the following and then click **Finish**:

Mode: **Default**

Source path: **/home/virtfs-shared**

Target Path: **/mnt**

Note: You could also do this in a text editor as follows:

In the text editor of your choice open the KVM virtual machine configuration file and add the following section to the end of the **<devices>** **</devices>** section:

```
<filesystem type='mount' accessmode='passthrough'>
```

```
<source dir='/home/virtfs-shared'/>
```

```
<target dir='/mnt'/>
```

```
</filesystem>
```

Save the file and close the text editor

7. Launch the virtual machine

Task II: Mount the VirtFS Filesystem in the KVM Virtual Machine

1. While logged into the KVM Virtual machine as the root user, open a terminal and enter the following command:

```
mount -t 9p -o trans=virtio -o version=9p2000.L /mnt  
/mnt
```

The VirtFS volume should be mounted on /mnt

2. Enter the following commands to verify that it is mounted and view the contents of the VirtFS shared filesystem:

```
mount  
ls -l /mnt
```

You should see that the VirtFS filesystem is mounted and you should be able to see the file in the shared filesystem

3. Enter the following command to add data to the existing file in the shared filesystem:

```
echo "Guest data" >> /mnt/host_file.txt
```

4. In the vHost, enter the following command to see that new data:

```
cat /home/virtfs-shared/host_file.txt
```

You should see the new line added in the VM

(End of Exercise)

