JUNE 18–20, 2008

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JUNE 18–20, 2008

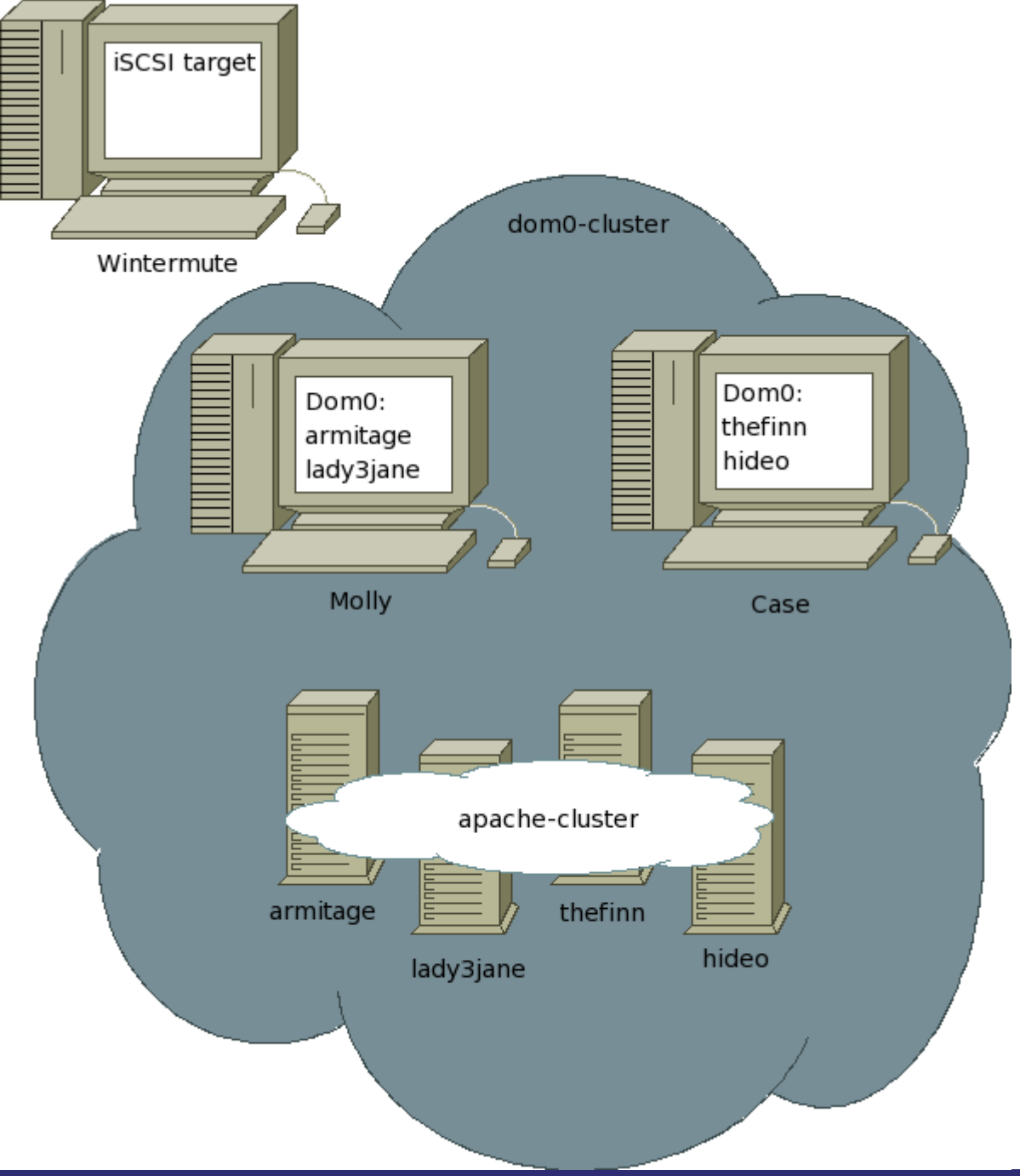
Dedicated to the Memory of
Jim Webb, Global Professional Services Consultant
March 1st, 1963 – May 31st, 2008

Cluster Failover For Any Application

- This session will present the installation and configuration of a high availability cluster of virtual machines using Red Hat Enterprise Linux Advanced Platform (RHEL AP).
- Demonstrations will include:
  - setting up an iSCSI target (server)
  - setting up iSCSI initiators (clients)
  - Red Hat Global Filesystem and Red Hat Cluster Suite functionality included in RHEL AP
  - the Conga web-based cluster management tool

Cluster Failover For Any Application (cont.)

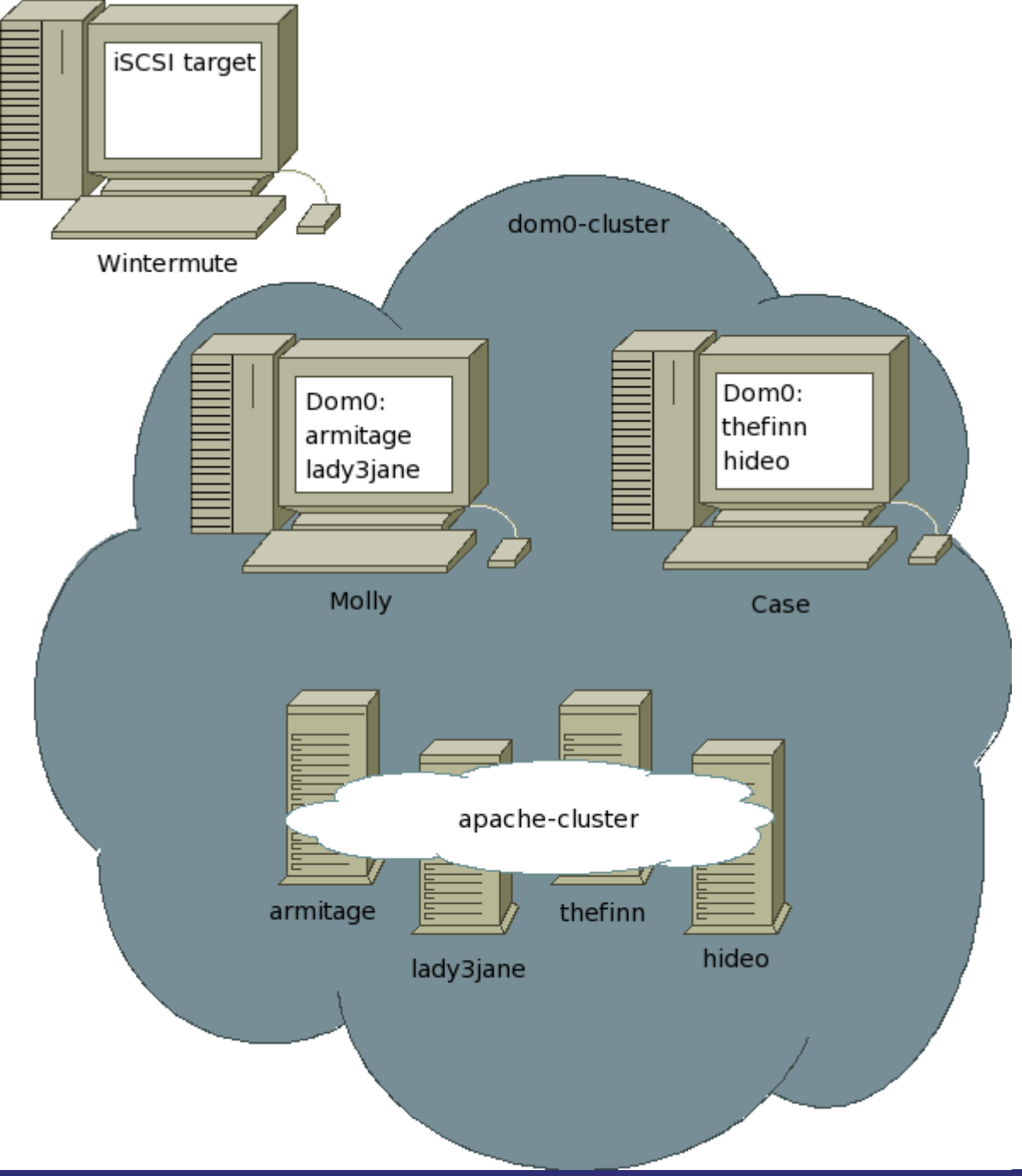
- This presentation will include:
  - setting up clustered logical volumes
  - deploying and clustering virtual machines
  - managing applications on that cluster
- This presentation is available online at
  http://people.redhat.com/tcameron



All hosts are in the fictional “redhat.lan” DNS domain.

wintermute, case and molly are physical servers.

case and molly are iSCSI initiators (clients) and they connect to wintermute, an iSCSI target (server)

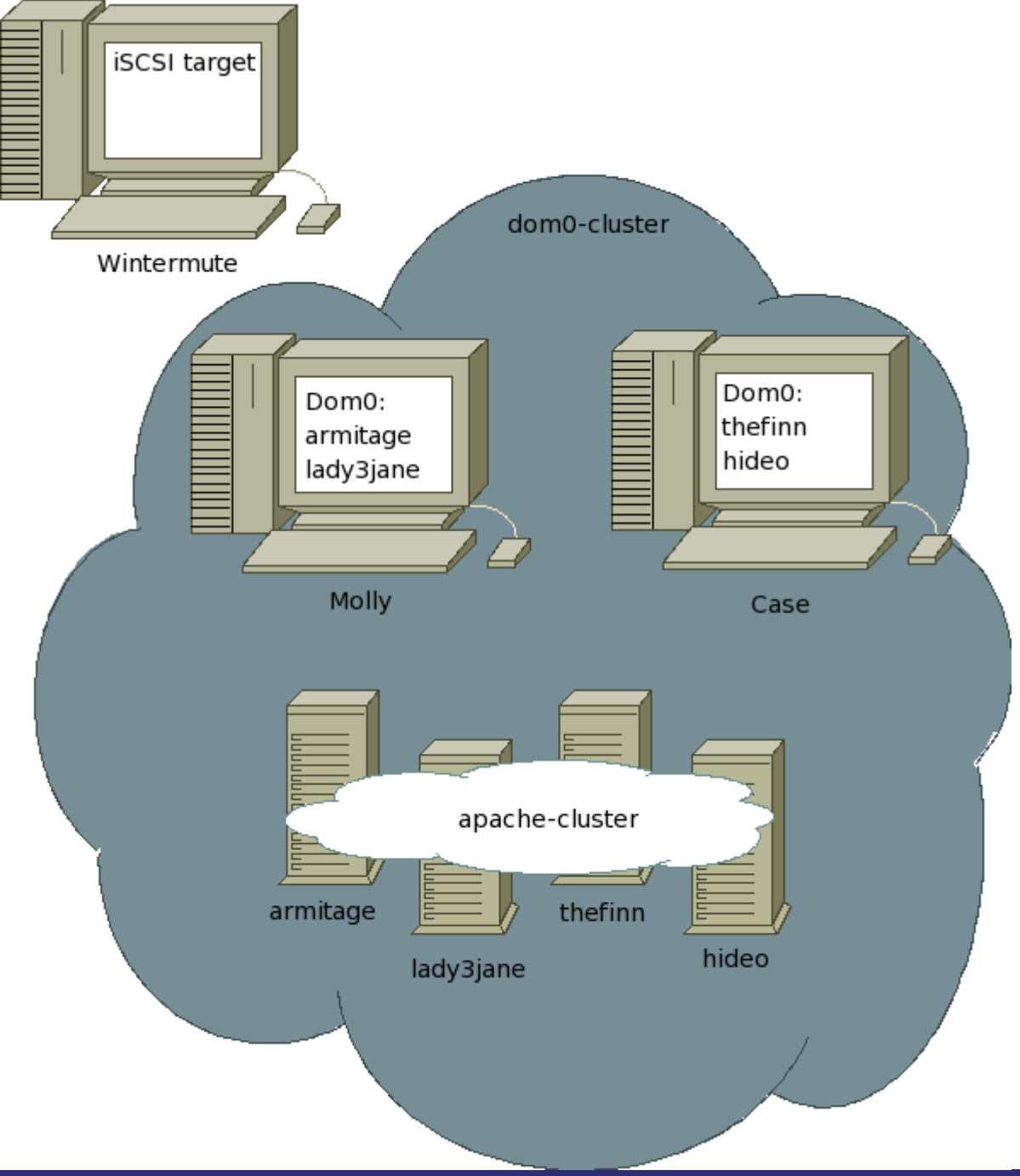


case and molly make up the dom0-cluster.

armitage and lady3Jane are domU guests on molly.

thefinn and hideo are domU guests on case.

armitage, lady3Jane, thefinn and hideo make up the Apache cluster



The apache-cluster is a cluster of web servers. These servers run on the four domU machines.

Setting up the dom0 cluster

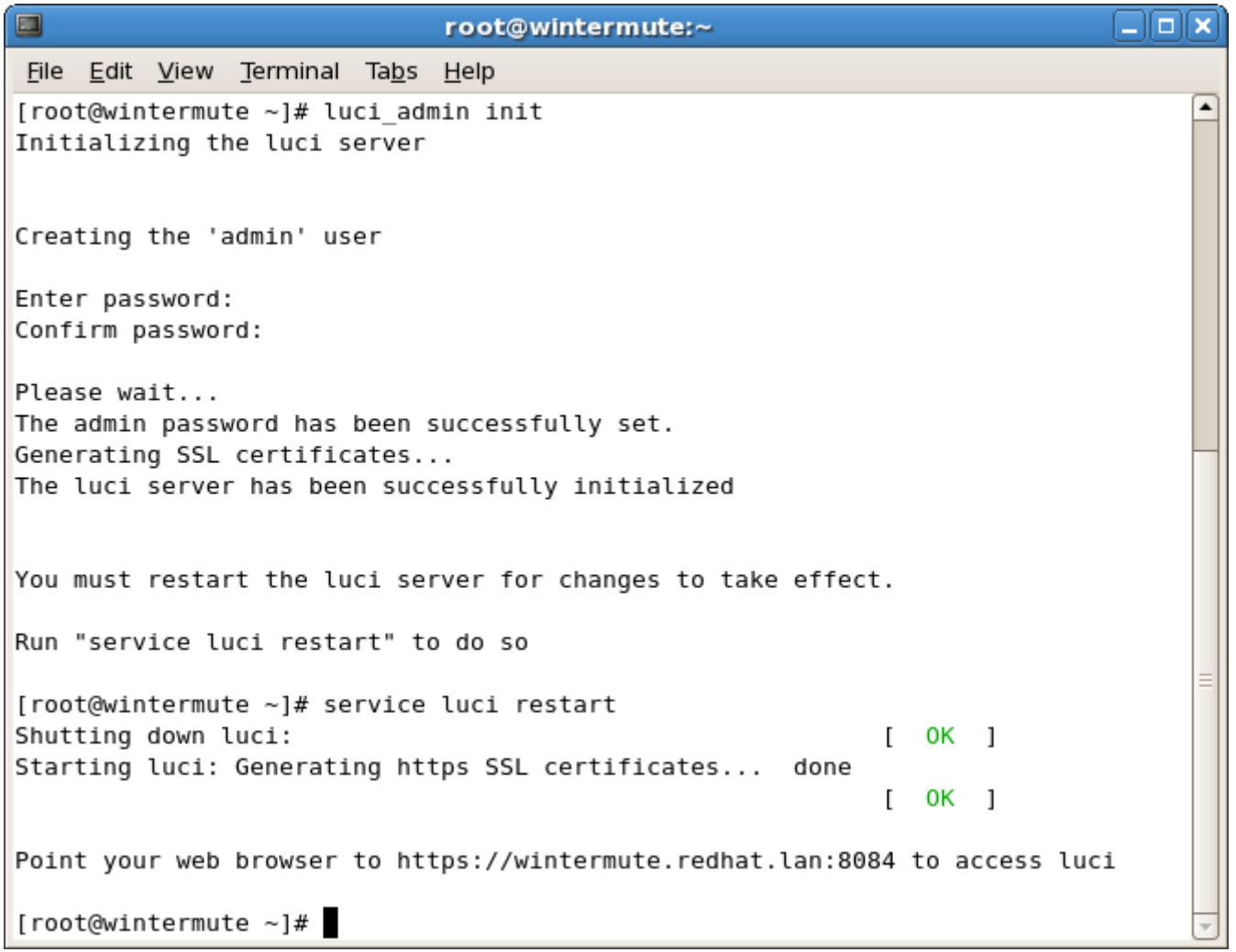
- Ensure that the Clustering and Cluster Storage groups are installed
- `yum grouplist`

```
 Installed Groups:
    Cluster Storage
    Clustering
```

Setting up the dom0 cluster

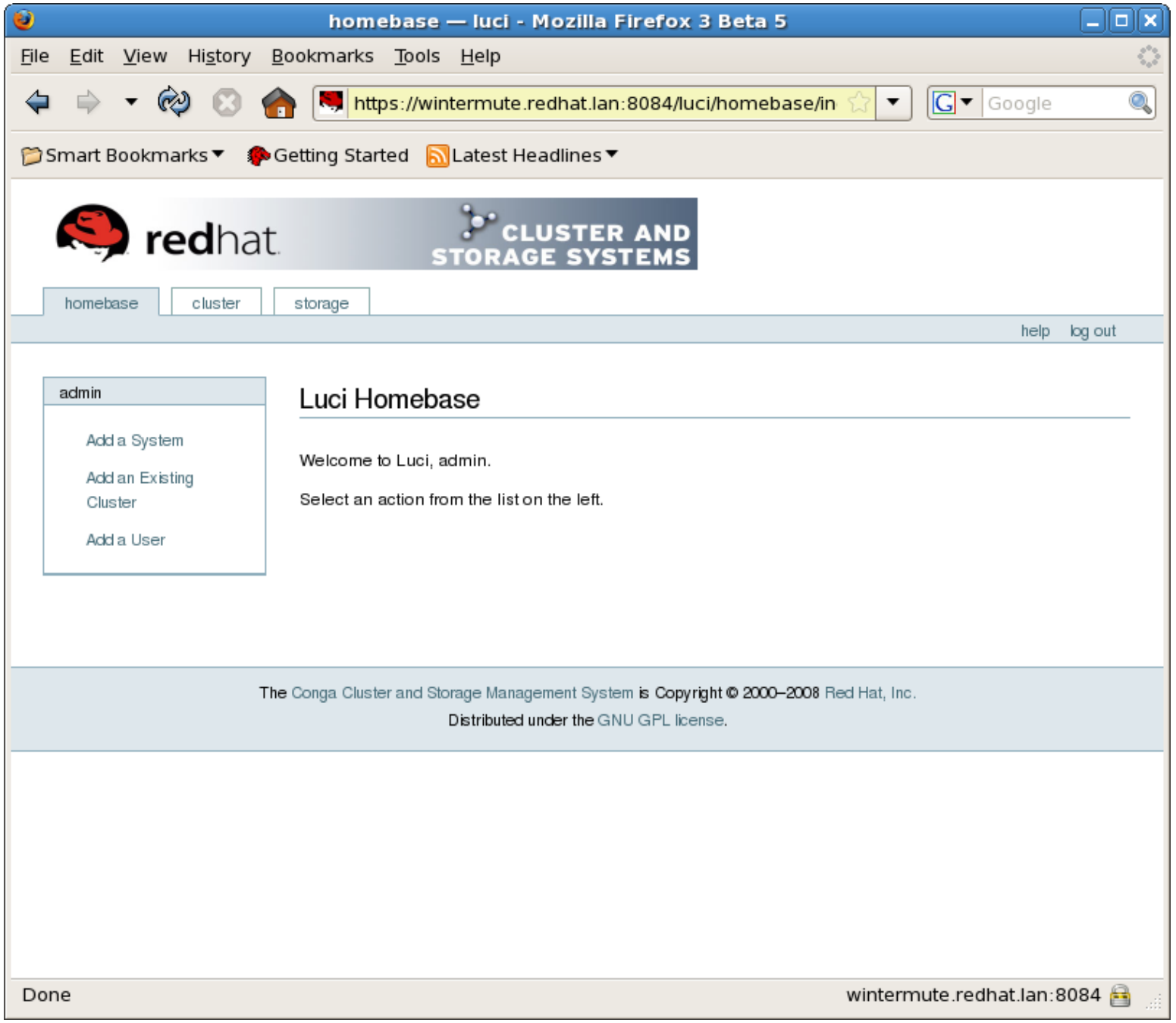
- Install luci on a machine which will not be a part of the cluster. For this presentation, wintermute is not actually part of the cluster.
- `yum install luci`
- `luci_admin init` and set administrative password
- `chkconfig luci on`
- `service luci restart`

Setting up the dom0 cluster



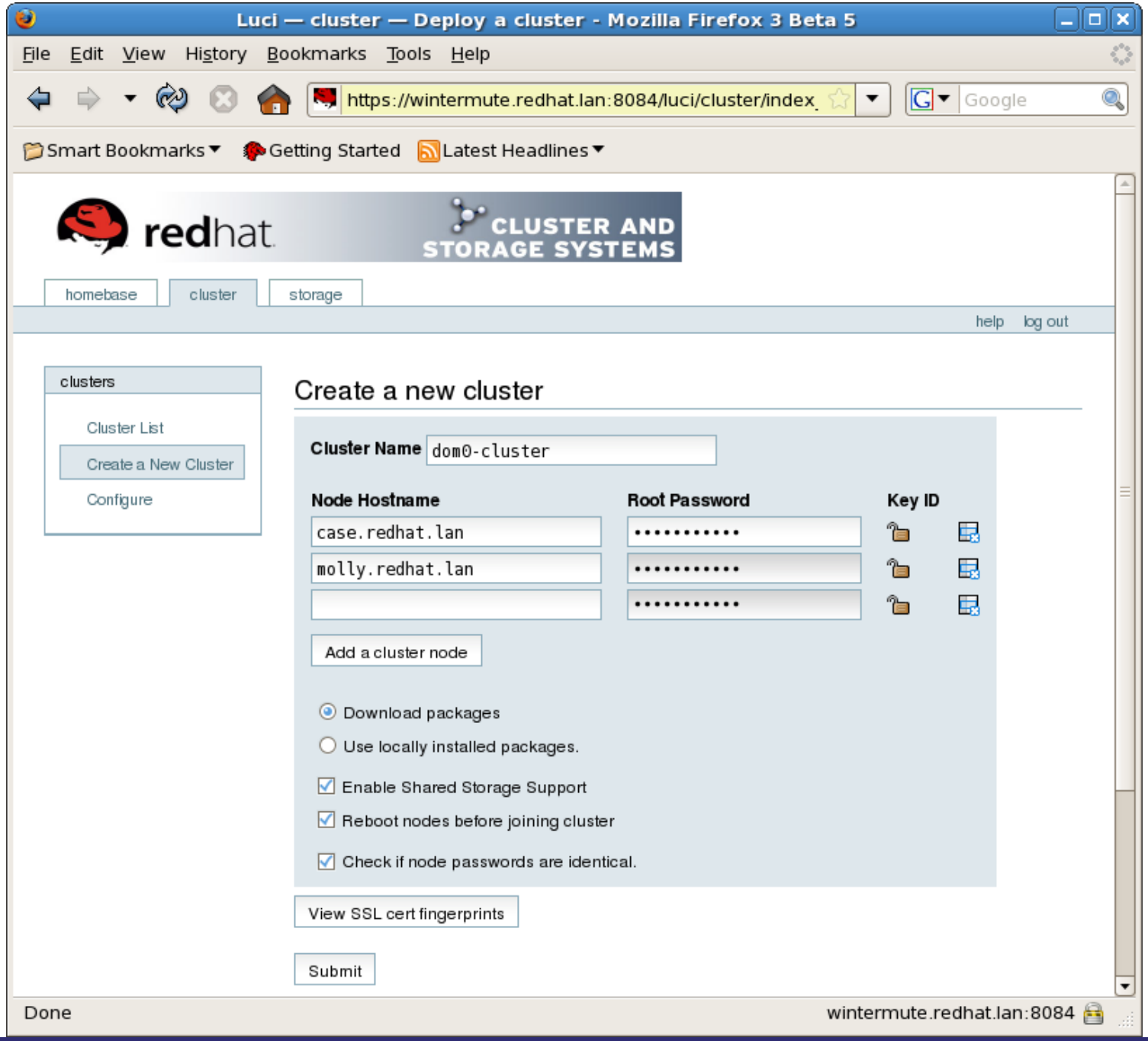
Setting up the dom0 cluster

- Go to the URL mentioned by when restarting the `luci` service
- In this case, https://wintermute.redhat.lan:8084
- Note that you'll have to add an exception in Firefox since it is a self-signed certificate


homebase — luci - Mozilla Firefox 3 Beta 5
File Edit View History Bookmarks Tools Help
https://wintermute.redhat.lan:8084/luci/homebase/in
Google
Smart Bookmarks
Getting Started
Latest Headlines
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
admin
Add a System
Add an Existing Cluster
Add a User
Luci Homebase
Welcome to Luci, admin.
Select an action from the list on the left.
The Conga Cluster and Storage Management System is Copyright © 2000–2008 Red Hat, Inc.
Distributed under the GNU GPL license.
Done
wintermute.redhat.lan:8084

Setting up the dom0 cluster

- Click on the Cluster tab, then on the “Create a new cluster” link
- In this example, the dom0 cluster is called “dom0-cluster.” Not imaginative, but effective.
- The two members are case and molly.
- Choose the “Download packages” radio button – the nodes will download the necessary packages from RHN
- Verify that “Enable Shared Storage Support” is checked
- Verify that “Reboot nodes before joining cluster” is checked to make sure that the systems join cleanly at boot time
- “Check if node passwords are identical” if they are


Luci — cluster — Deploy a cluster - Mozilla Firefox 3 Beta 5
File Edit View History Bookmarks Tools Help
https://wintermute.redhat.lan:8084/luci/cluster/index
Google
Smart Bookmarks
Getting Started
Latest Headlines
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
Create a new cluster
Cluster Name
dom0-cluster
Node Hostname
Root Password
Key ID
case.redhat.lan
molly.redhat.lan
Add a cluster node
Download packages
Use locally installed packages.
Enable Shared Storage Support
Reboot nodes before joining cluster
Check if node passwords are identical.
View SSL cert fingerprints
Submit
Done
wintermute.redhat.lan:8084

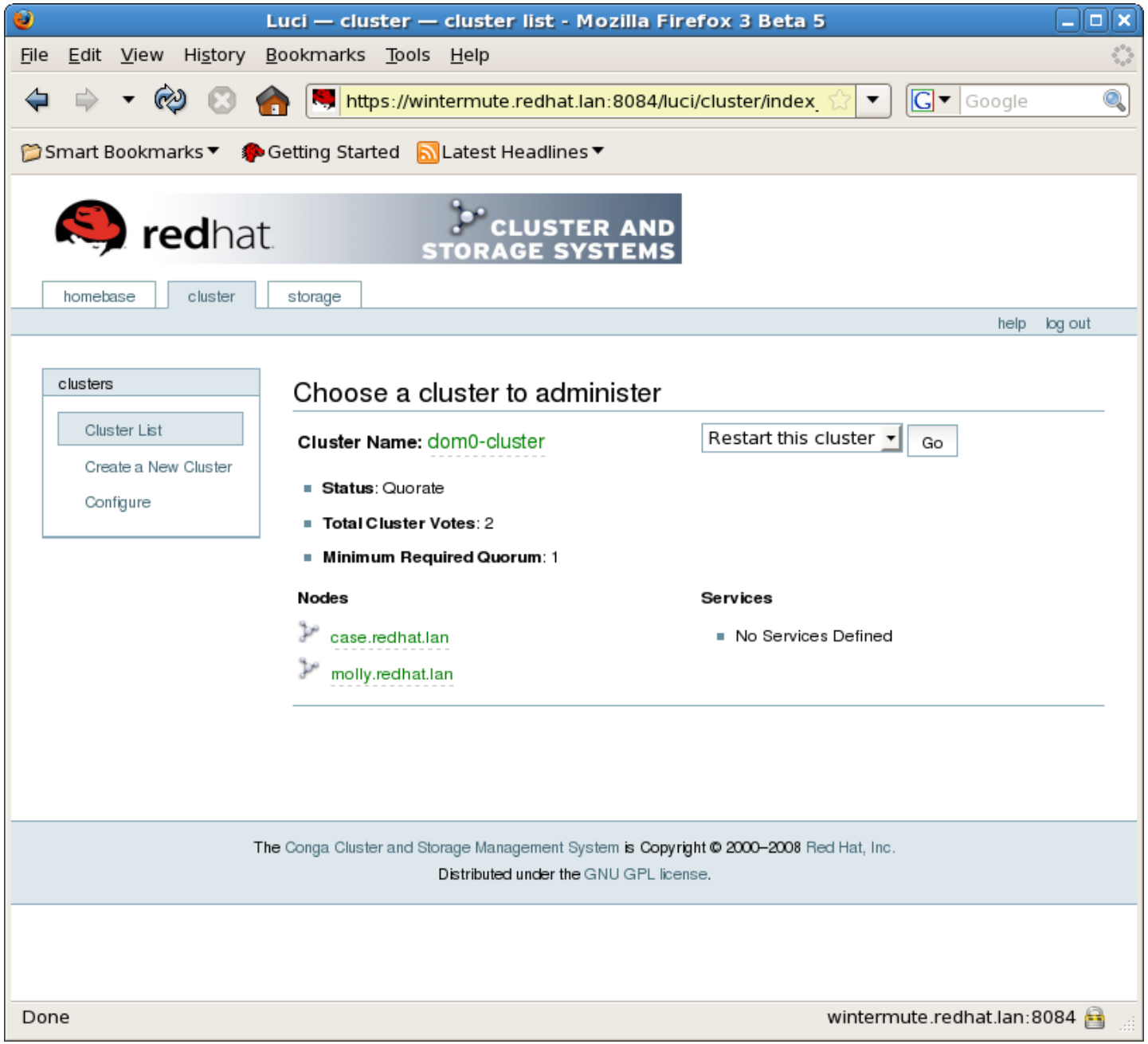
Setting up the dom0 cluster

- Click on Submit to install and reboot


cluster — luci - Mozilla Firefox 3 Beta 5
File Edit View History Bookmarks Tools Help
https://wintermute.redhat.lan:8084/luci/cluster/index
Google
Smart Bookmarks
Getting Started
Latest Headlines
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
dom0-cluster
dom0-cluster
Please be patient - this cluster's configuration is being modified.
Creating node "case.redhat.lan" for cluster "dom0-cluster"
Currently unable to reach the ricci agent on this node. The install state is not yet complete.
Install
Reboot
Configure
Join
Stop waiting for this job to complete
Creating node "molly.redhat.lan" for cluster "dom0-cluster"
Currently unable to reach the ricci agent on this node. The install state is not yet complete.
Install
Reboot
Configure
Join
Stop waiting for this job to complete
Done
wintermute.redhat.lan:8084

Setting up the dom0 cluster

- When the systems come back up the cluster and the nodes should all show up in green


Luci — cluster — cluster list - Mozilla Firefox 3 Beta 5
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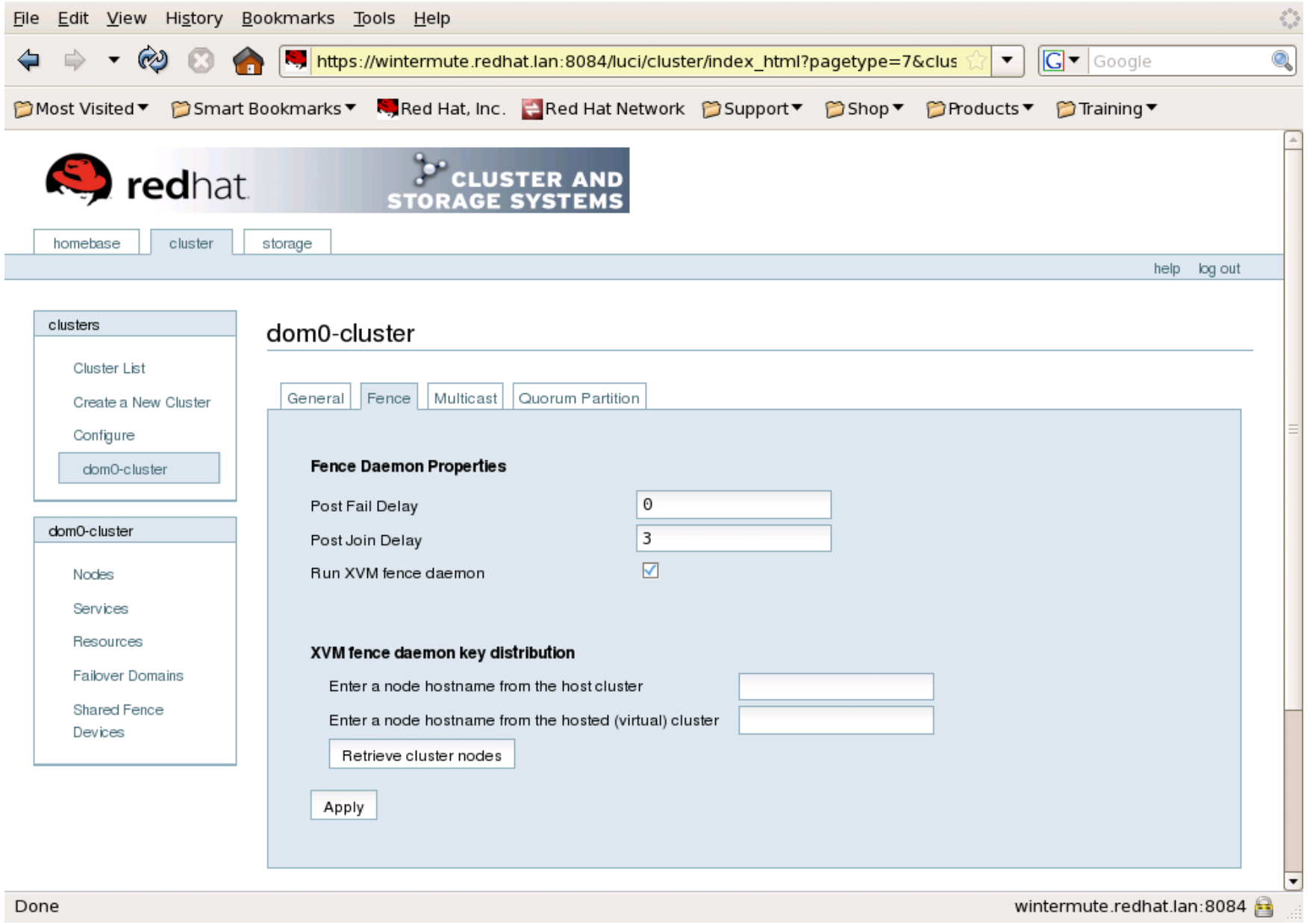
https://wintermute.redhat.lan:8084/luci/cluster/index
Google
Smart Bookmarks
Getting Started
Latest Headlines
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
Choose a cluster to administer
Cluster Name: dom0-cluster
Restart this cluster
Go
Status: Quorate
Total Cluster Votes: 2
Minimum Required Quorum: 1
Nodes
case.redhat.lan
molly.redhat.lan
Services
No Services Defined
The Conga Cluster and Storage Management System is Copyright © 2000–2008 Red Hat, Inc.
Distributed under the GNU GPL license.
Done
wintermute.redhat.lan:8084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Red Hat, Inc.
Red Hat Network
Support
Shop
Products
Training
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
dom0-cluster
dom0-cluster
Nodes
Services
Resources
Failover Domains
Shared Fence Devices
dom0-cluster
General
Fence
Multicast
Quorum Partition
Fence Daemon Properties
Post Fail Delay
0
Post Join Delay
3
Run XVM fence daemon
XVM fence daemon key distribution
Enter a node hostname from the host cluster
Enter a node hostname from the hosted (virtual) cluster
Retrieve cluster nodes
Apply
Done
wintermute.redhat.lan:8084

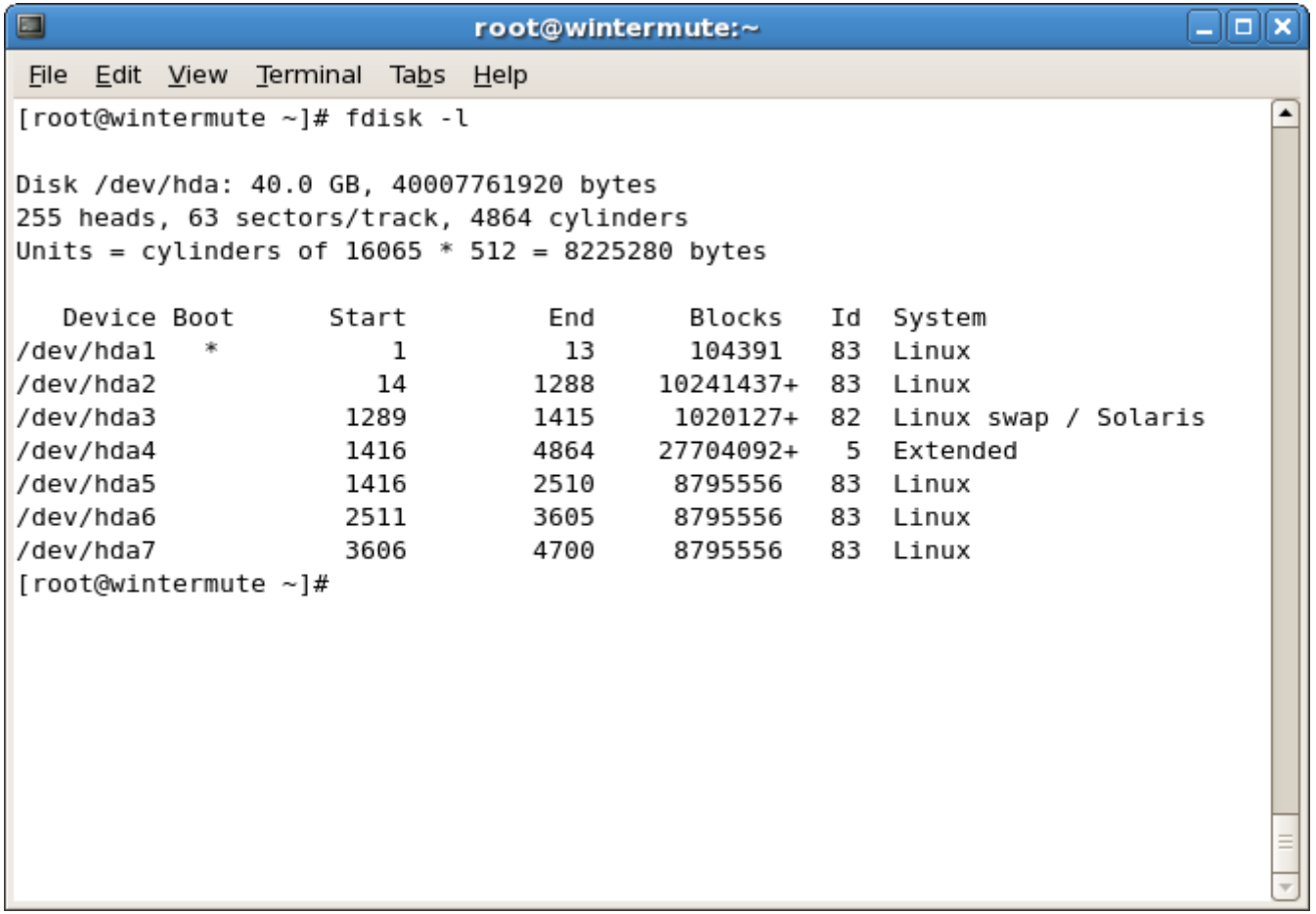
Setting up the iSCSI Target

- RHEL 5 AP with
  - @ Clustering
  - @ Cluster Storage
  - scsi-target-utils

Setting up the iSCSI Target

- In this case, wintermute will be the target
- First, set up partition(s) to export
- `/sbin/fdisk` to create partitions
  - For this demonstration, three 9GB partitions were created, `/dev/hda5`, `/dev/hda6` and `/dev/hda7`

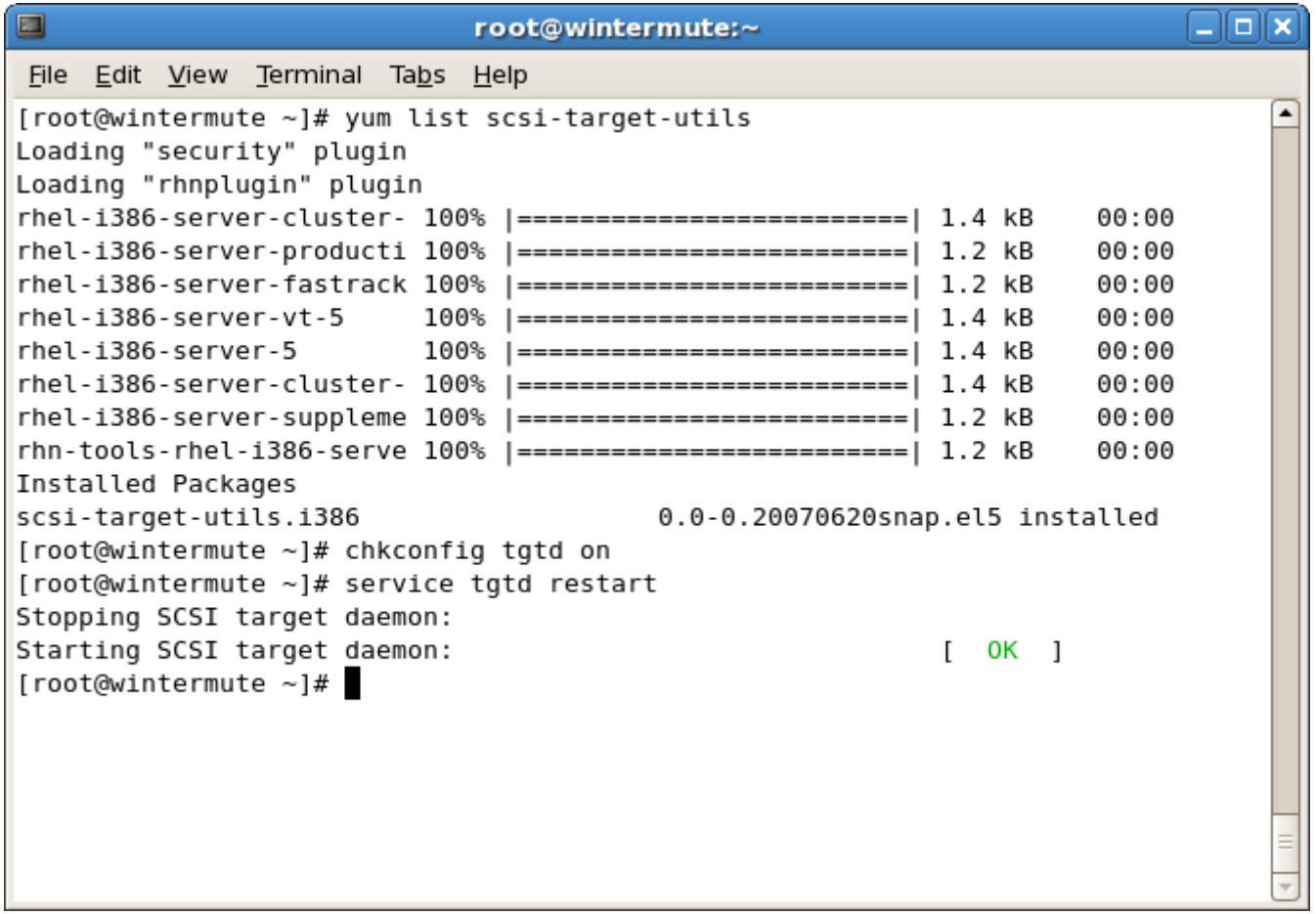
Setting up the iSCSI Target



Setting up the iSCSI Target

- Verify that `scsi-target-utils` is installed
- Enable the `tgtd` service with your favorite service management tool

Setting up the iSCSI Target



Setting up the iSCSI Target

- Use `tgtadm` to define the iSCSI target qualified names
- `tgtadm --lld iscsi --op new --mode target \ --tid 1 -T iqn.2008-06.lan.redhat.disk1`
  - `/usr/sbin/tgtadm` is the SCSI target admin tool
  - `--lld iscsi` defines the low level driver as iSCSI
  - `--op new` defines an operation to create a new definition
  - `--mode target` defines that definition as a target
  - `--tid 1` defines the target identifier as “1”
  - `-T iqn.2008-06.lan.redhat.disk1` defines the iSCSI qualified name with the date (year and month), reversed hostname and the disk label

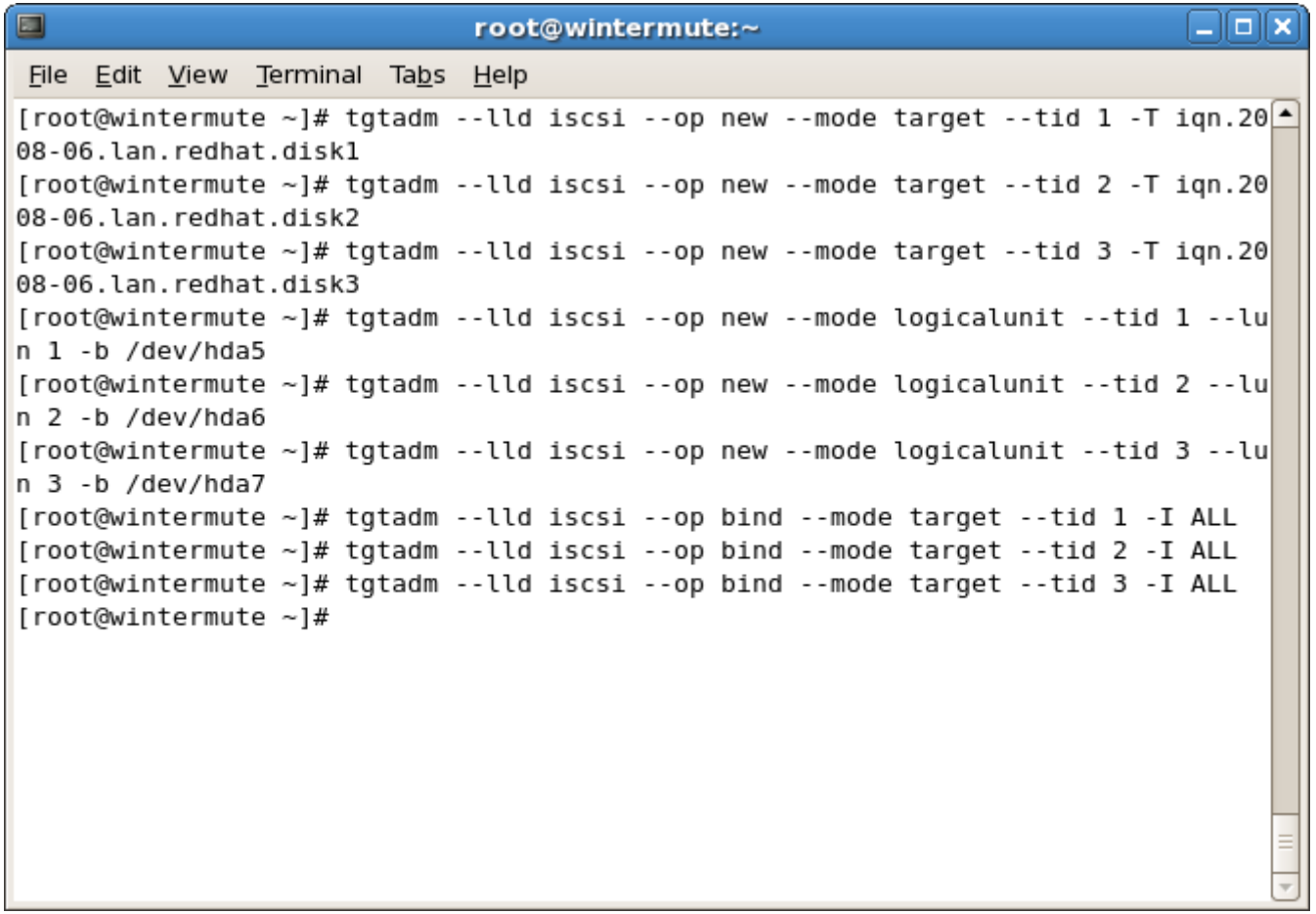
Setting up the iSCSI Target

- Use `tgtadm` to add the partitions created earlier as targets
- `tgtadm --lld iscsi --op new --mode \ logicalunit --tid 1 --lun=1 -b /dev/hda5`
- `--mode localunit` defines the new device as a LUN
- `--tid 1` matches to the target identifier previously defined
- --lun=1 defines this as the first logical unit (LUN)
- `-b /dev/sdb2` associates that LUN to the block device `/dev/hda5`
- Repeat for each of the partitions created earlier

Setting up the iSCSI Target

- Use `tgtadm` to allow clients to attach to the targets
- `tgtadm --lld iscsi --op bind --mode target --tid 1 -I 172.31.100.3`
- Or
- `tgtadm --lld iscsi --op bind --mode target --tid 1 -I ALL`
  - `--op bind` defines a bind operation
  - `-I [addr] or -I ALL` allows a specific host or everyone to connect

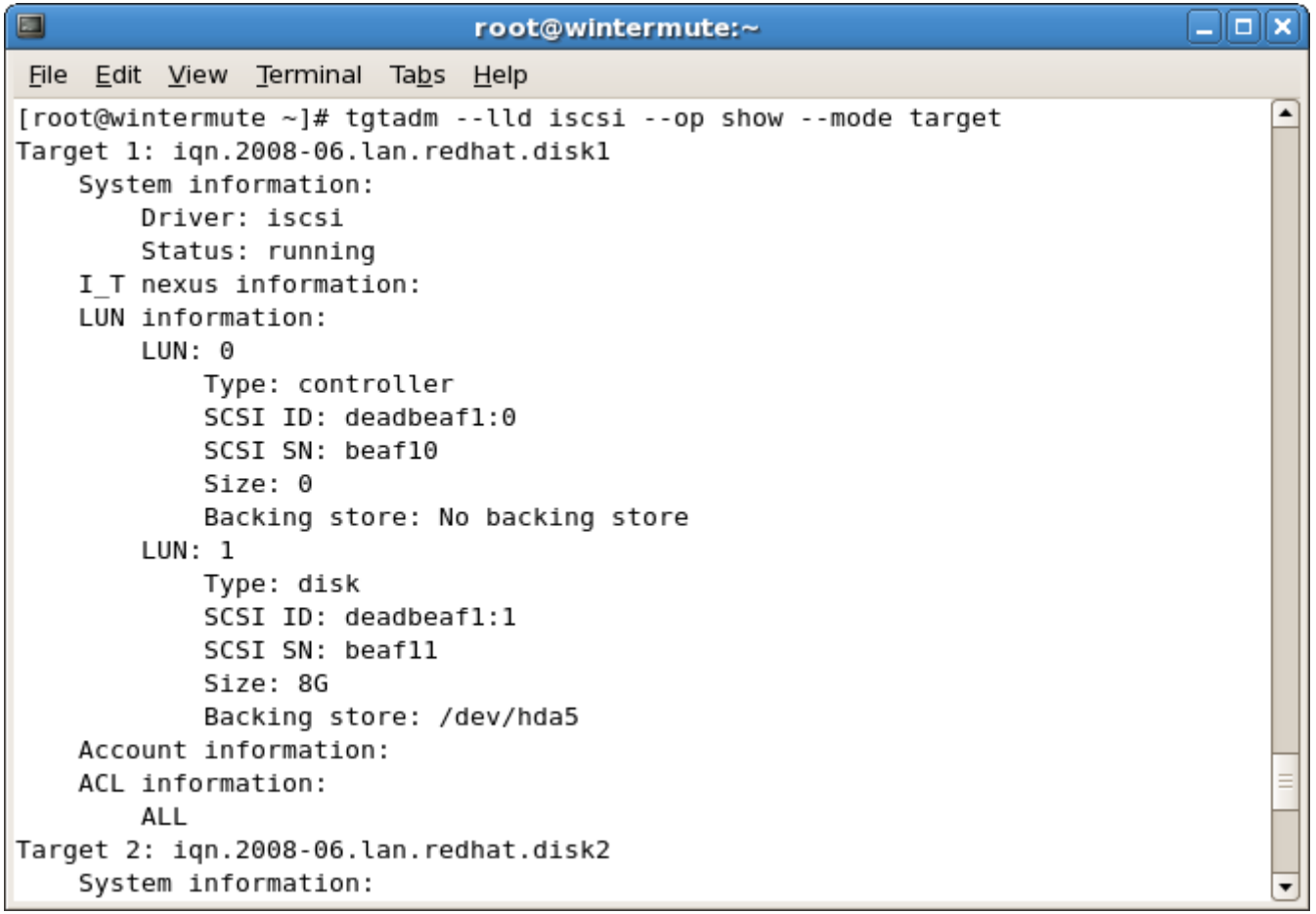
Setting up the iSCSI Target



Setting up the iSCSI Target

- Use tgtadm to verify that you are exporting all targets correctly:
- `tgtadm --lld iscsi --op show --mode target`

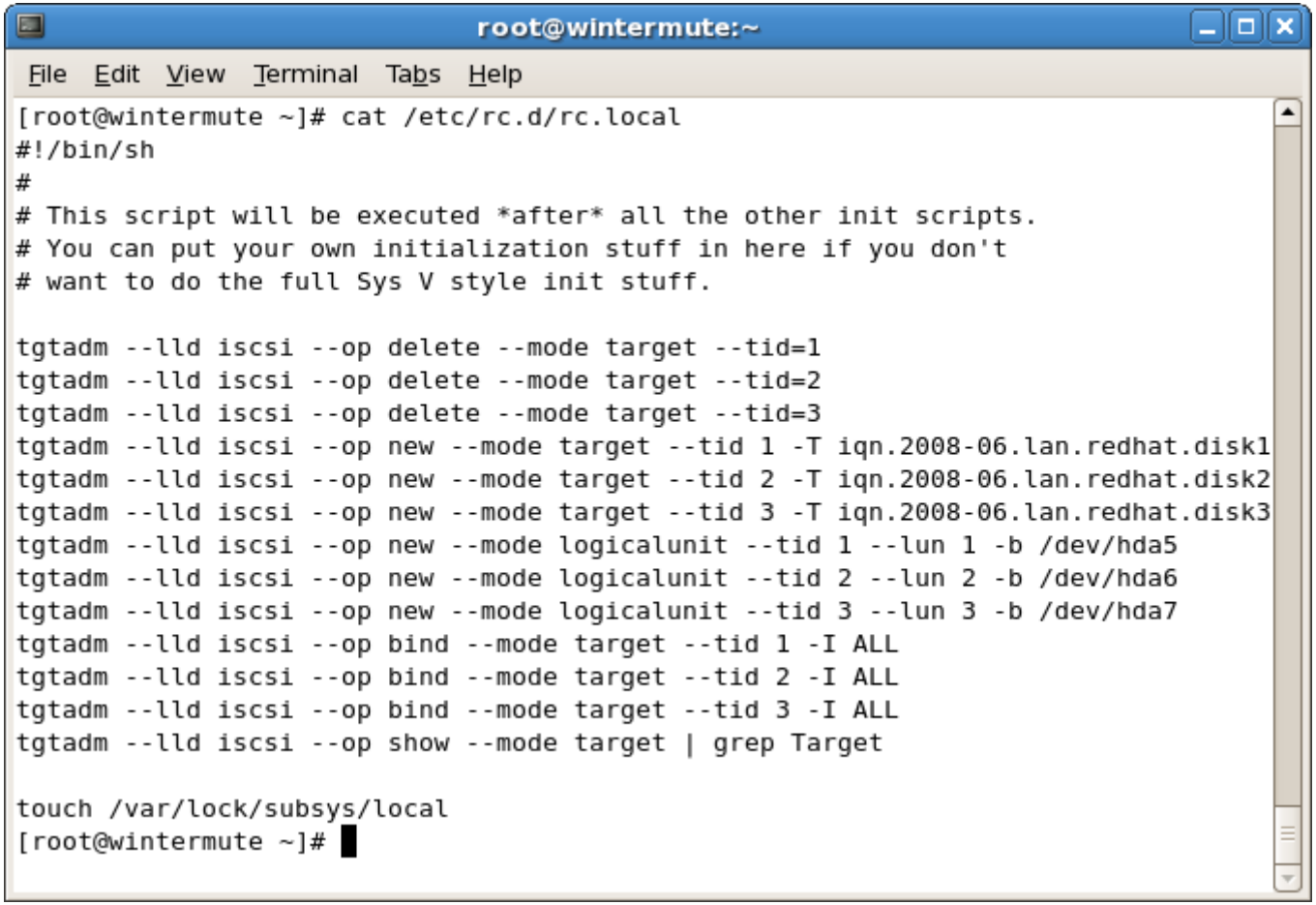
Setting up the iSCSI Target



Setting up the iSCSI Target

- To make it persistent, either create a custom startup script or just add the lines to `/etc/rc.d/rc.local`

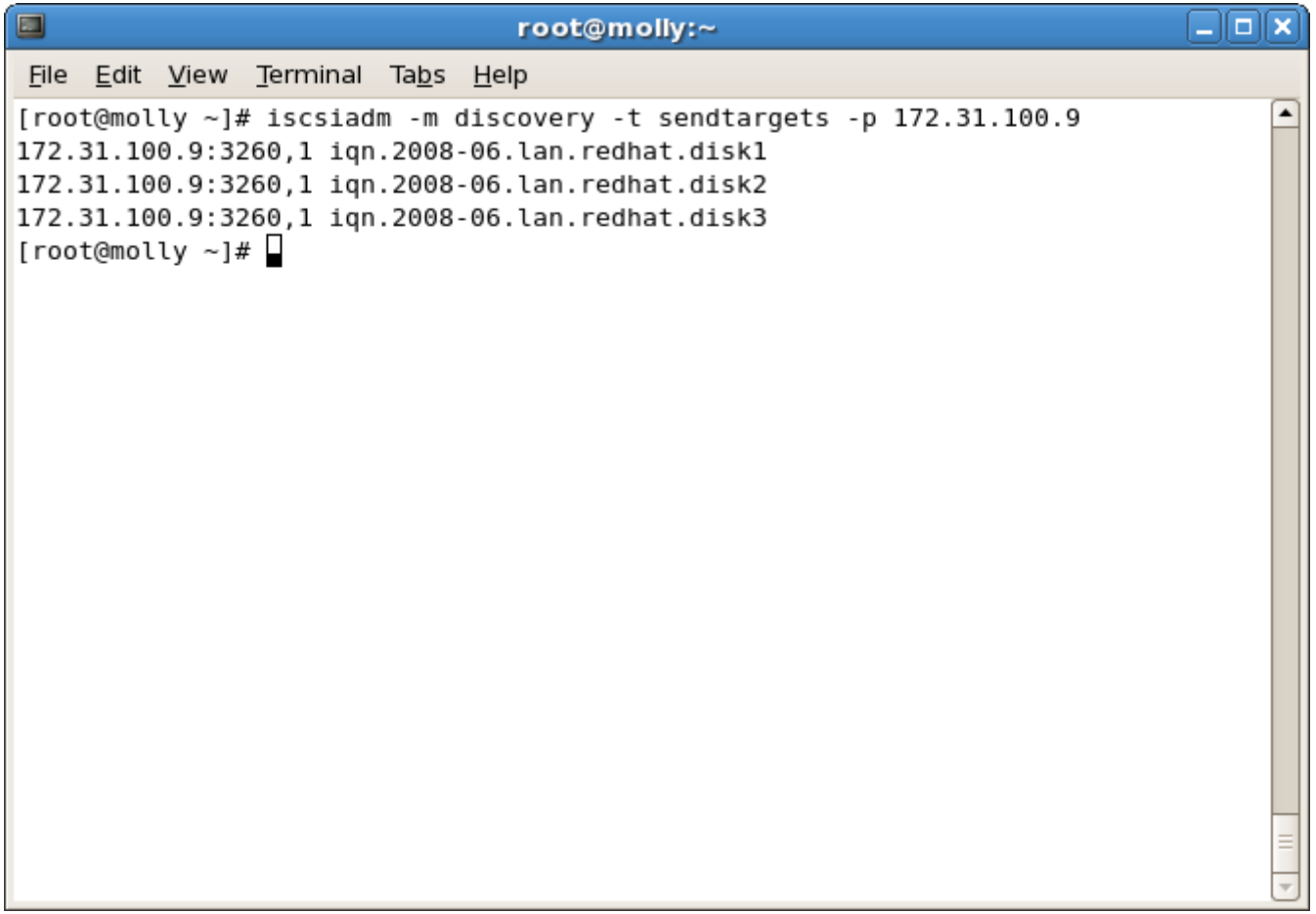
Setting up the iSCSI Target



Setting up the iSCSI Initiator

- Use the `iscsadm` utility to determine what the target is exporting:
- `iscsiadm -m discovery -t sendtargets -p [host]:3260`
  - `-m discovery` tells iscsiadm to discover new information
  - `-t sendtargets` says that information should be target definitions
  - -p `[host]:3260` is the host and optionally the port number to discover

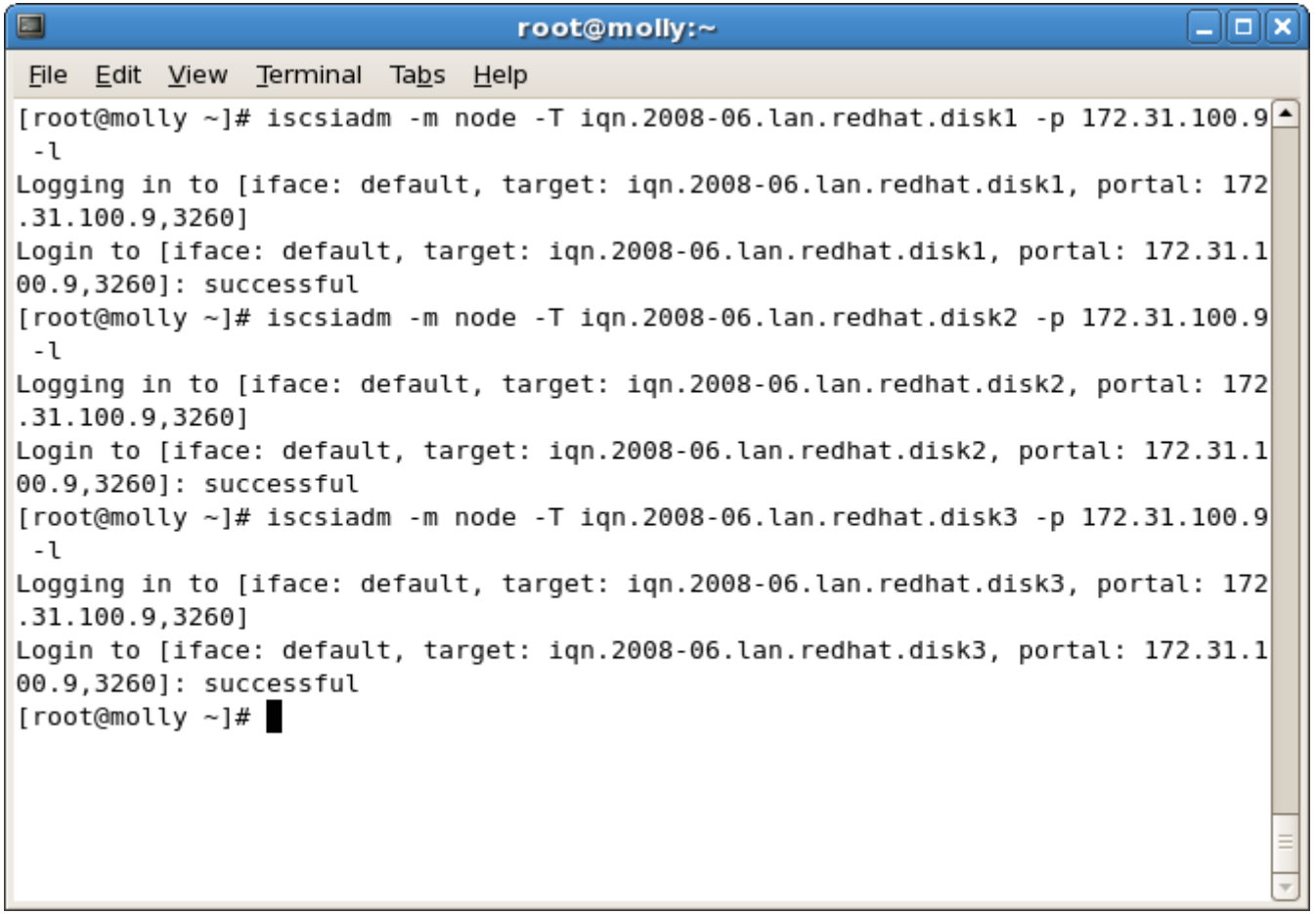
Setting up the iSCSI Initiator



Setting up the iSCSI Initiator

- Use the `iscsadm` utility to log into the target
- `iscsiadm -m node -T \`
  `iqn.2008-06.lan.redhat.disk1 \`
  `-p 172.31.100.9 -l`
  - `-l` logs the initiator into the target

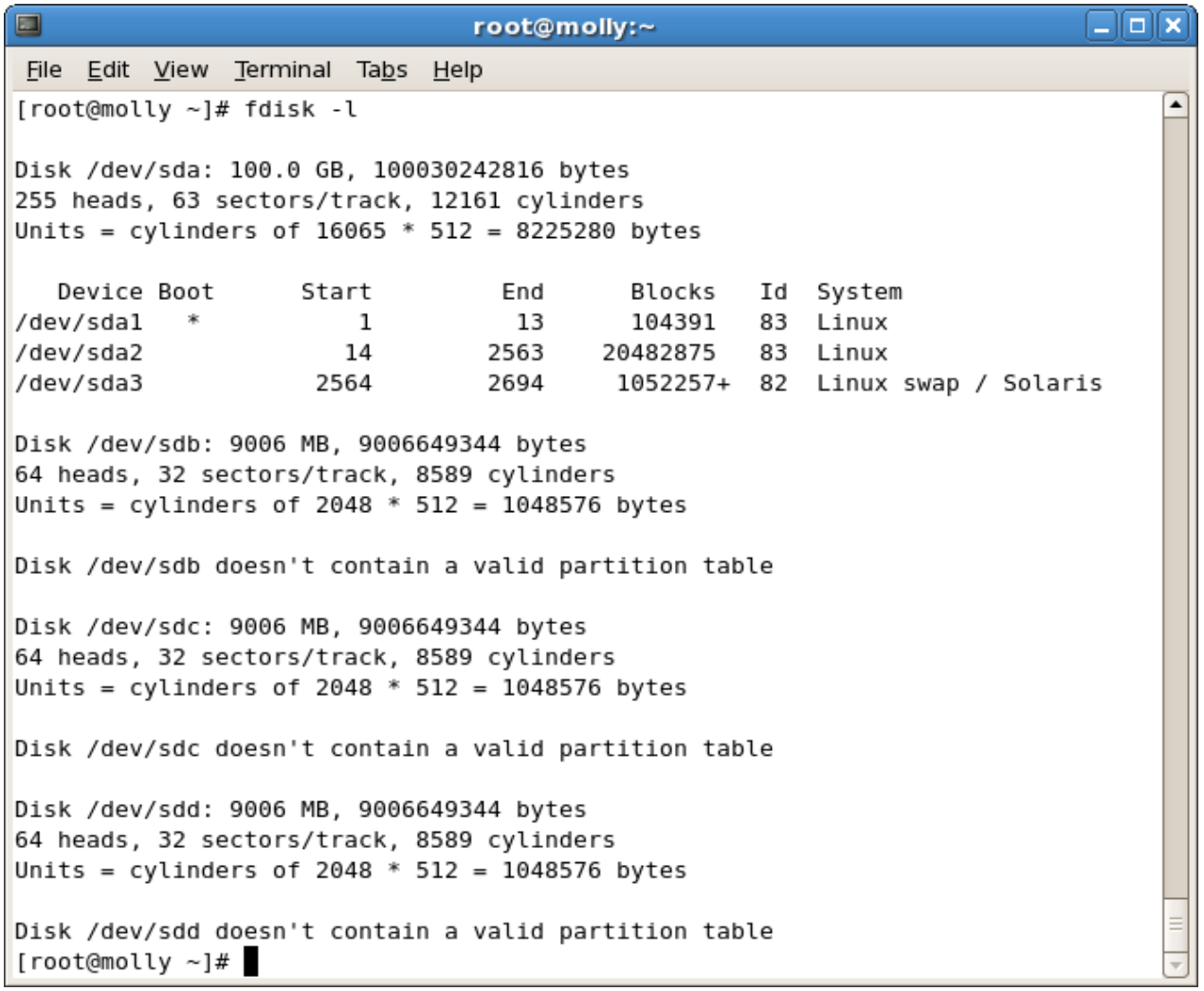
Setting up the iSCSI Initiator



Setting up the iSCSI Initiator

- Verify that the LUNs are available to the initiator
- `fdisk -l`

Setting up the iSCSI Initiator

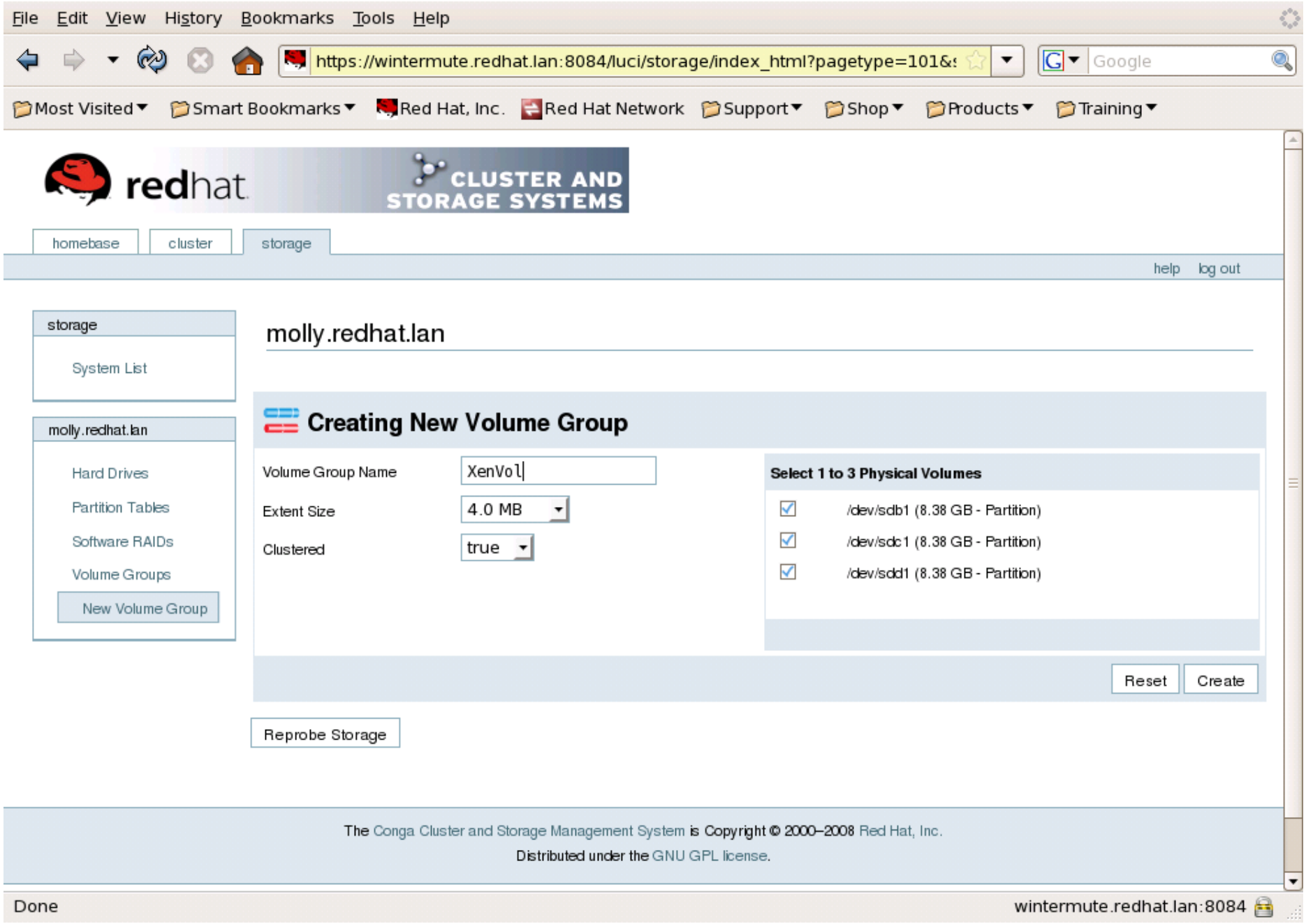


Setting up clustered logical volumes

- Ensure that `clvmd` is running and will survive a reboot
- Create partitions using `fdisk`

Setting up clustered logical volumes

- Use Conga to create a volume group
- Storage tab, select the host, Volume Groups, New Volume Group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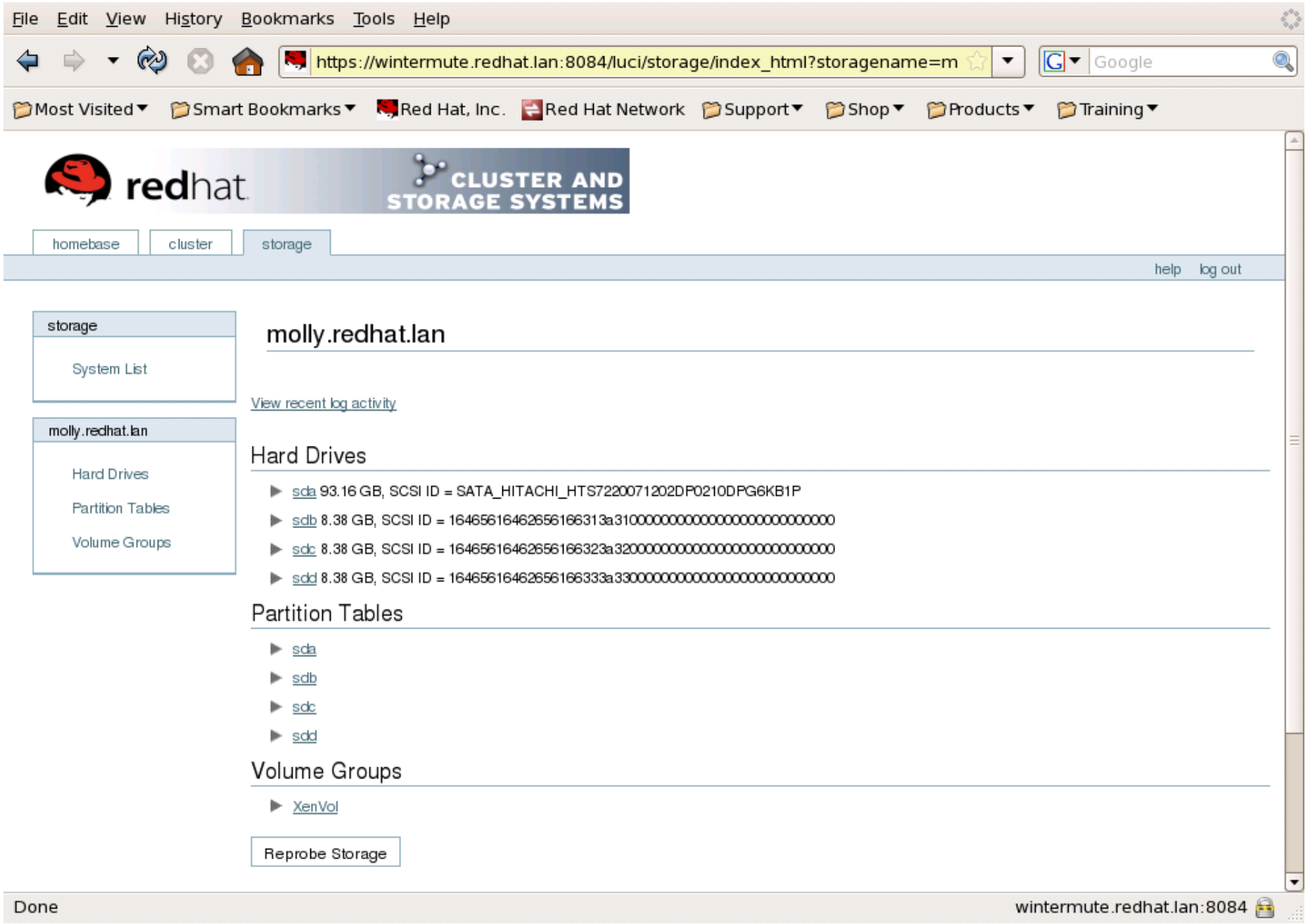
Smart Bookmarks
Red Hat, Inc.
Red Hat Network
Support
Shop
Products
Training
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
storage
System List
molly.redhat.lan
Hard Drives
Partition Tables
Software RAIDs
Volume Groups
New Volume Group
molly.redhat.lan
Creating New Volume Group
Volume Group Name
XenVol
Extent Size
4.0 MB
Clustered
true
Select 1 to 3 Physical Volumes
/dev/sdb1 (8.38 GB - Partition)
/dev/sdc1 (8.38 GB - Partition)
/dev/sdd1 (8.38 GB - Partition)
Reset
Create
Reprobe Storage
The Conga Cluster and Storage Management System is Copyright © 2000–2008 Red Hat, Inc.
Distributed under the GNU GPL license.
Done
wintermute.redhat.lan:8084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Red Hat, Inc.
Red Hat Network
Support
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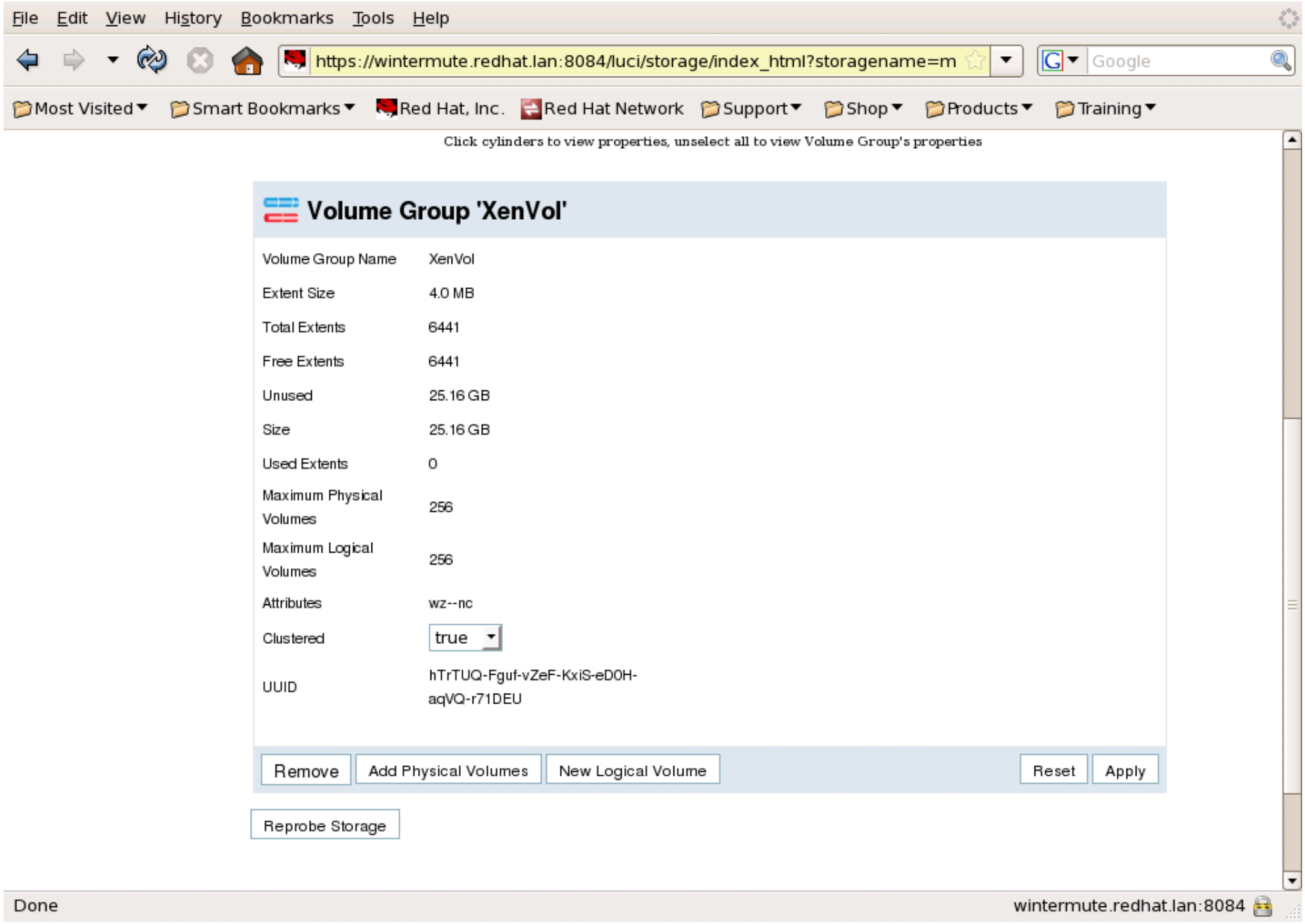
Training
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
storage
System List
molly.redhat.lan
Hard Drives
Partition Tables
Volume Groups
molly.redhat.lan
View recent log activity
Hard Drives
sda 93.16 GB, SCSI ID = SATA_HITACHI_HTS7220071202DP0210DPG6KB1P
sdb 8.38 GB, SCSI ID = 164656164626561663 13a310000000000000000000000000
sdc 8.38 GB, SCSI ID = 164656164626561663 23a320000000000000000000000000
sdd 8.38 GB, SCSI ID = 164656164626561663 33a330000000000000000000000000
Partition Tables
sda
sdb
sdc
sdd
Volume Groups
XenVol
Reprobe Storage
Done
wintermute.redhat.lan:8084

Setting up clustered logical volumes

- Use Conga to create a logical volume
- Storage tab, select the host, Volume Groups, select the VG, then New Logical Volume at the bottom of the screen

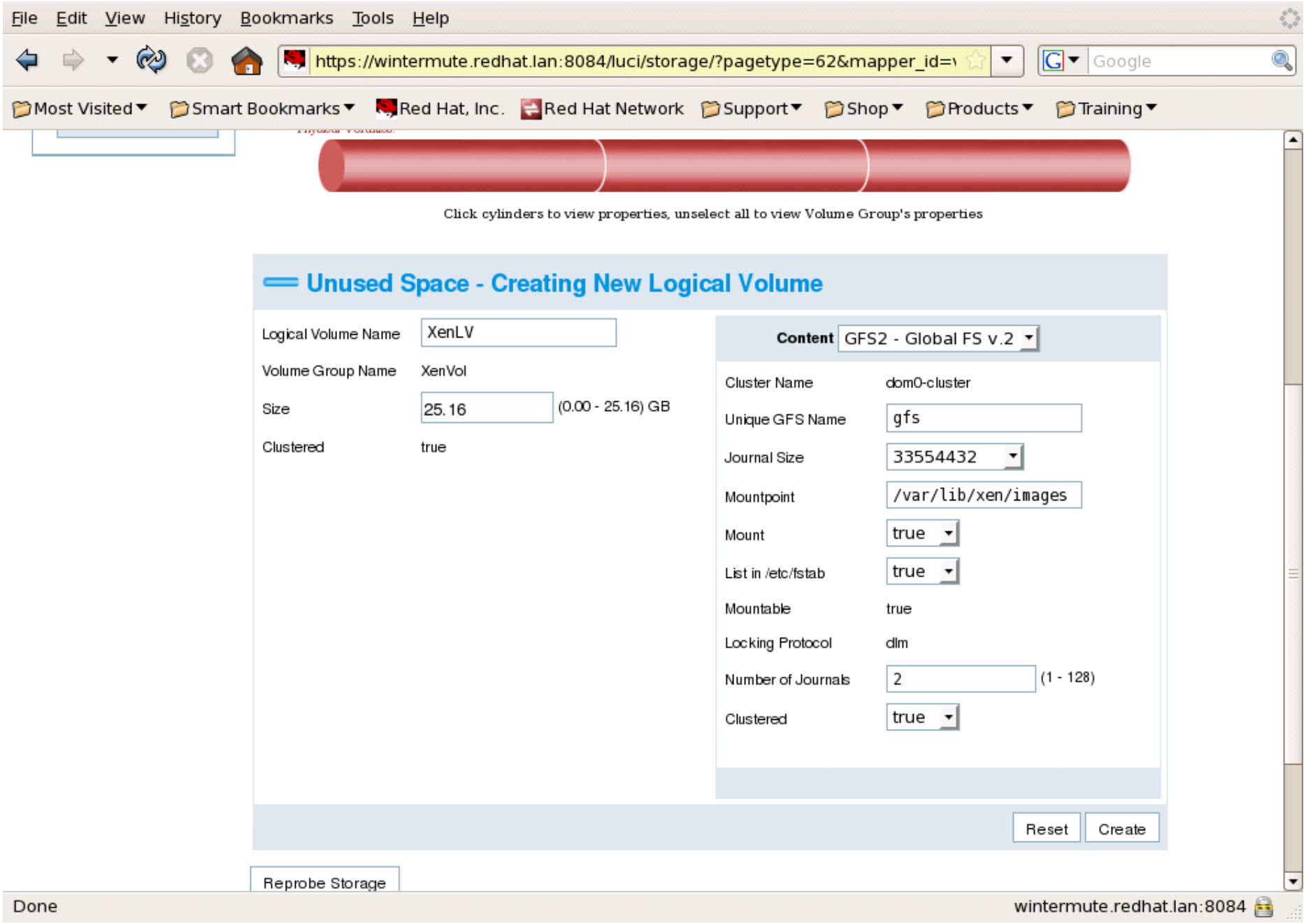

File Edit View History Bookmarks Tools Help
https://wintermute.redhat.lan:8084/luci/storage/index_html?storagename=m
Google
Most Visited
Smart Bookmarks
Red Hat, Inc.
Red Hat Network
Support
Shop
Products
Training
Click cylinders to view properties, unselect all to view Volume Group's properties
Volume Group 'XenVol'
Volume Group Name XenVol
Extent Size 4.0 MB
Total Extents 6441
Free Extents 6441
Unused 25.16 GB
Size 25.16 GB
Used Extents 0
Maximum Physical Volumes 256
Maximum Logical Volumes 256
Attributes wz--nc
Clustered true
UUID hTrTUQ-Fguf-vZeF-KxiS-eD0H-aqVQ-r71DEU
Remove
Add Physical Volumes
New Logical Volume
Reset
Apply
Reprobe Storage
Done
wintermute.redhat.lan:8084

Setting up clustered logical volumes

- Define the content
- Give the cluster a name
- Verify the journal size
- Define the mount point
- Define whether to mount at boot time
- Define whether to modify fstab
- Set the number of journals. Note that with GFS2, the journals are files so adding more later is not painful
- Define whether this is a clustered filesystem

Setting up clustered logical volumes

- PLEASE NOTE THAT GFS2 IS A TECH PREVIEW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https://wintermute.redhat.lan:8084/luci/storage/?pagetype=62&mapper_id=
Google
Most Visited
Smart Bookmarks
Red Hat, Inc.
Red Hat Network
Support
Shop
Products
Training
Click cylinders to view properties, unselect all to view Volume Group's properties
Unused Space - Creating New Logical Volume
Logical Volume Name
XenLV
Volume Group Name
XenVol
Size
25.16
(0.00 - 25.16) GB
Clustered
true
Content
GFS2 - Global FS v.2
Cluster Name
dom0-cluster
Unique GFS Name
gfs
Journal Size
33554432
Mountpoint
/var/lib/xen/images
Mount
true
List in /etc/fstab
true
Mountable
true
Locking Protocol
dlm
Number of Journals
2
(1 - 128)
Clustered
true
Reset
Create
Reprobe Storage
Done
wintermute.redhat.lan:8084

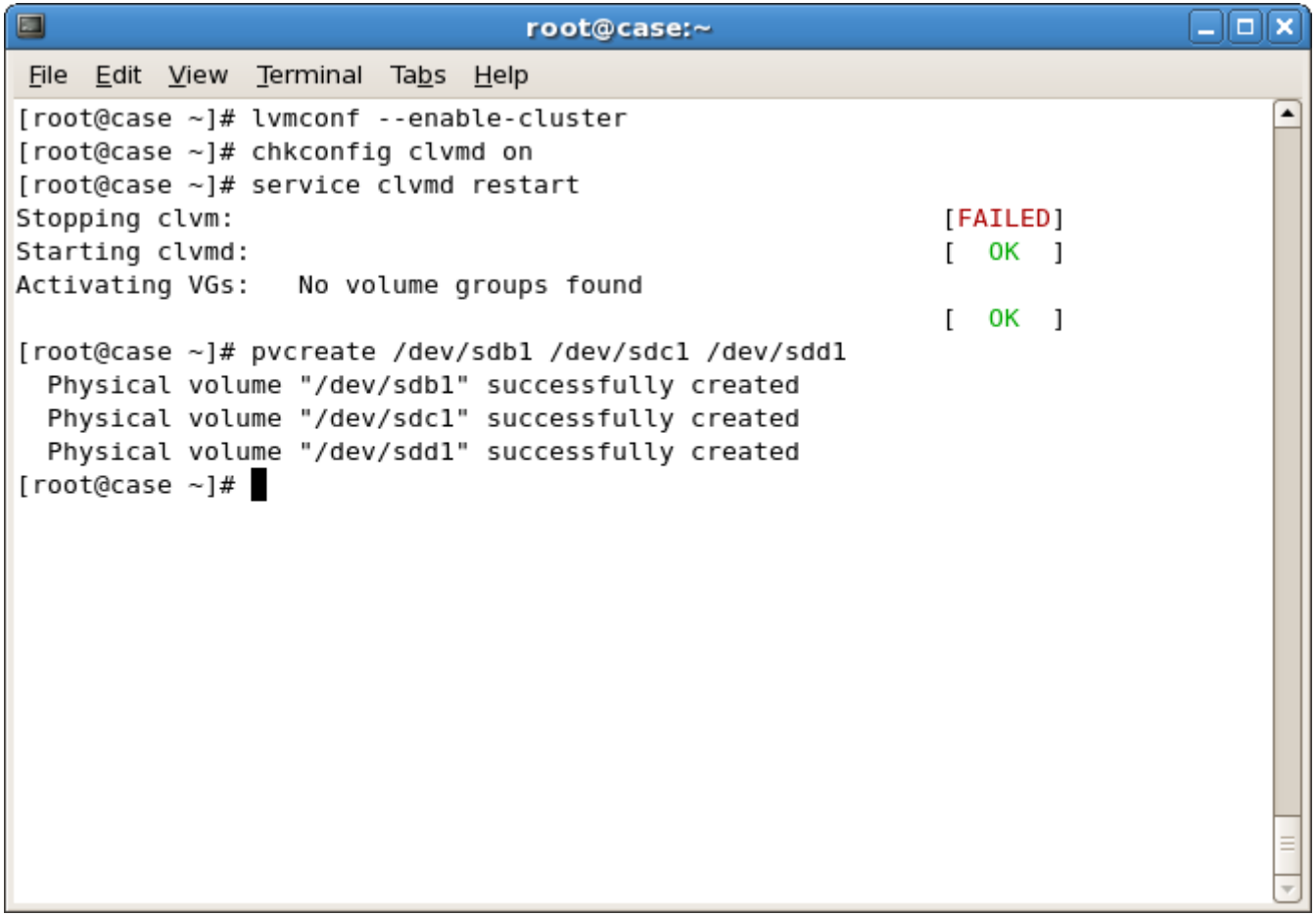
Setting up clustered logical volumes

- Note that you'll need to manually edit the /etc/fstab on the other node(s), restart clvmd and mount the filesystem there

Setting up clustered logical volumes manually

- Turn on clustered logical volume management with the `/usr/sbin/lvmconf` utility:
- `lvmconf --enable-cluster`
  - Changes `/etc/lvm/lvm.conf` so that the `locking_type` entry is changed to “3” (built-in cluster-wide locking)
- Ensure that `clvmd` is running and will survive a reboot
- Create partitions using `fdisk`
- Create physical volumes using `pvcreate` or Conga
  - `pvcreate /dev/sdb1 /dev/sdc1 /dev/sdd1`

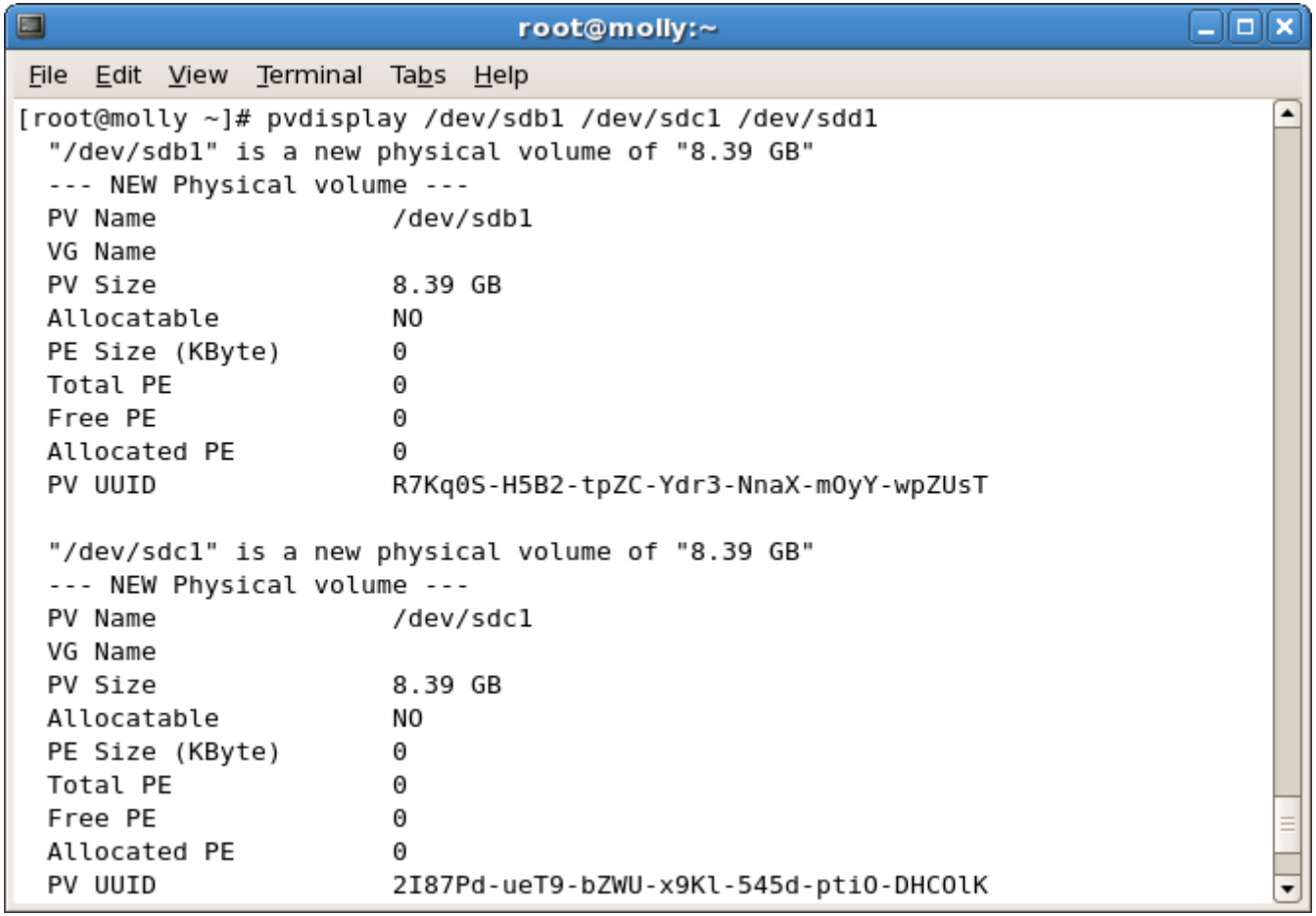
Setting up clustered logical volumes manually



Setting up clustered logical volumes manually

- Run `pvdisplay /dev/sdb1 /dev/sdc1 /dev/scd1` on the other initiator(s) in the cluster to verify that they see the physical volumes

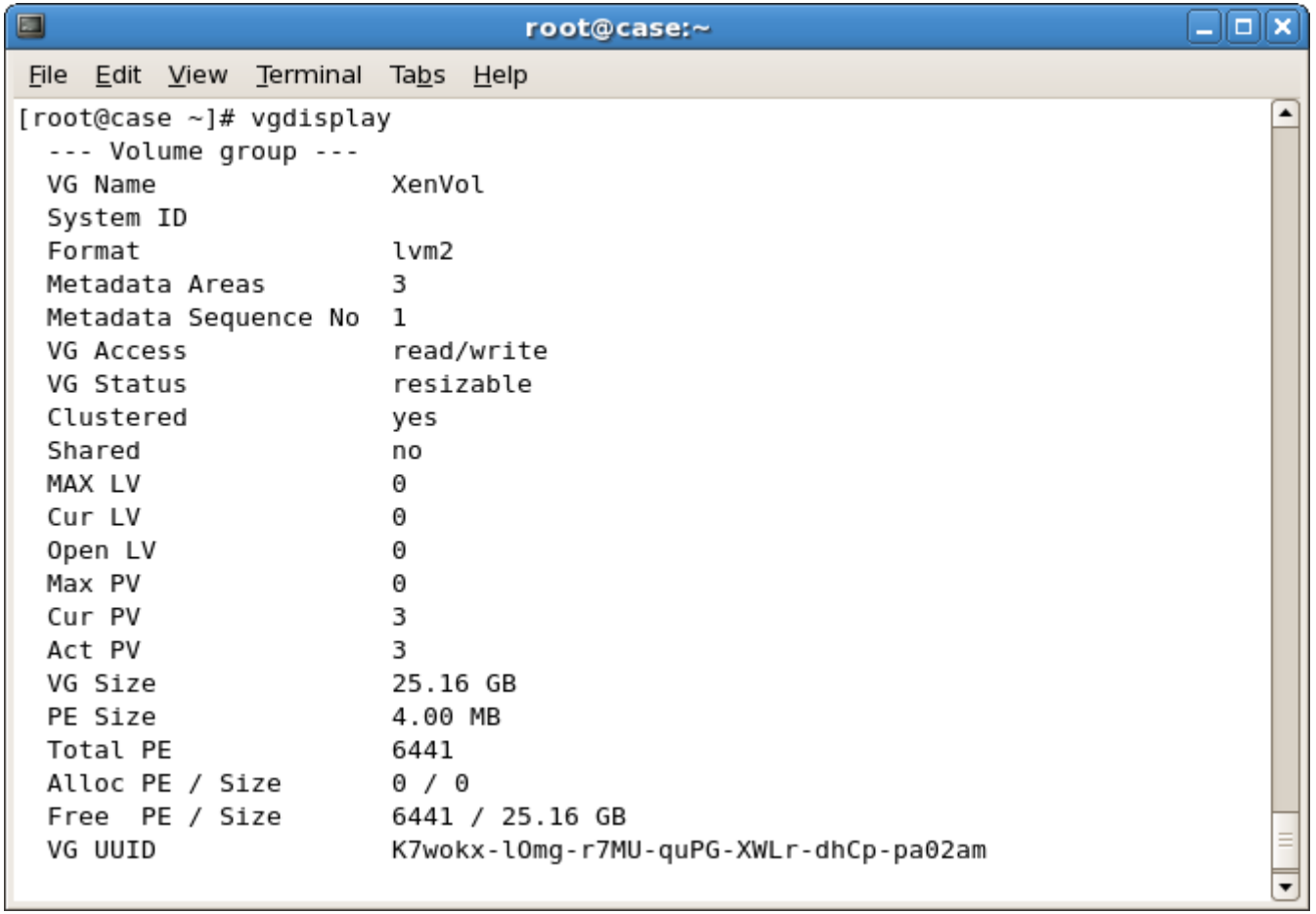
Setting up clustered logical volumes manually



Setting up clustered logical volumes manually

- Create volume groups using `/usr/sbin/vgcreate`
  - `vgcreate XenVol \`
    `/dev/sdb1 /dev/sdc1 /dev/sdd1`
- You can determine how many free physical extents available using `/usr/sbin/vgdisplay`

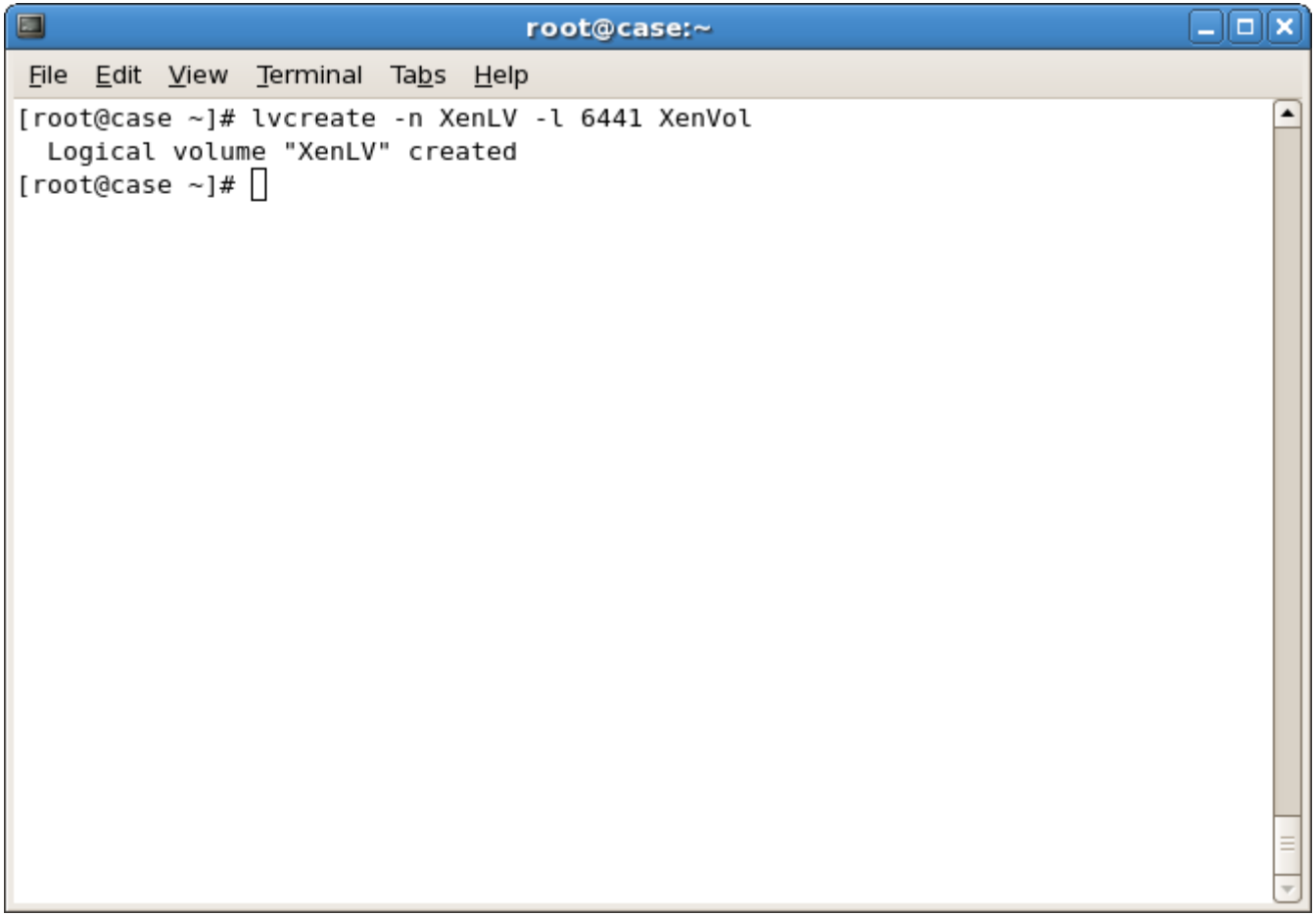
Setting up clustered logical volumes manually



Setting up clustered logical volumes manually

- Create logical volume using `/usr/sbin/lvcreate`
  - `lvcreate -n XenLV -l 6441 XenVol`
  - Alternatively, you can specify a percentage of free space as in
    - `lvcreate -n XenLV -l 100%FREE XenVol`

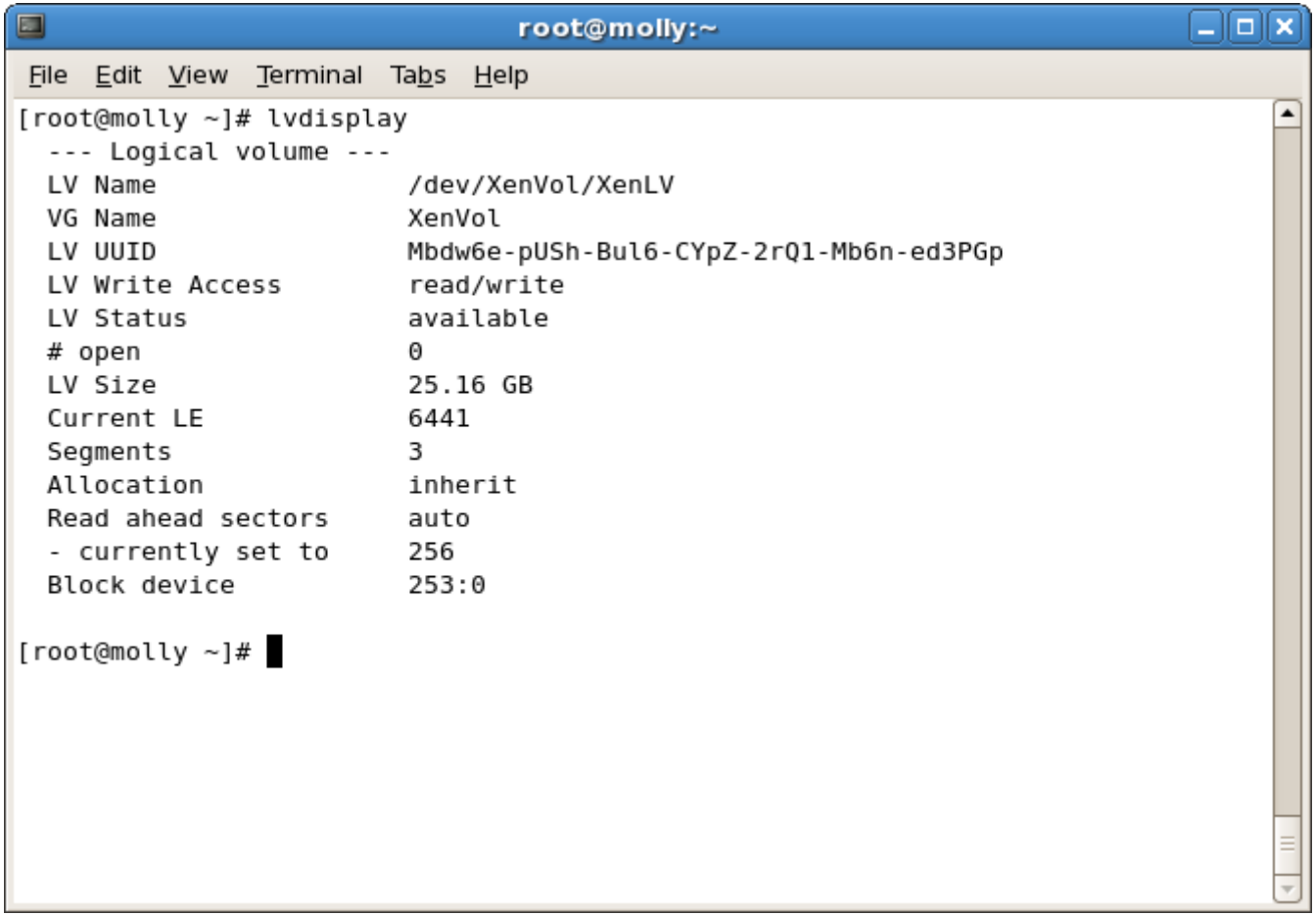
Setting up clustered logical volumes manually



Setting up clustered logical volumes manually

- Verify that the other node can “see” the logical volume
  - `/usr/sbin/lvdisplay`

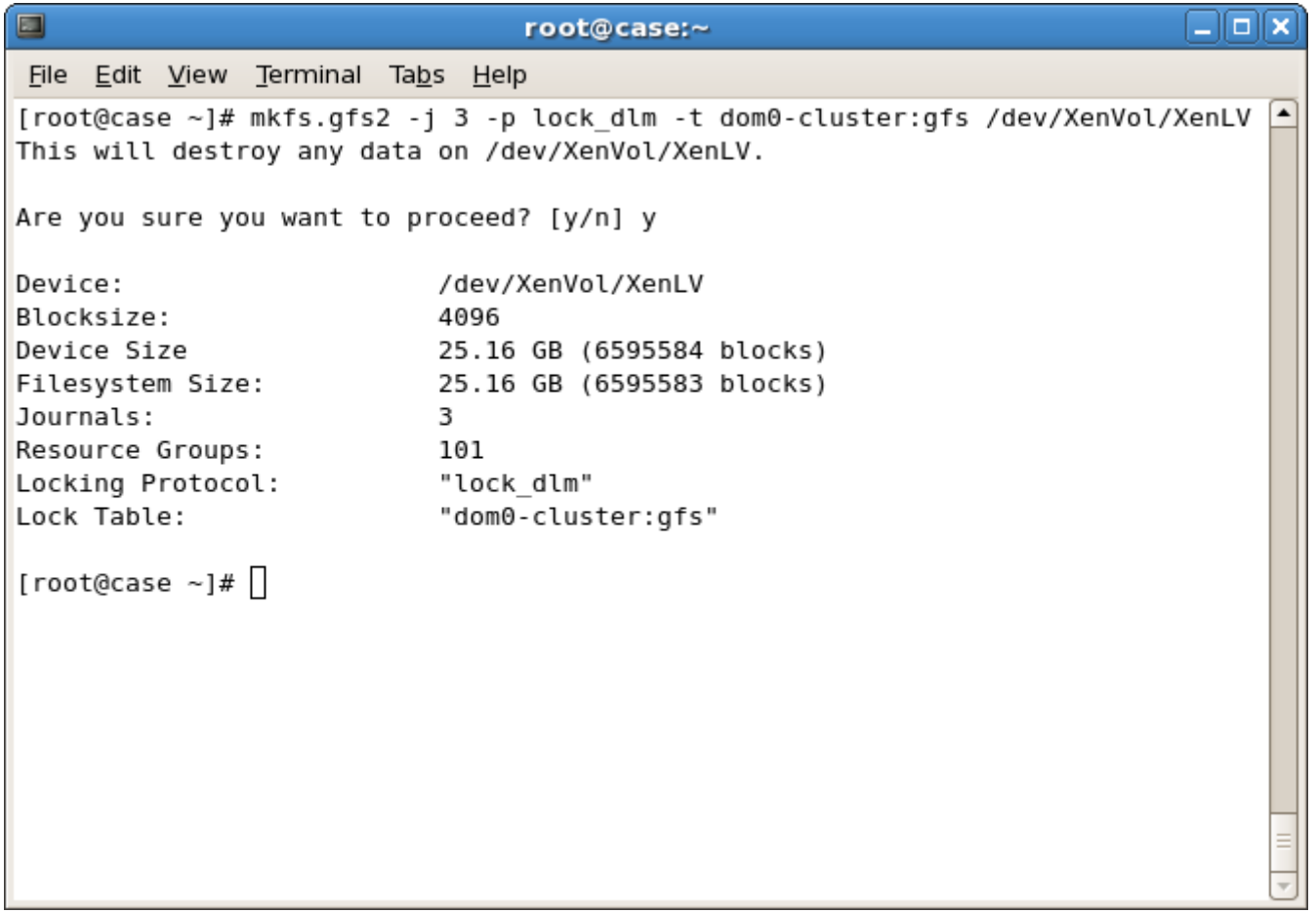
Setting up clustered logical volumes manually



Setting up clustered logical volumes manually

- Set up the shared GFS version 2 filesystem using `/sbin/mkfs.gfs2` (TECH PREVIEW)
  - `mkfs.gfs2 -j 3 -p lock_dlm -t \`
    `dom0-cluster:gfs /dev/XenVol/XenLV`
  - `mkfs.gfs2` creates the gfs2 filesystem
  - `-j 3` defines the number of journals – in this case, one for each node plus one extra in case the cluster is expanded
  - `-p lock_dlm` defines the locking protocol. In this case, distributed lock manager
  - `-t dom0-cluster:gfs` specifies the lock table name, which is the cluster name and the shared filesystem name
  - `/dev/XenVol/XenLV` is the device to be formatted

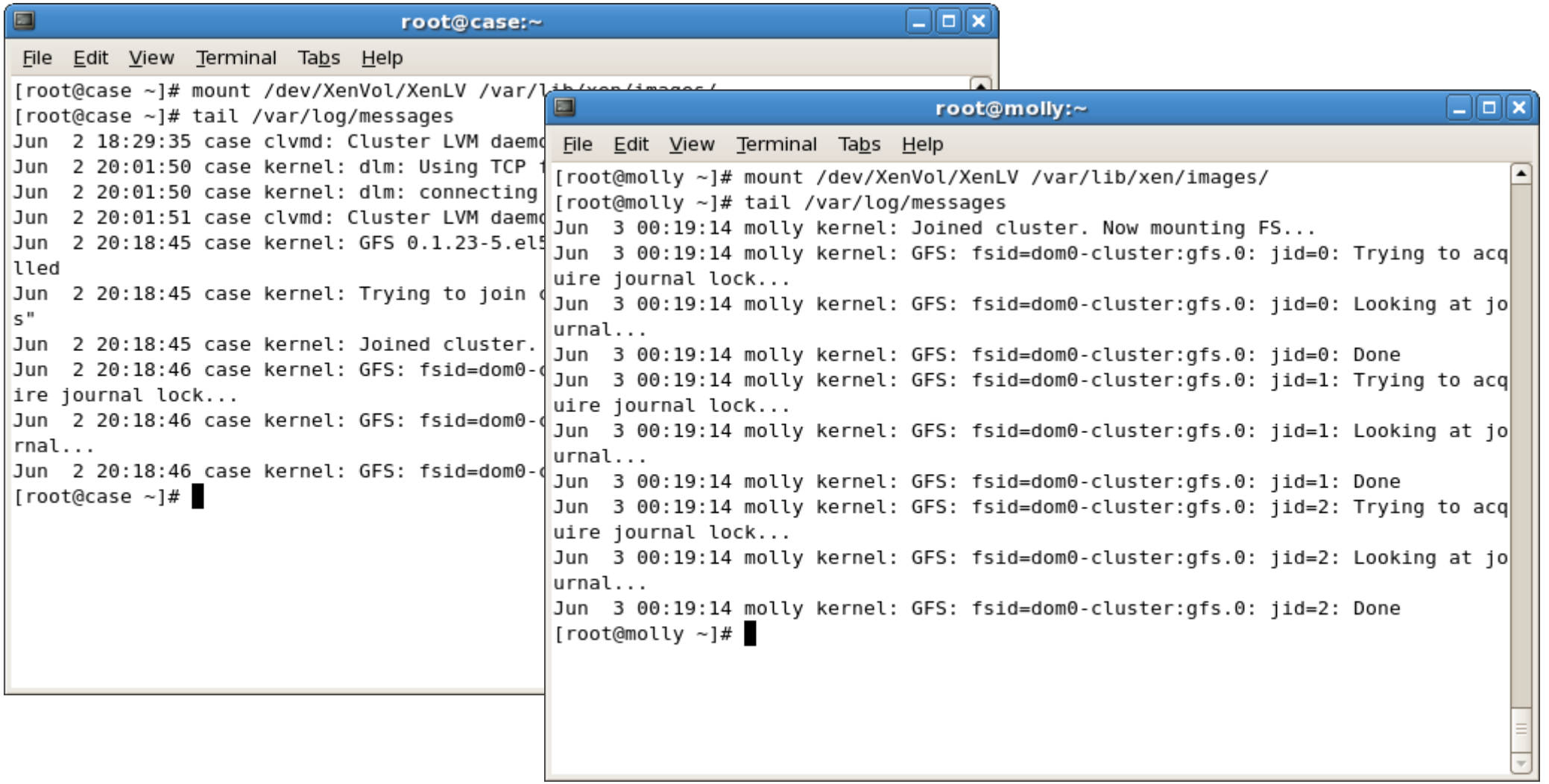
Setting up clustered logical volumes manually



Setting up clustered logical volumes manually

- Mount the newly created GFS filesystem. In this case on `/var/lib/xen/images` for both dom0 machines
  - `mount /dev/XenVol/XenLV /var/lib/xen/images`
- You can check `/var/log/messages` to see that the shared storage was mounted correctly

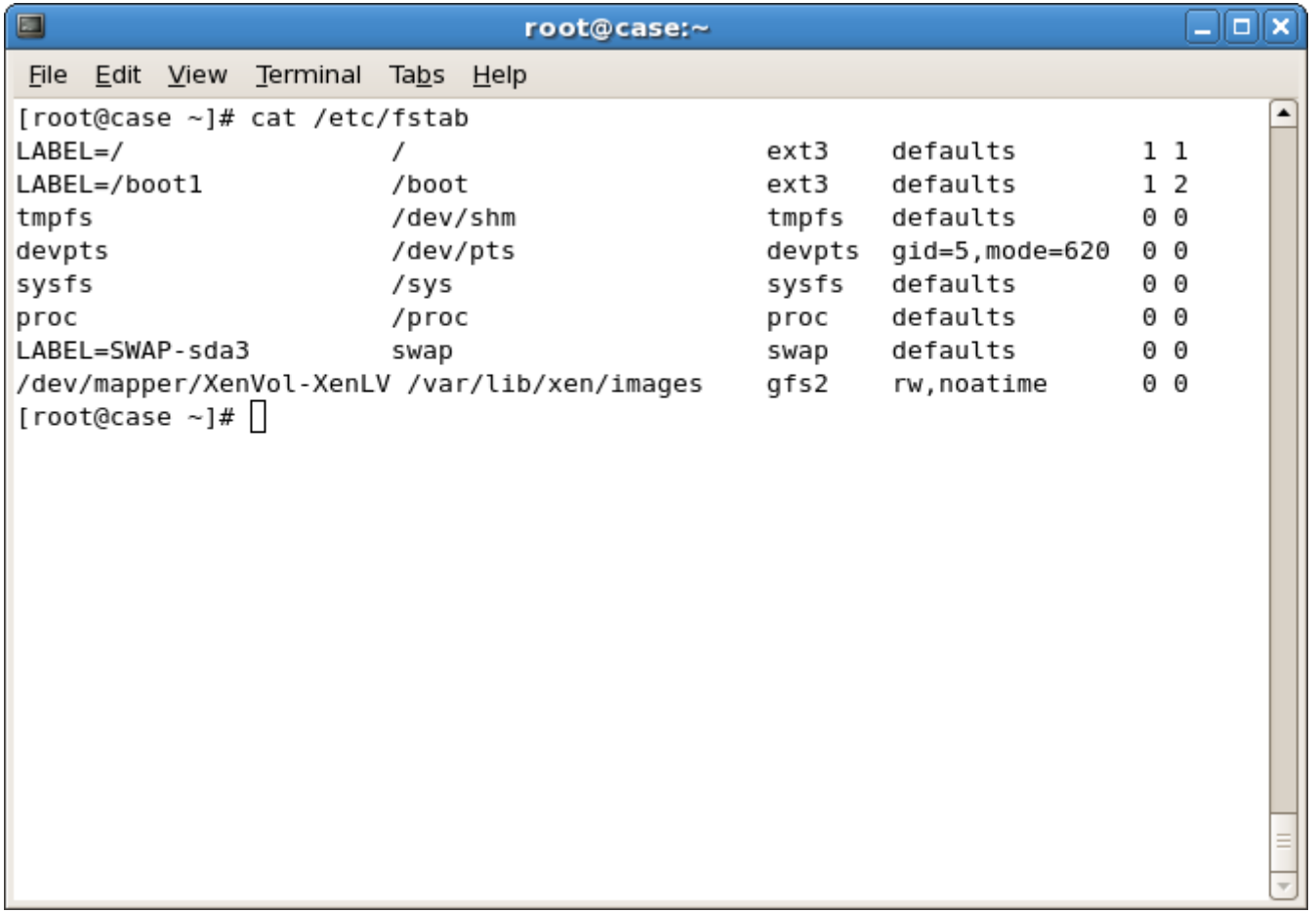
Setting up clustered logical volumes manually



Setting up clustered logical volumes manually

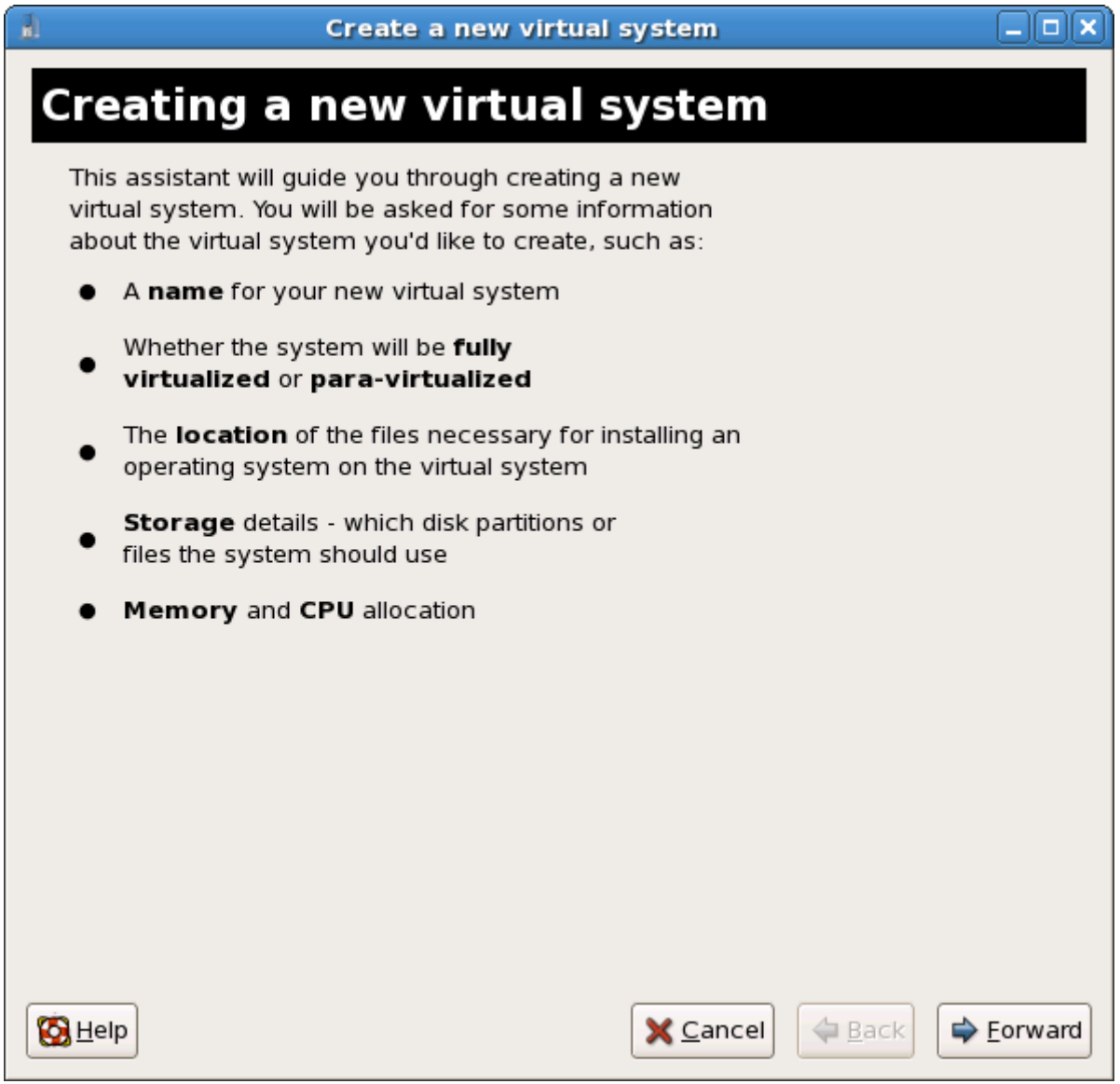
- Add the mount point to /etc/fstab on both hosts

Setting up clustered logical volumes manually

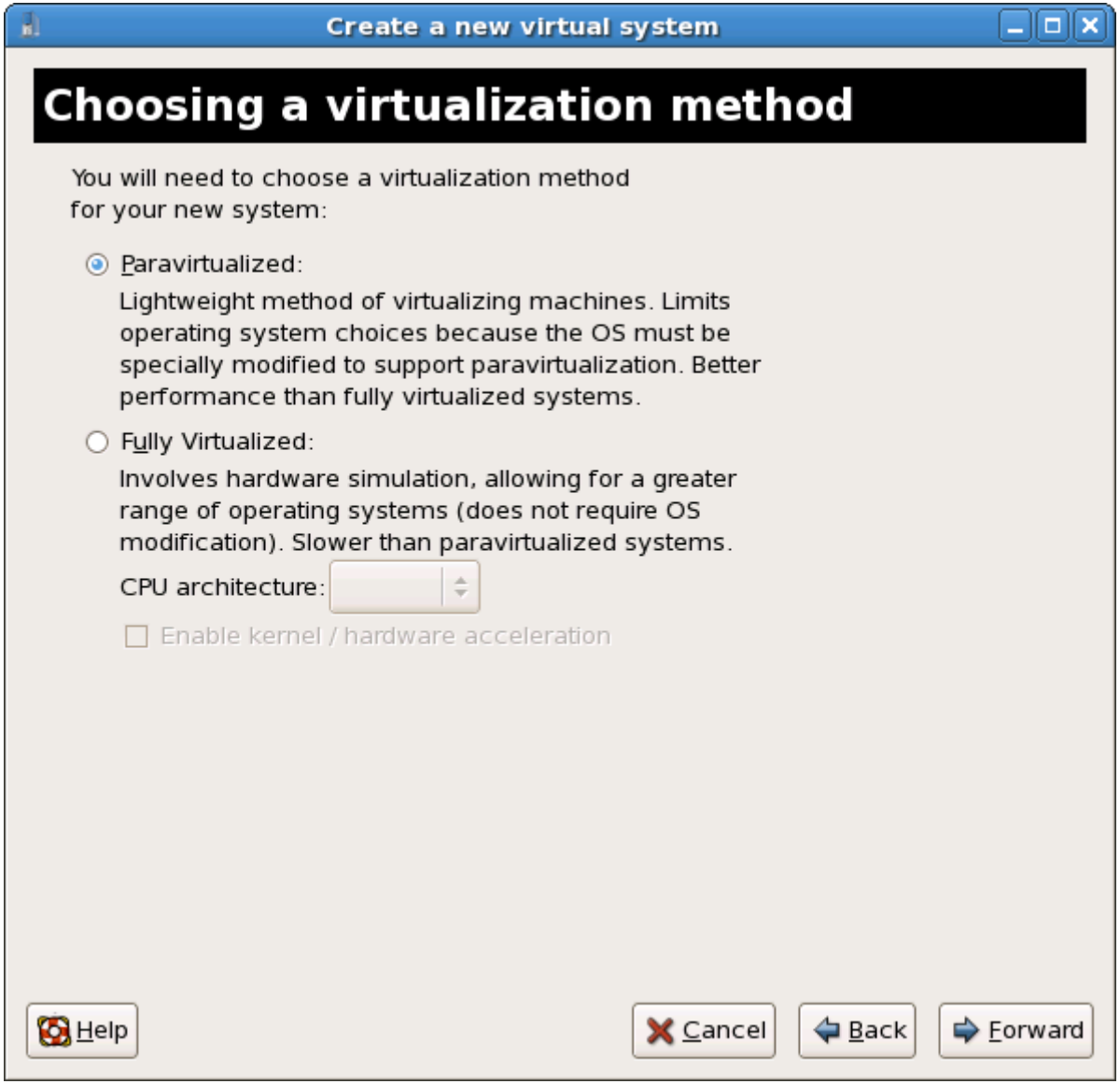


Installing the domU machines

- Use your favorite installer (`/usr/sbin/virt-manager` if you're a Windows™ admin or `/usr/sbin/virt-install` if you're a real sysadmin)

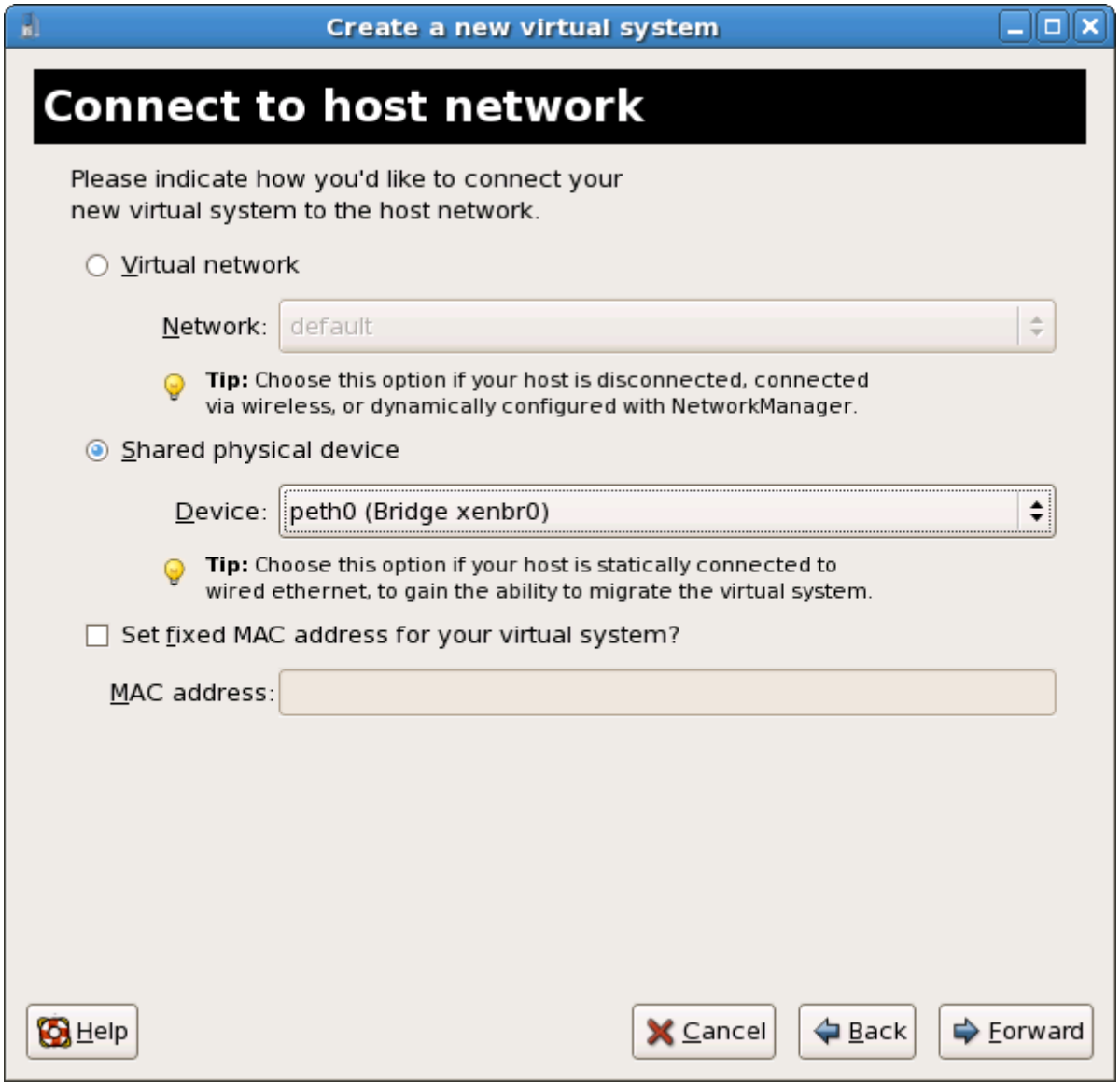

Create a new virtual system
Creating a new virtual system
This assistant will guide you through creating a new virtual system. You will be asked for some information about the virtual system you'd like to create, such as:
A name for your new virtual system
Whether the system will be fully virtualized or para-virtualized
The location of the files necessary for installing an operating system on the virtual system
Storage details - which disk partitions or files the system should use
Memory and CPU allocation
Help
Cancel
Back
Forward

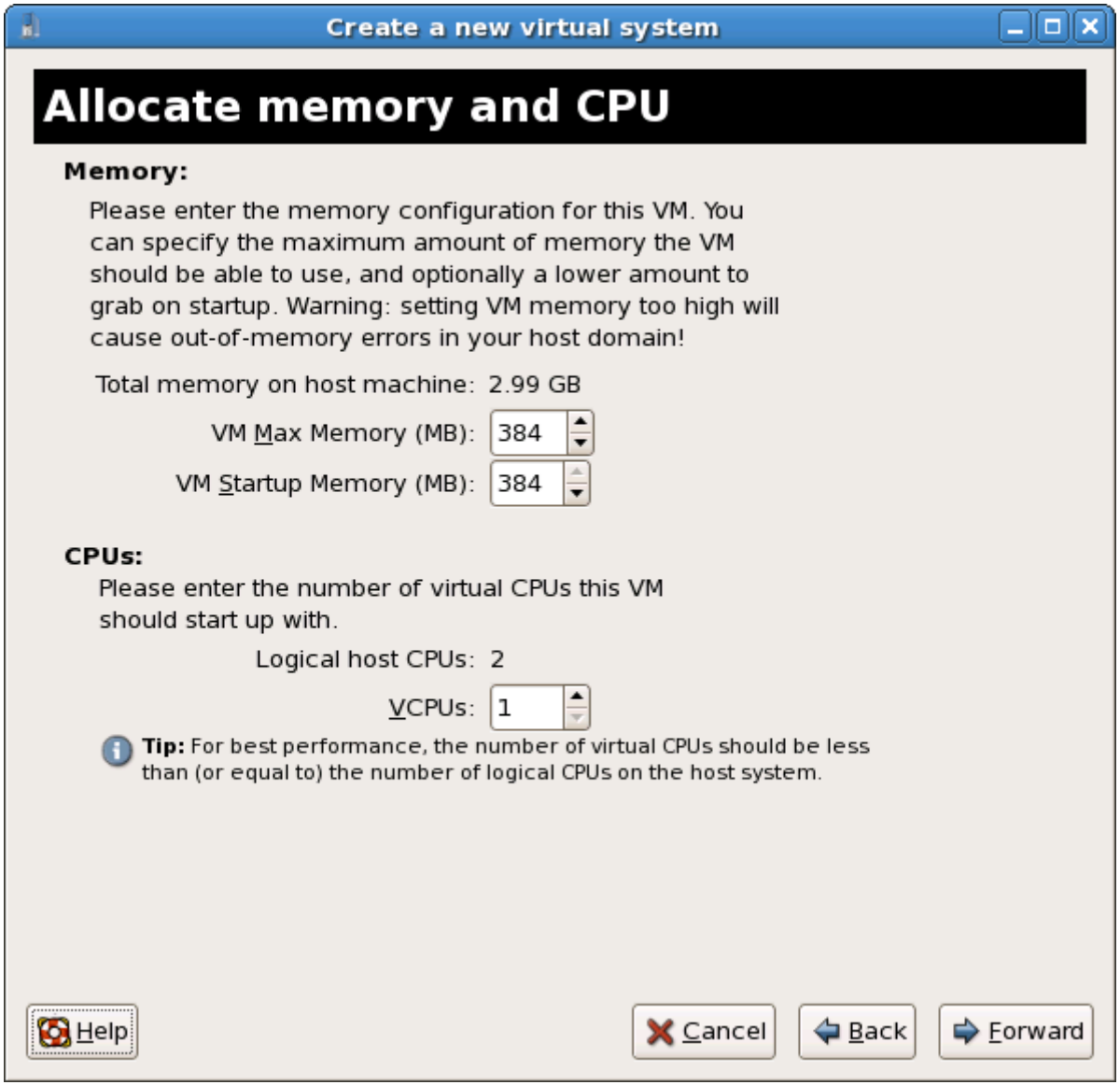

Create a new virtual system
Naming your virtual system
Please choose a name for your virtual system:
System Name:
armitage
Example: system1
Help
Cancel
Back
Forward

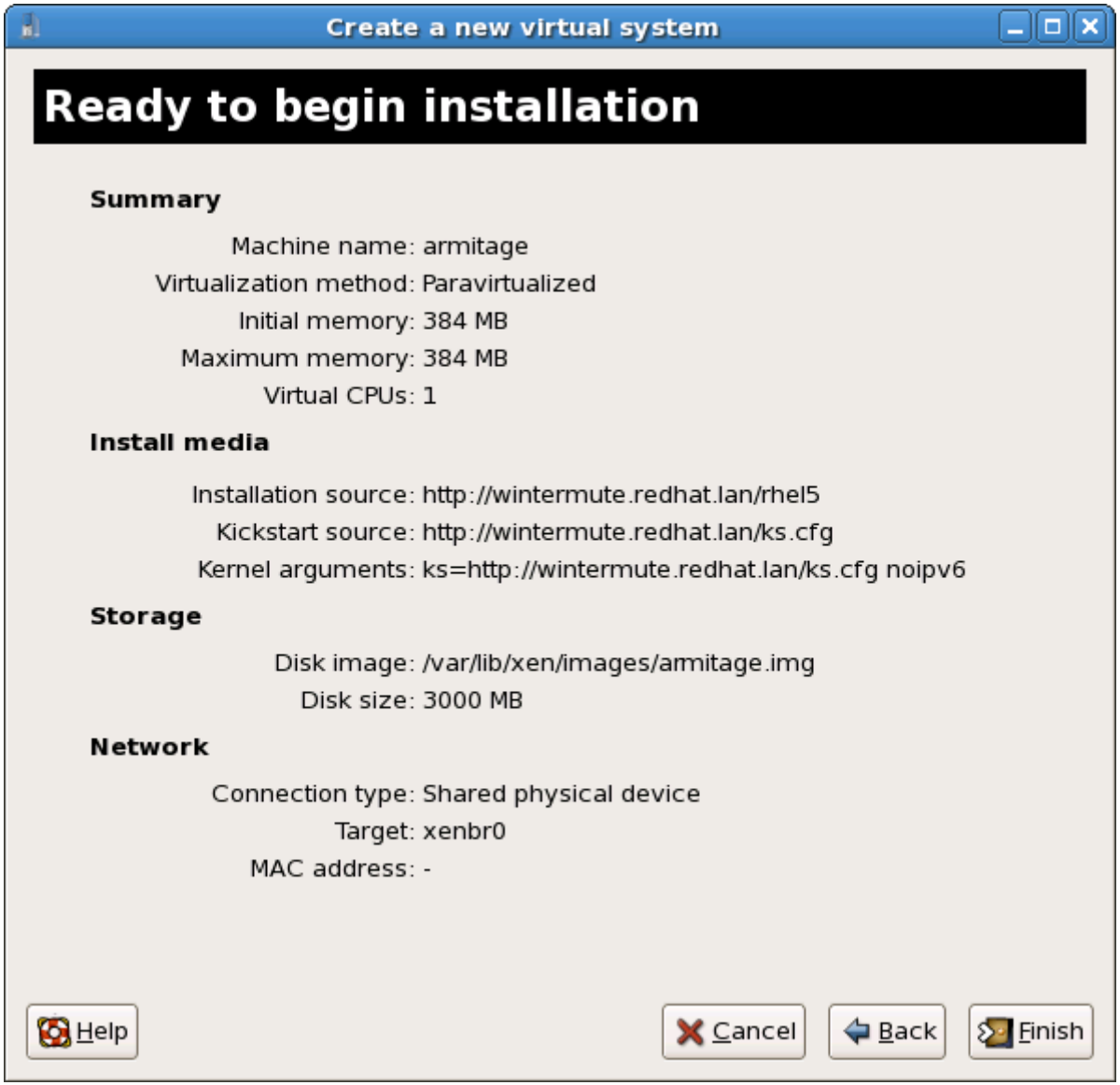

Create a new virtual system
Choosing a virtualization method
You will need to choose a virtualization method for your new system:
Paravirtualized:
Lightweight method of virtualizing machines. Limits operating system choices because the OS must be specially modified to support paravirtualization. Better performance than fully virtualized systems.
Fully Virtualized:
Involves hardware simulation, allowing for a greater range of operating systems (does not require OS modification). Slower than paravirtualized systems.
CPU architecture:
Enable kernel / hardware acceleration
Help
Cancel
Back
Forward

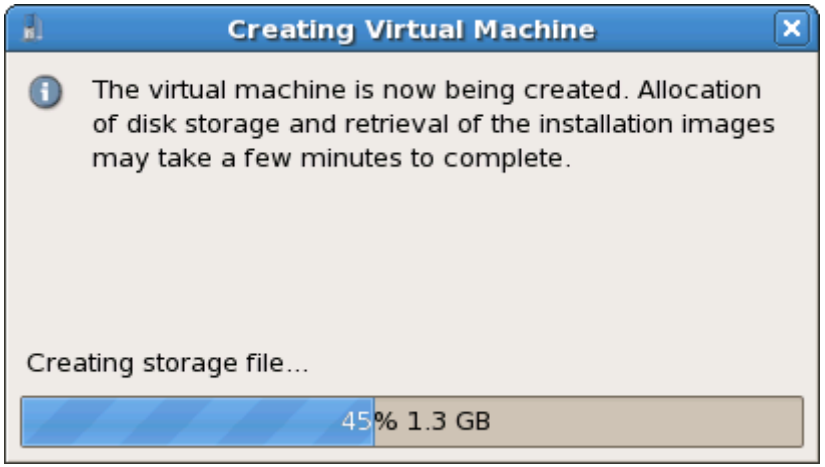

Create a new virtual system
Locating installation media
Please indicate where installation media is available for the operating system you would like to install on this **paravirtualized** virtual system. Optionally you can provide the URL for a kickstart file that describes your system:
Install Media URL:
http://wintermute.redhat.lan/rhel5
Example: http://servername.example.com/distro/i386/tree
Kickstart URL:
http://wintermute.redhat.lan/ks.cfg
Example: ftp://hostname.example.com/ks/ks.cfg
Kernel parameters:
noipv6
Example: updates=http://hostname.example.com/updates.img
Help
Cancel
Back
Forward

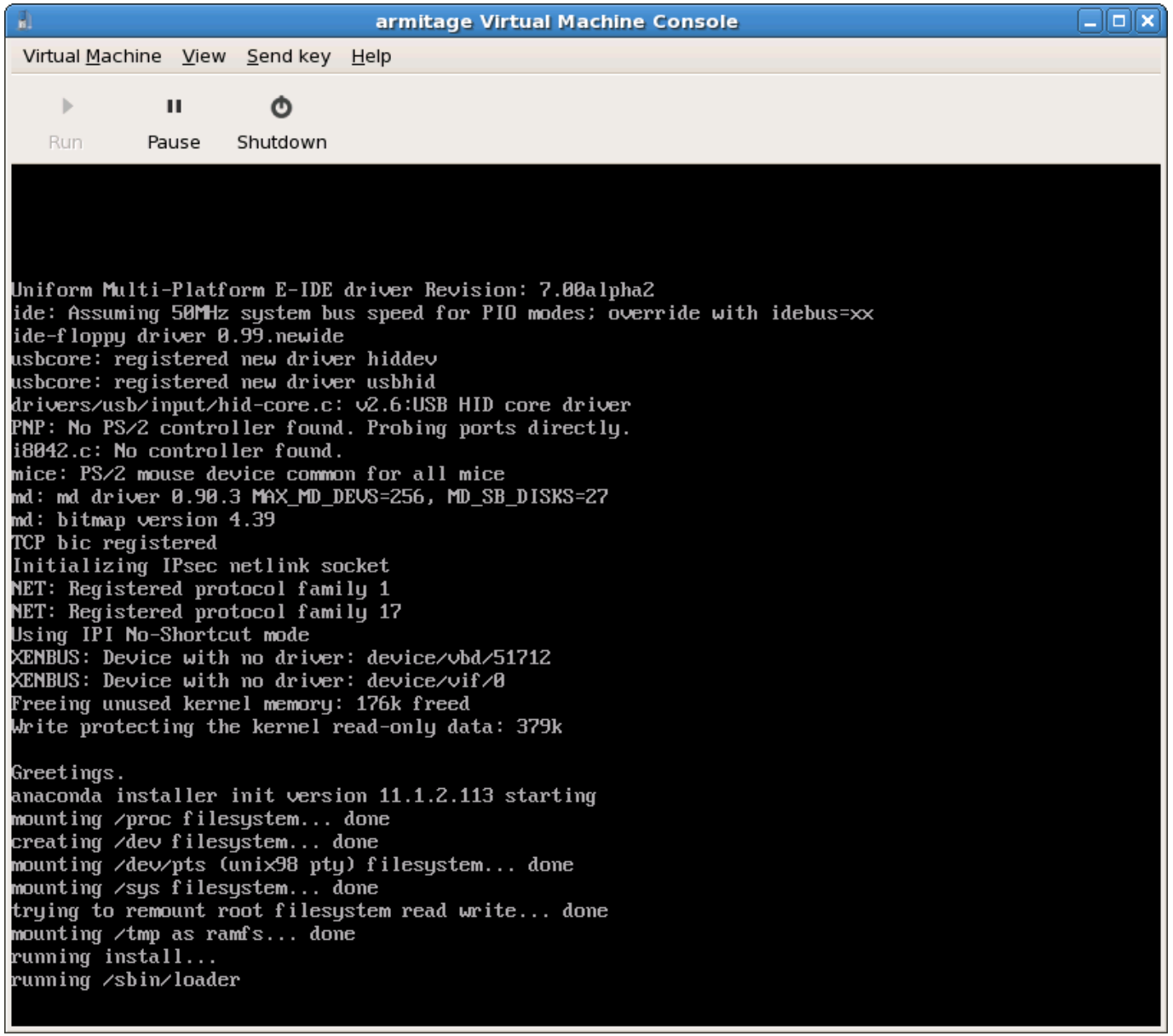

Create a new virtual system
Assigning storage space
Please indicate how you'd like to assign space on this physical host system for your new virtual system. This space will be used to install the virtual system's operating system.
Normal Disk Partition:
Partition:
Browse...
Example: /dev/hdc2
Simple File:
File Location:
/var/lib/xen/images/armitage.in
Browse...
File Size:
3000
MB
Allocate entire virtual disk now?
Warning: If you do not allocate the entire disk at VM creation, space will be allocated as needed while the guest is running. If sufficient free space is not available on the host, this may result in data corruption on the guest.
Tip: You may add additional storage, including network-mounted storage, to your virtual system after it has been created using the same tools you would on a physical system.
Help
Cancel
Back
Forward

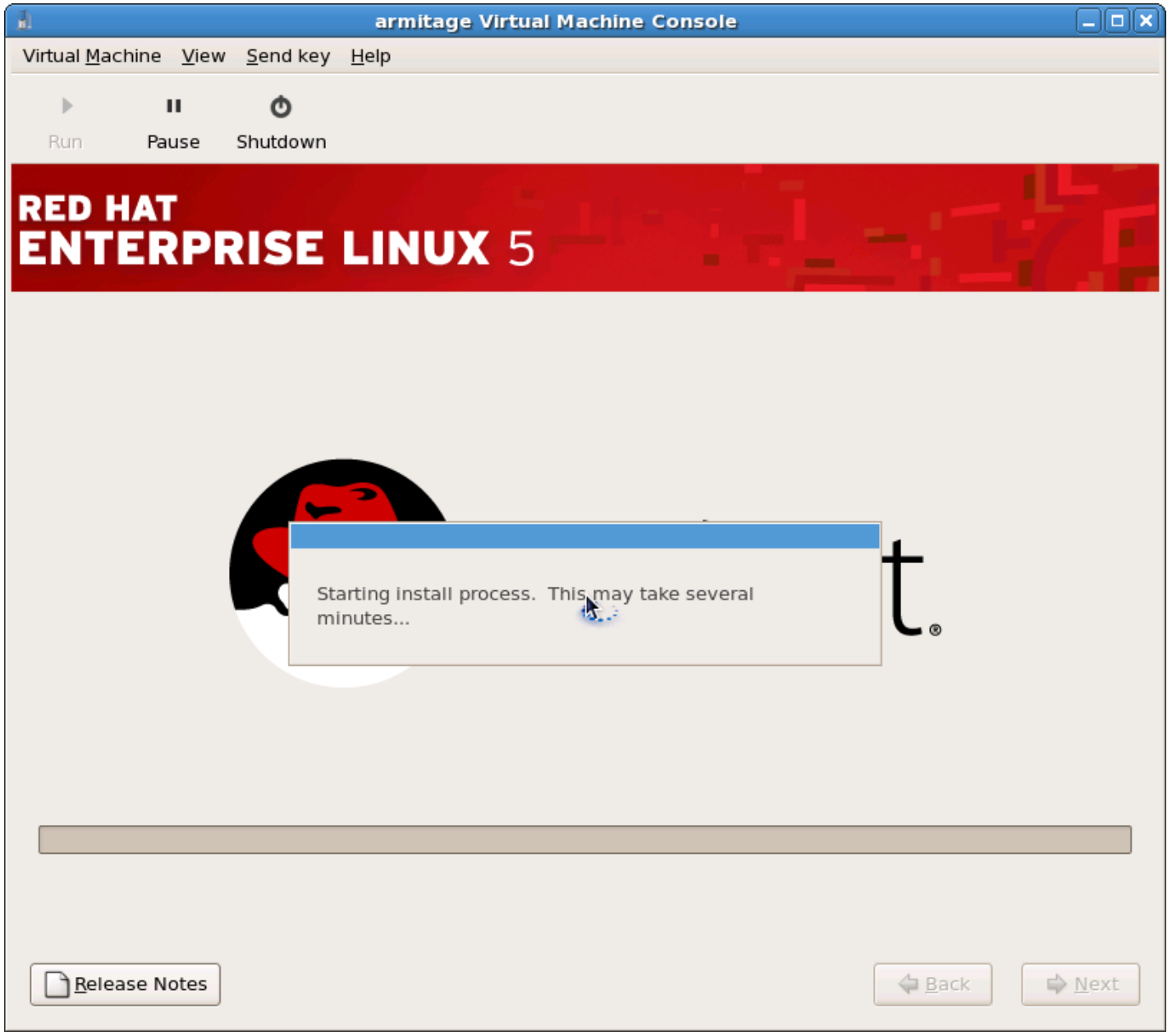

Create a new virtual system
Connect to host network
Please indicate how you'd like to connect your new virtual system to the host network.
Virtual network
Network:
default
Tip: Choose this option if your host is disconnected, connected via wireless, or dynamically configured with NetworkManager.
Shared physical device
Device:
peth0 (Bridge xenbr0)
Tip: Choose this option if your host is statically connected to wired ethernet, to gain the ability to migrate the virtual system.
Set fixed MAC address for your virtual system?
MAC address:
Help
Cancel
Back
Forward

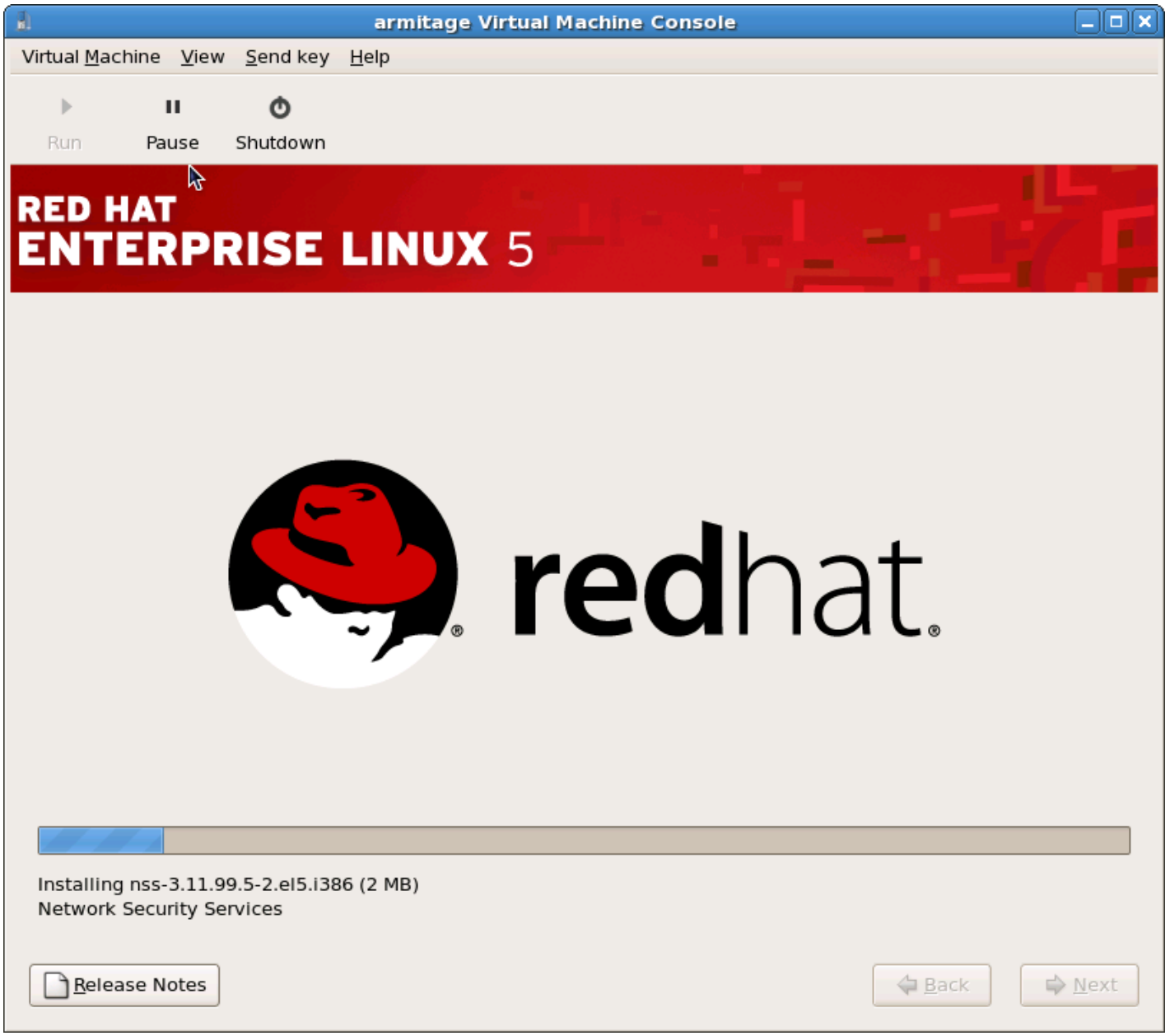

Create a new virtual system
Allocate memory and CPU
Memory:
Please enter the memory configuration for this VM. You can specify the maximum amount of memory the VM should be able to use, and optionally a lower amount to grab on startup. Warning: setting VM memory too high will cause out-of-memory errors in your host domain!
Total memory on host machine: 2.99 GB
VM Max Memory (MB): 384
VM Startup Memory (MB): 384
CPUs:
Please enter the number of virtual CPUs this VM should start up with.
Logical host CPUs: 2
VCPUs: 1
Tip: For best performance, the number of virtual CPUs should be less than (or equal to) the number of logical CPUs on the host system.
Help
Cancel
Back
Forward


Create a new virtual system
Ready to begin installation
Summary
Machine name: armitage
Virtualization method: Paravirtualized
Initial memory: 384 MB
Maximum memory: 384 MB
Virtual CPUs: 1
Install media
Installation source: http://wintermute.redhat.lan/rhel5
Kickstart source: http://wintermute.redhat.lan/ks.cfg
Kernel arguments: ks=http://wintermute.redhat.lan/ks.cfg noipv6
Storage
Disk image: /var/lib/xen/images/armitage.img
Disk size: 3000 MB
Network
Connection type: Shared physical device
Target: xenbr0
MAC address: -
Help
Cancel
Back
Finish


Creating Virtual Machine
The virtual machine is now being created. Allocation of disk storage and retrieval of the installation images may take a few minutes to complete.
Creating storage file...
45% 1.3 GB


armitage Virtual Machine Console
Virtual Machine View Send key Help
Run
Pause
Shutdown
Uniform Multi-Platform E-IDE driver Revision: 7.00alpha2
ide: Assuming 50MHz system bus speed for PIO modes; override with idebus=xx
ide-floppy driver 0.99.newide
usbcore: registered new driver hiddev
usbcore: registered new driver usbhid
drivers/usb/input/hid-core.c: v2.6:USB HID core driver
PNP: No PS/2 controller found. Probing ports directly.
i8042.c: No controller found.
mice: PS/2 mouse device common for all mice
md: md driver 0.90.3 MAX_MD_DEVS=256, MD_SB_DISKS=27
md: bitmap version 4.39
TCP bic registered
Initializing IPsec netlink socket
NET: Registered protocol family 1
NET: Registered protocol family 17
Using IPI No-Shortcut mode
XENBUS: Device with no driver: device/vbd/51712
XENBUS: Device with no driver: device/vif/0
Freeing unused kernel memory: 176k freed
Write protecting the kernel read-only data: 379k
Greetings.
anaconda installer init version 11.1.2.113 starting
mounting /proc filesystem... done
creating /dev filesystem... done
mounting /dev/pts (unix98 pty) filesystem... done
mounting /sys filesystem... done
trying to remount root filesystem read write... done
mounting /tmp as ramfs... done
running install...
running /sbin/loader


armitage Virtual Machine Console
Virtual Machine View Send key Help
Run
Pause
Shutdown
RED HAT
ENTERPRISE LINUX 5
Starting install process. This may take several minutes...
Release Notes
Back
Next


armitage Virtual Machine Console
Virtual Machine
View
Send key
Help
Run
Pause
Shutdown
RED HAT
ENTERPRISE LINUX 5
redhat.
Installing nss-3.11.99.5-2.el5.i386 (2 MB)
Network Security Services
Release Notes
Back
Next

Installing the domU machines

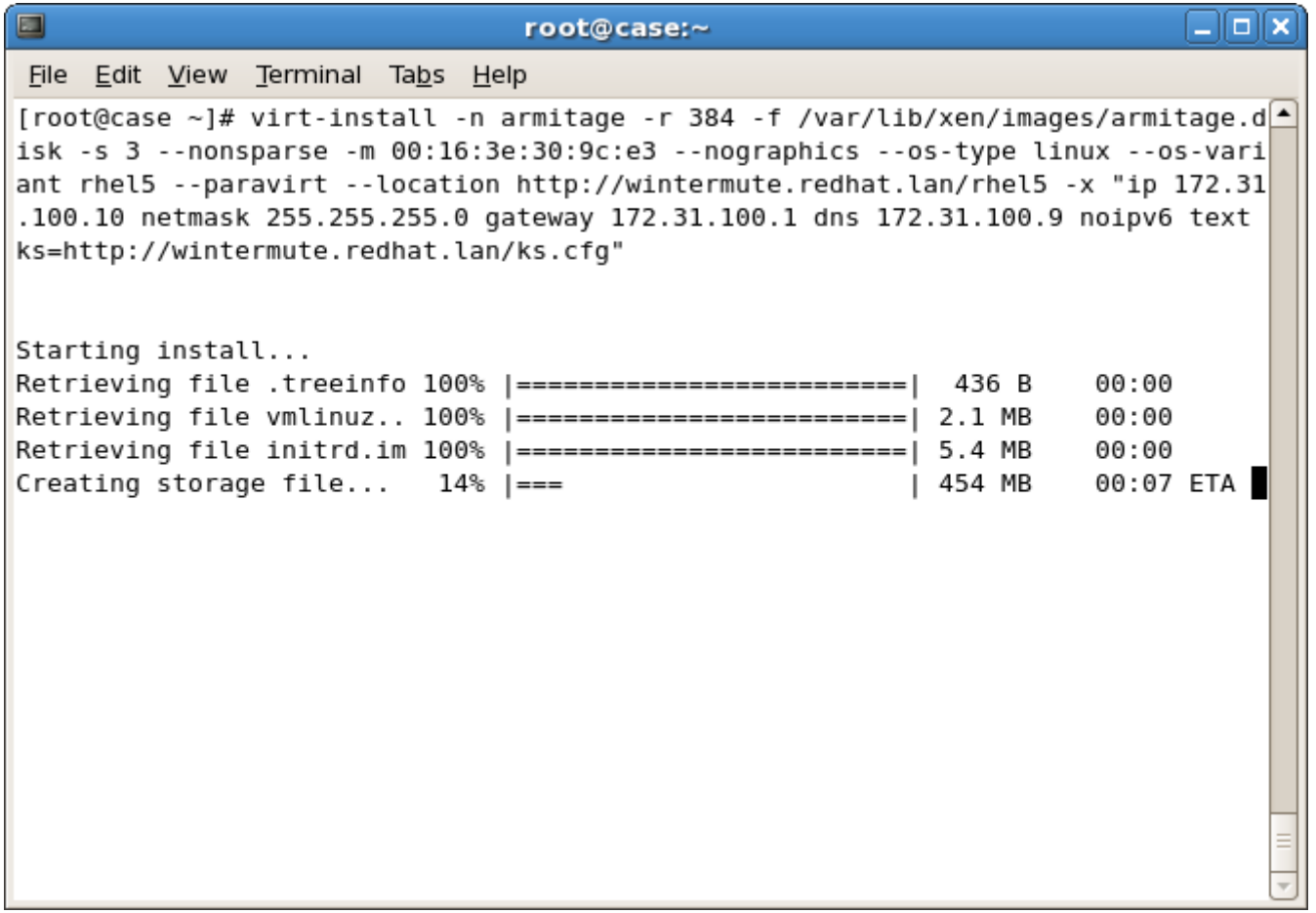
- `virt-install -n armitage -r 384 \`
  `-f /var/lib/xen/images/armitage.disk \`
  `-s 3 --nonsparse -m 00:16:3e:30:9c:e3 \`
  `--nographics --os-type linux --os-variant \`
  `rhel5 --paravirt --location \`
  `http://wintermute.redhat.lan/rhel5 \`

Installing the domU machines

```
-x "ip 172.31.100.10 netmask 255.255.255.0 \
gateway 172.31.100.1 dns 172.31.100.9 \
noipv6 text \
ks=http://wintermute.redhat.lan/ks.cfg"
```

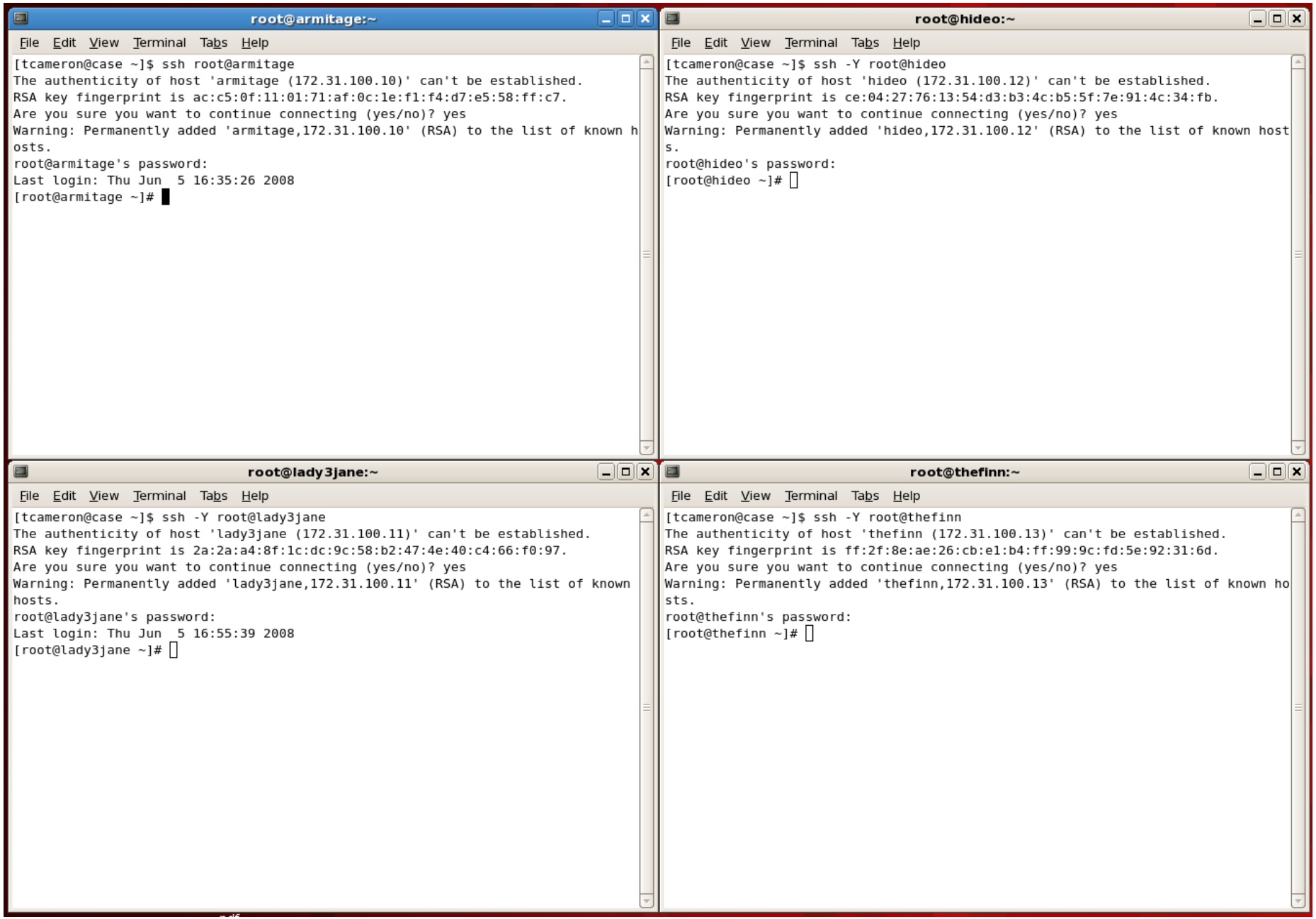
- Make sure that the Clustering and Cluster Storage groups are part of your installation

Installing the domU machines



Installing the domU machines

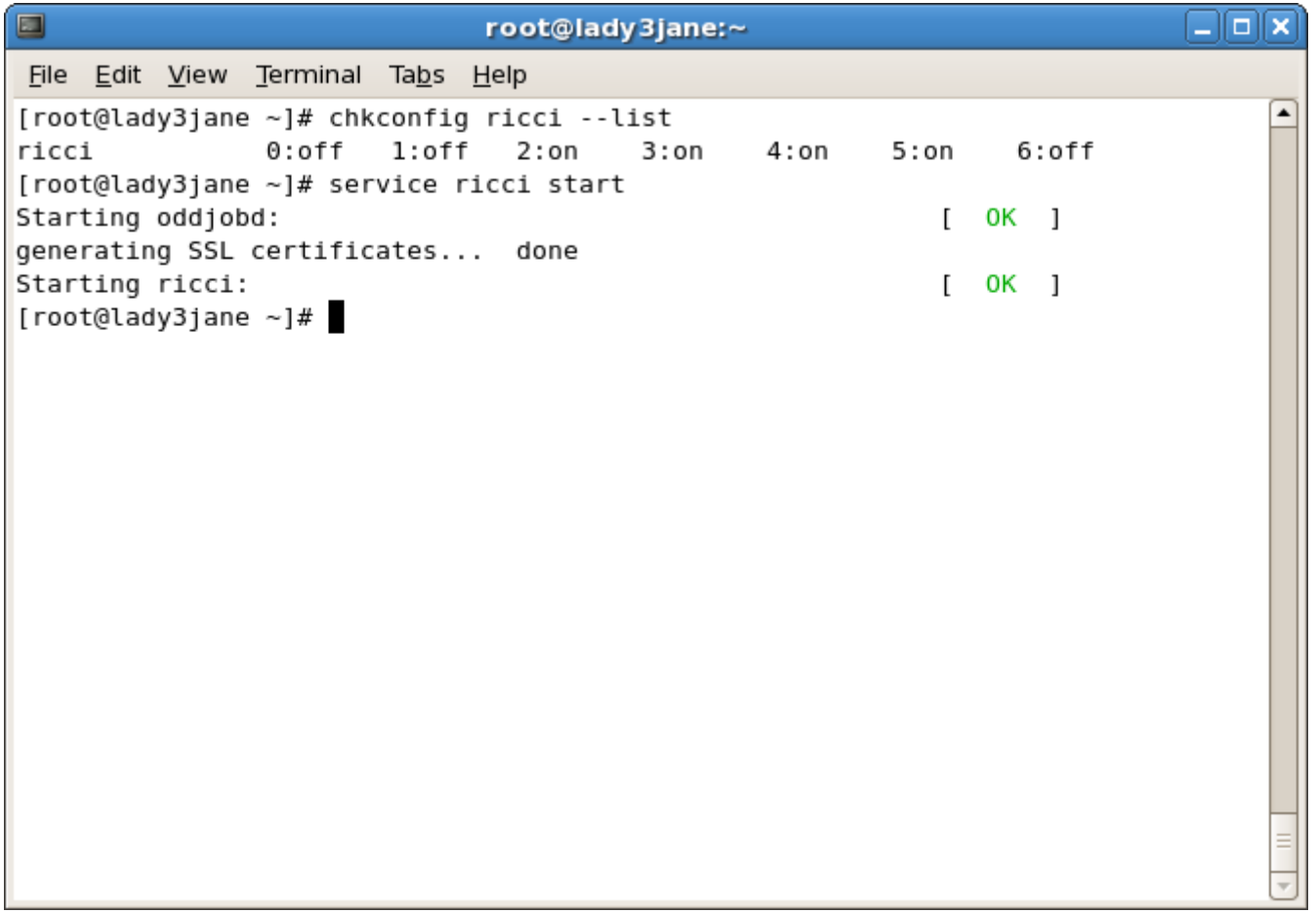
- Verify that all hosts are up


root@armitage:~
File Edit View Terminal Tabs Help
[tcameron@case ~]$ ssh root@armitage
The authenticity of host 'armitage (172.31.100.10)' can't be established.
RSA key fingerprint is ac:c5:0f:11:01:71:af:0c:1e:f1:f4:d7:e5:58:ff:c7.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'armitage,172.31.100.10' (RSA) to the list of known hosts.
root@armitage's password:
Last login: Thu Jun 5 16:35:26 2008
[root@armitage ~]#
root@hideo:~
File Edit View Terminal Tabs Help
[tcameron@case ~]$ ssh -Y root@hideo
The authenticity of host 'hideo (172.31.100.12)' can't be established.
RSA key fingerprint is ce:04:27:76:13:54:d3:b3:4c:b5:5f:7e:91:4c:34:fb.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'hideo,172.31.100.12' (RSA) to the list of known hosts.
root@hideo's password:
[root@hideo ~]#
root@lady3jane:~
File Edit View Terminal Tabs Help
[tcameron@case ~]$ ssh -Y root@lady3jane
The authenticity of host 'lady3jane (172.31.100.11)' can't be established.
RSA key fingerprint is 2a:2a:a4:8f:1c:dc:9c:58:b2:47:4e:40:c4:66:f0:97.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'lady3jane,172.31.100.11' (RSA) to the list of known hosts.
root@lady3jane's password:
Last login: Thu Jun 5 16:55:39 2008
[root@lady3jane ~]#
root@thefinn:~
File Edit View Terminal Tabs Help
[tcameron@case ~]$ ssh -Y root@thefinn
The authenticity of host 'thefinn (172.31.100.13)' can't be established.
RSA key fingerprint is ff:2f:8e:ae:26:cb:e1:b4:ff:99:9c:fd:5e:92:31:6d.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'thefinn,172.31.100.13' (RSA) to the list of known hosts.
root@thefinn's password:
[root@thefinn ~]#

Installing the domU machines

- Make sure that `ricci` is set to start at bootup
- Make sure `ricci` is running

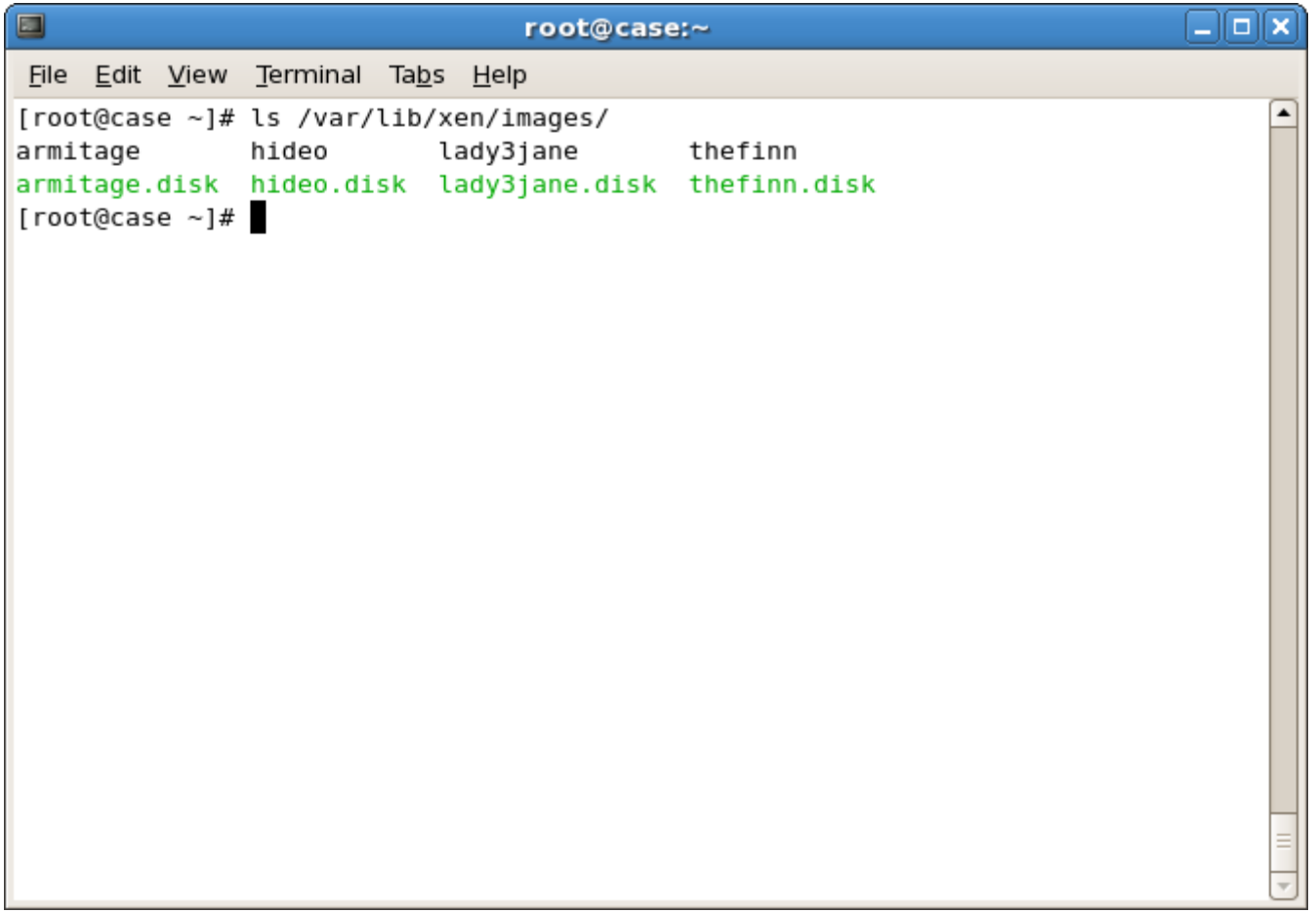
Installing the domU machines



Define the domUs as cluster resources

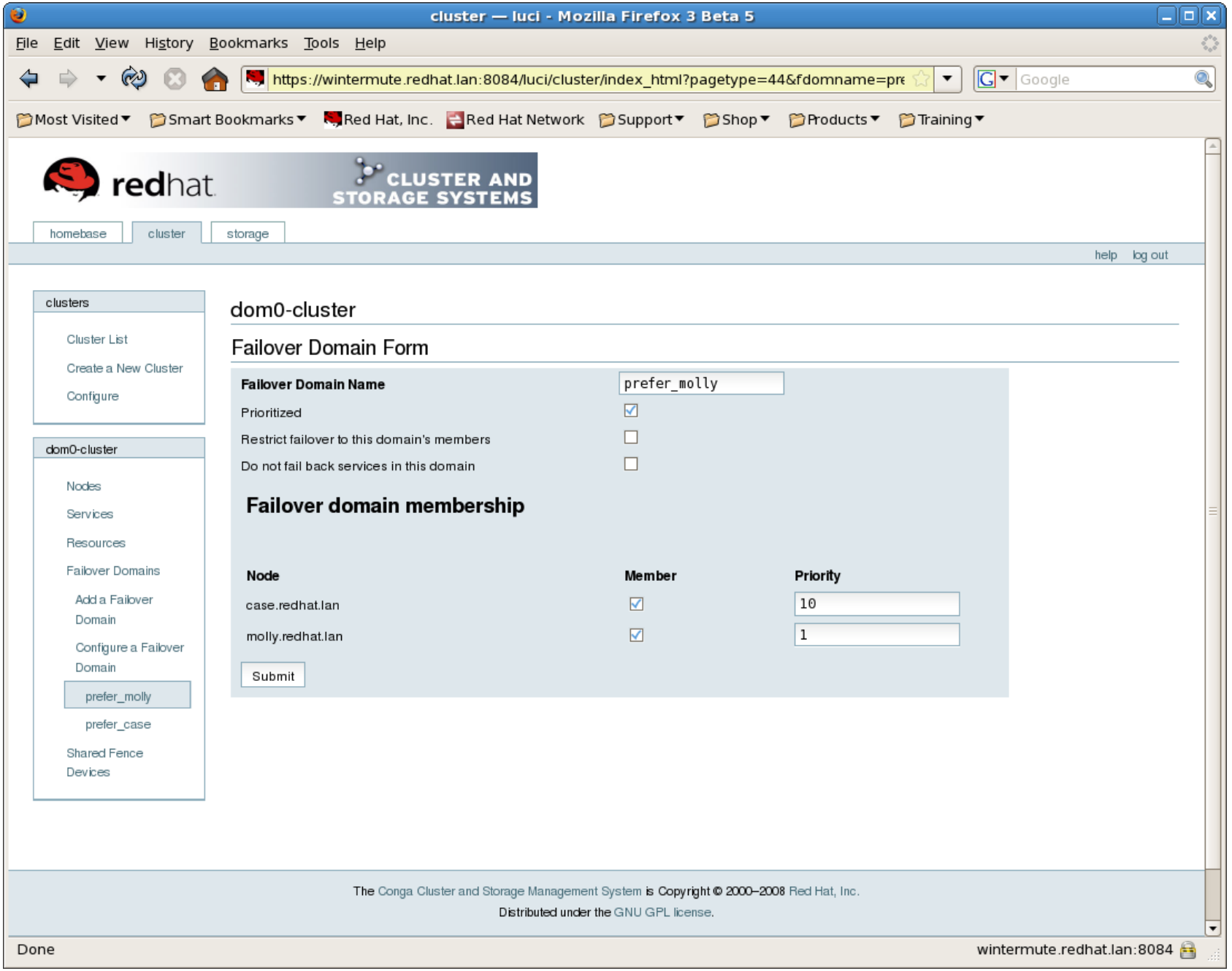
- Since the domU cluster will be a clustered service, disable the per-dom0 xendomains service
  - `chkconfig xendomains off`
  - `service xendomains stop`
- Move the config files for each domU from `/etc/xen` to `/var/lib/xen/images`

Create the domU Cluster



Define the domUs as cluster resources

- Define each dom0 as a failover domain
  - `prefer_case`
  - `prefer_molly`
- Choose the dom0 cluster, go to “Failover Domains,” then “Add a Failover Domain,” then create the domains
- Set prioritization so that the preferred machine has a lower number


cluster — luci - Mozilla Firefox 3 Beta 5
File Edit View History Bookmarks Tools Help
https://wintermute.redhat.lan:8084/luci/cluster/index_html?pagetype=44&fdomname=pre
Google
Most Visited
Smart Bookmarks
Red Hat, Inc.
Red Hat Network
Support
Shop
Products
Training
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
dom0-cluster
Nodes
Services
Resources
Failover Domains
Add a Failover Domain
Configure a Failover Domain
prefer_molly
prefer_case
Shared Fence Devices
dom0-cluster
Failover Domain Form
Failover Domain Name
prefer_molly
Prioritized
Restrict failover to this domain's members
Do not fail back services in this domain
Failover domain membership
Node
Member
Priority
case.redhat.lan
10
molly.redhat.lan
1
Submit
The Conga Cluster and Storage Management System is Copyright © 2000–2008 Red Hat, Inc.
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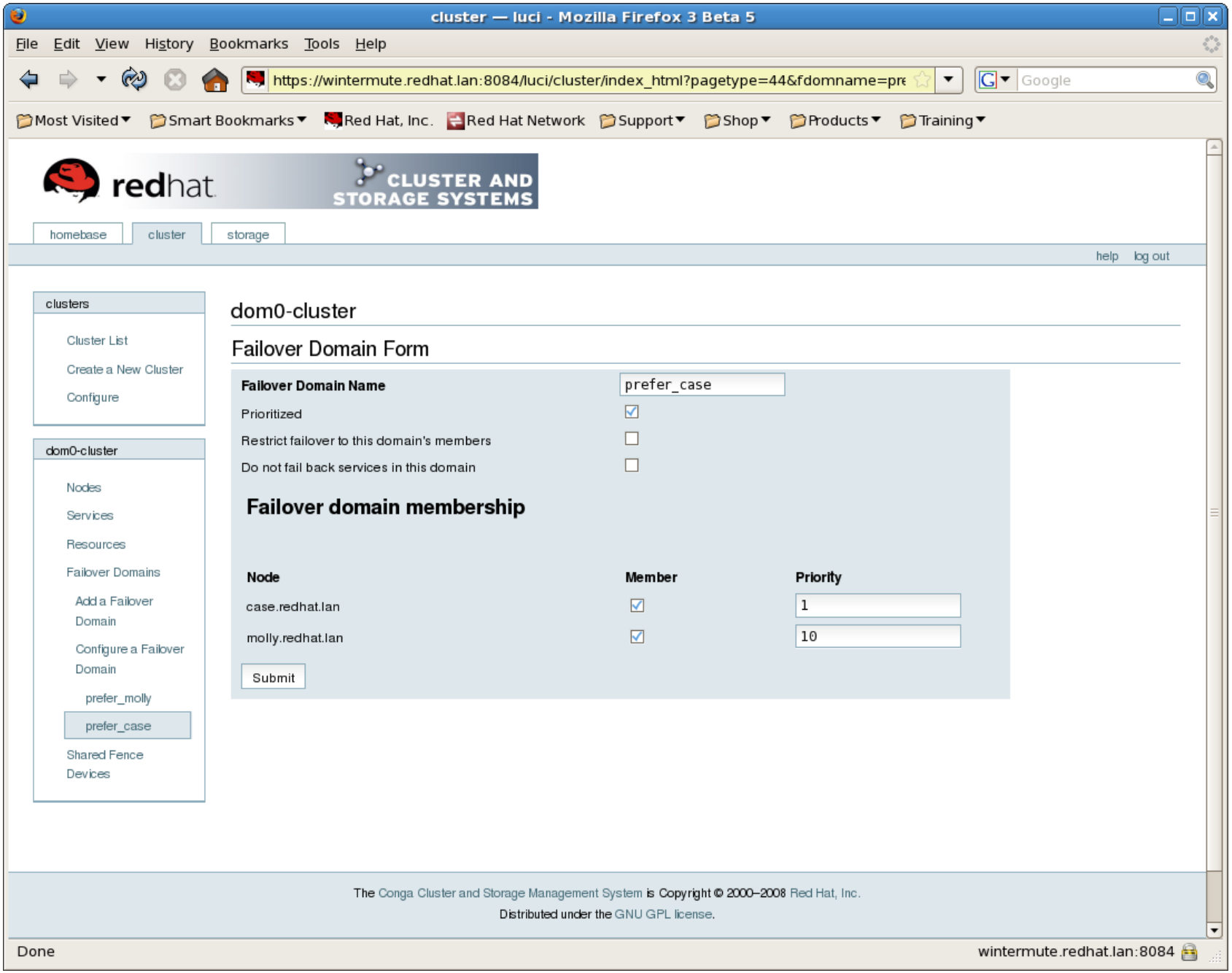
Done
wintermute.redhat.lan:8084


cluster — luci - Mozilla Firefox 3 Beta 5
File Edit View History Bookmarks Tools Help
https://wintermute.redhat.lan:8084/luci/cluster/index_html?pagetype=44&fdomname=pre
Google
Most Visited
Smart Bookmarks
Red Hat, Inc.
Red Hat Network
Support
Shop
Products
Training
redhat
CLUSTER AND STORAGE SYSTEMS
homebase
cluster
storage
help
log out
clusters
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Add a Failover Domain
Configure a Failover Domain
prefer_molly
prefer_case
Shared Fence Devices
dom0-cluster
Failover Domain Form
Failover Domain Name
prefer_case
Prioritized
Restrict failover to this domain's members
Do not fail back services in this domain
Failover domain membership
Node
Member
Priority
case.redhat.lan
1
molly.redhat.lan
10
Submit
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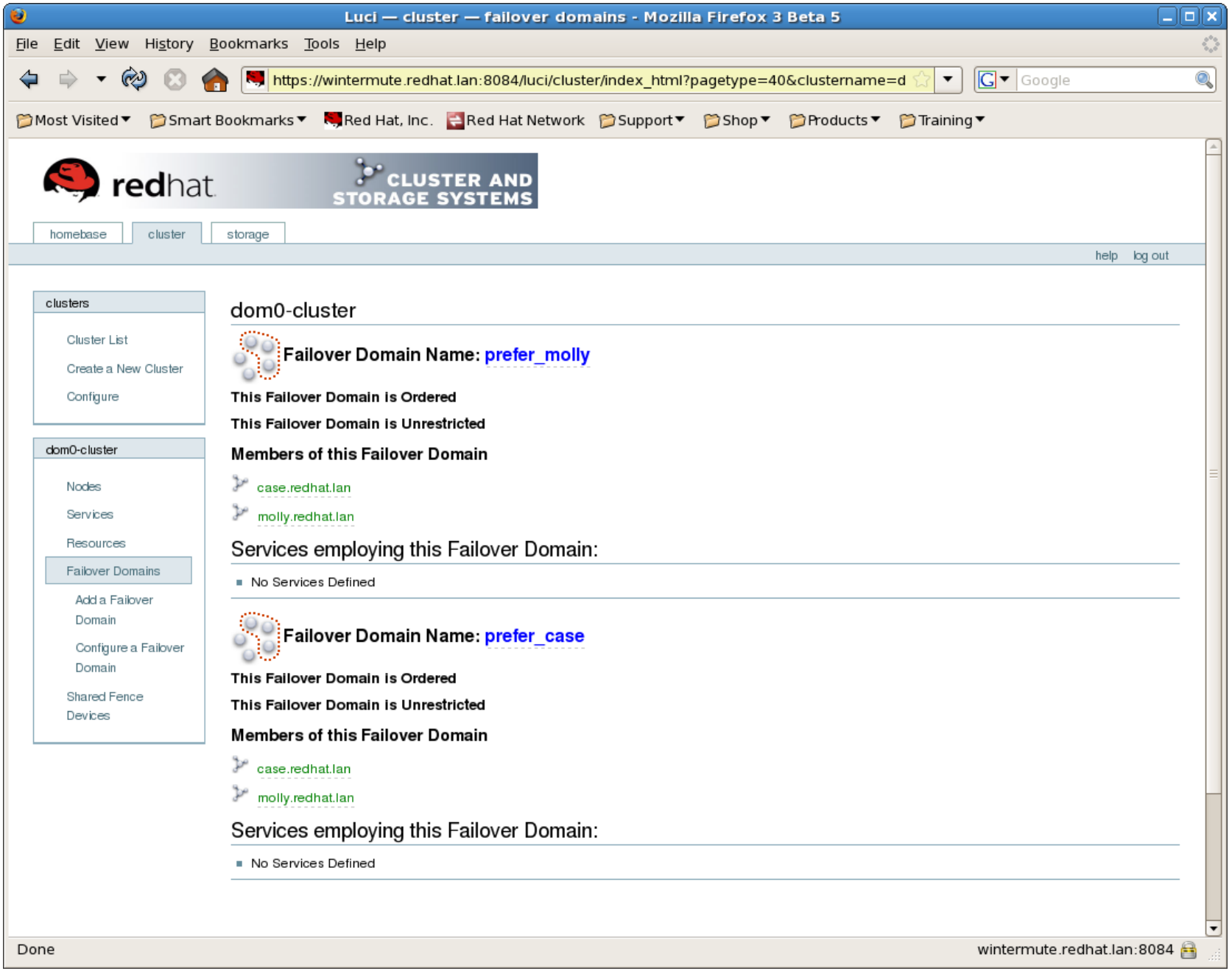
Distributed under the GNU GPL license.
Done
wintermute.redhat.lan:8084


Luci — cluster — failover domains - Mozilla Firefox 3 Beta 5
File Edit View History Bookmarks Tools Help
https://wintermute.redhat.lan:8084/luci/cluster/index_html?pagetype=40&clustername=d
Google
Most Visited
Smart Bookmarks
Red Hat, Inc.
Red Hat Network
Support
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redhat
CLUSTER AND STORAGE SYSTEMS
homebase
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storage
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log out
clusters
Cluster List
Create a New Cluster
Configure
dom0-cluster
Nodes
Services
Resources
Failover Domains
Add a Failover Domain
Configure a Failover Domain
Shared Fence Devices
dom0-cluster
Failover Domain Name: prefer_molly
This Failover Domain is Ordered
This Failover Domain is Unrestricted
Members of this Failover Domain
case.redhat.lan
molly.redhat.lan
Services employing this Failover Domain:
No Services Defined
Failover Domain Name: prefer_case
This Failover Domain is Ordered
This Failover Domain is Unrestricted
Members of this Failover Domain
case.redhat.lan
molly.redhat.lan
Services employing this Failover Domain:
No Services Defined
Done
wintermute.redhat.lan:8084

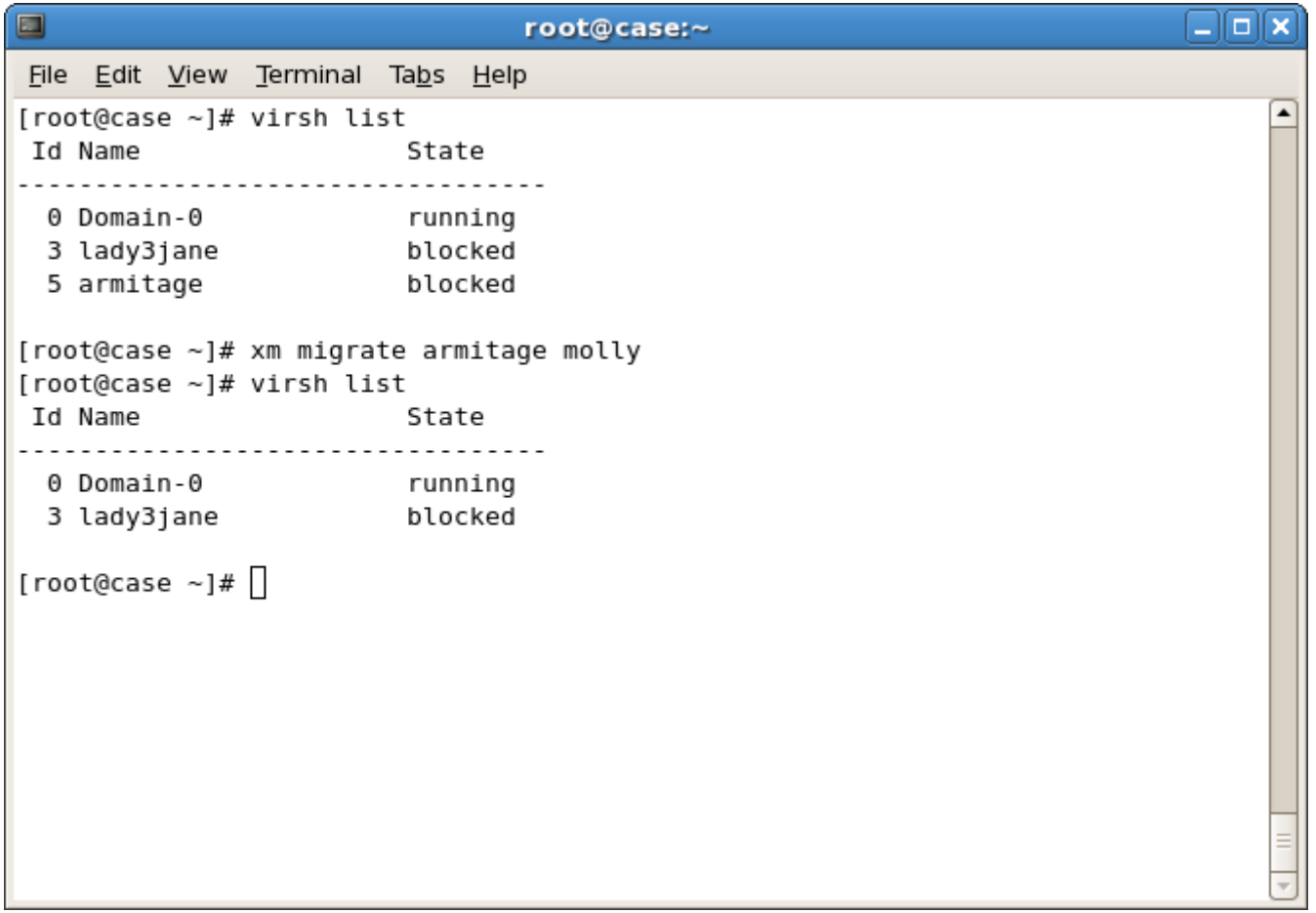
Create the domU Cluster

- Enable live migration by setting the following three settings in `/etc/xen/xend-config.sxp`:
  - `(xend-relocation-server yes)`
  - `(xend-relocation-port 8002)`
  - `(xend-relocation-address '')`
- The `''` in xend-relocation-address is two single quotes, not a double quote
- Be aware of the security implications of having this wide open, you can also specify a space separated list of regular expressions for hostnames or ip addresses
- Restart the xend service

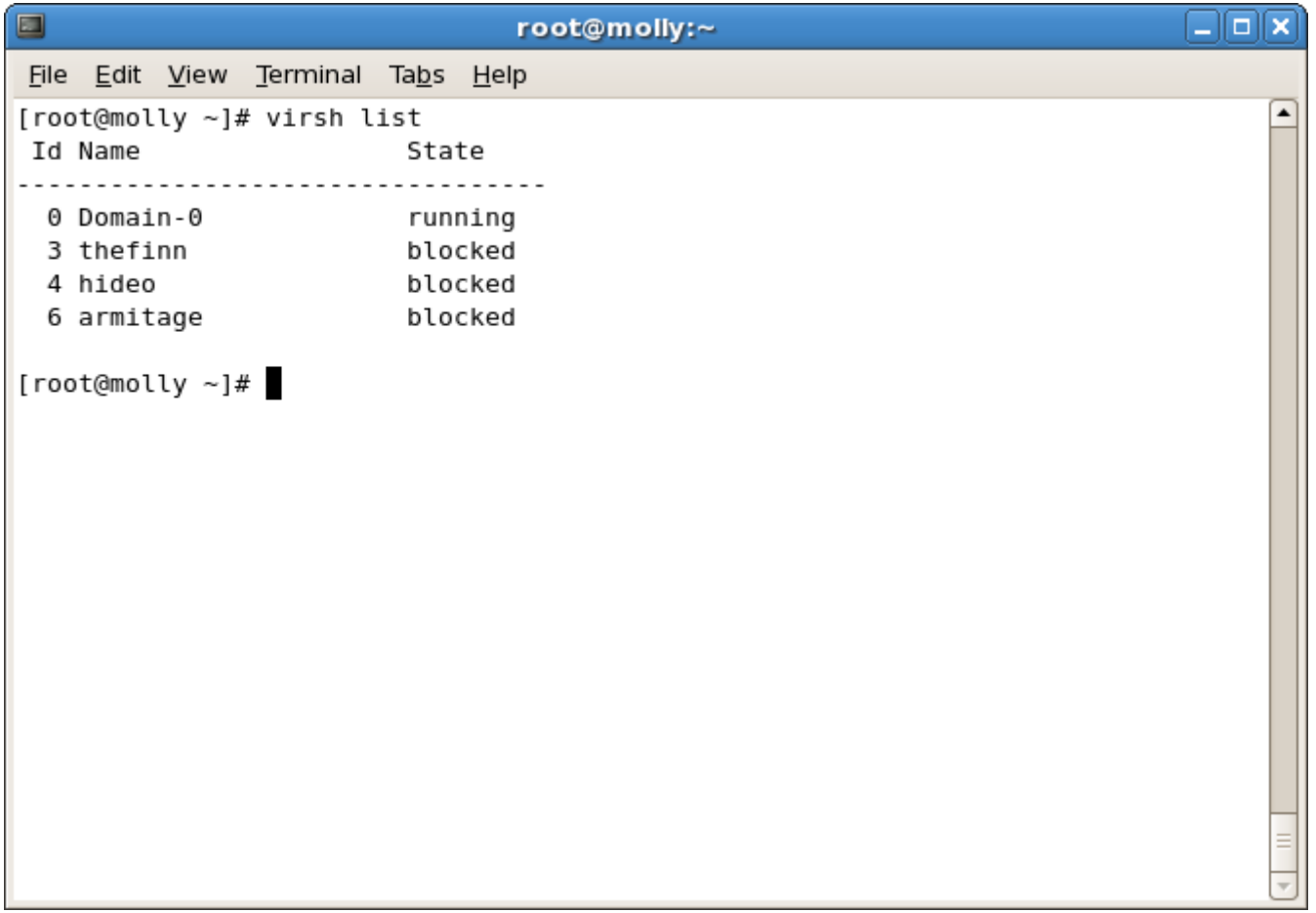
Create the domU Cluster

- Test live migration.
- From case, issue the command:
  - `xm migrate -l armitage molly`

Create the domU Cluster

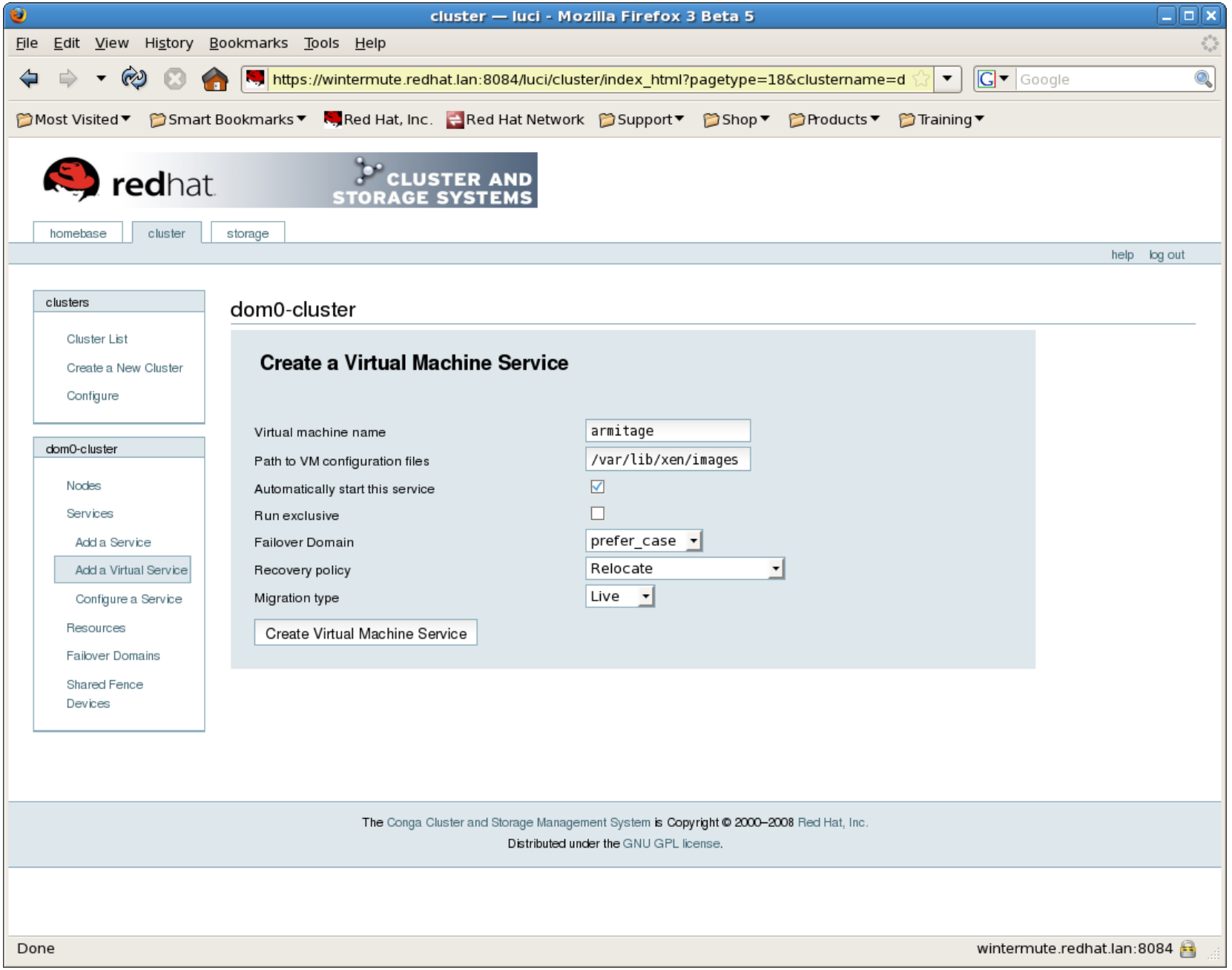


Create the domU Cluster



Define the domUs as cluster resources

- Define the domUs as resources for the dom0 to which they are assigned
- Choose the cluster, then “Services,” then “Add a Virtual Service.”
  - Name of domU
  - Path to config
  - Automatically start
  - Failover domain
  - Recovery policy
  - Migration type
- Do this for all domUs


cluster — luci - Mozilla Firefox 3 Beta 5
File Edit View History Bookmarks Tools Help
https://wintermute.redhat.lan:8084/luci/cluster/index_html?pagetype=18&clustername=d
Google
Most Visited
Smart Bookmarks
Red Hat, Inc.
Red Hat Network
Support
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CLUSTER AND STORAGE SYSTEMS
homebase
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Cluster List
Create a New Cluster
Configure
dom0-cluster
Nodes
Services
Add a Service
Add a Virtual Service
Configure a Service
Resources
Failover Domains
Shared Fence Devices
dom0-cluster
Create a Virtual Machine Service
Virtual machine name
armitage
Path to VM configuration files
/var/lib/xen/images
Automatically start this service
Run exclusive
Failover Domain
prefer_case
Recovery policy
Relocate
Migration type
Live
Create Virtual Machine Service
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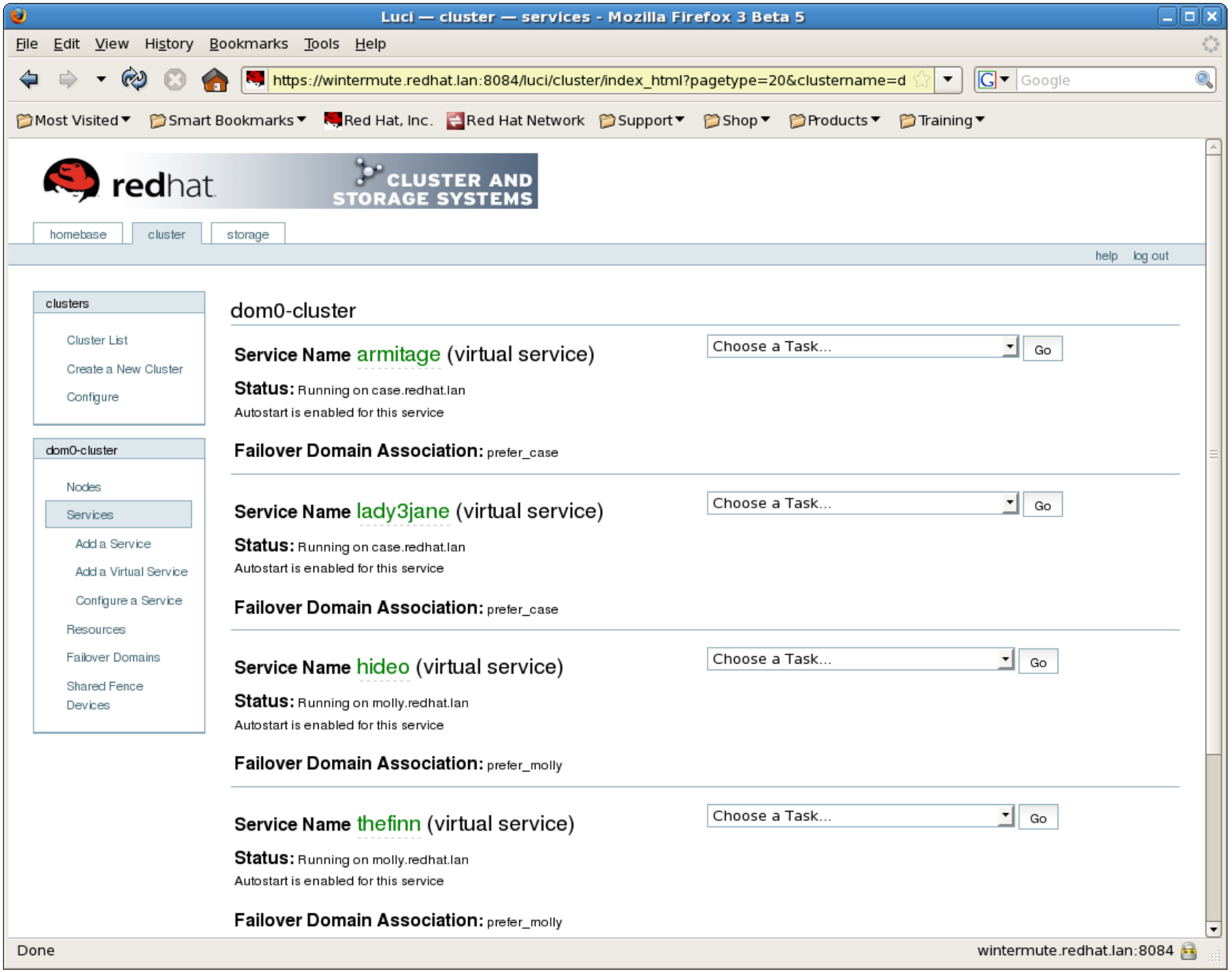
Done
wintermute.redhat.lan:8084


Luci — cluster — services - Mozilla Firefox 3 Beta 5
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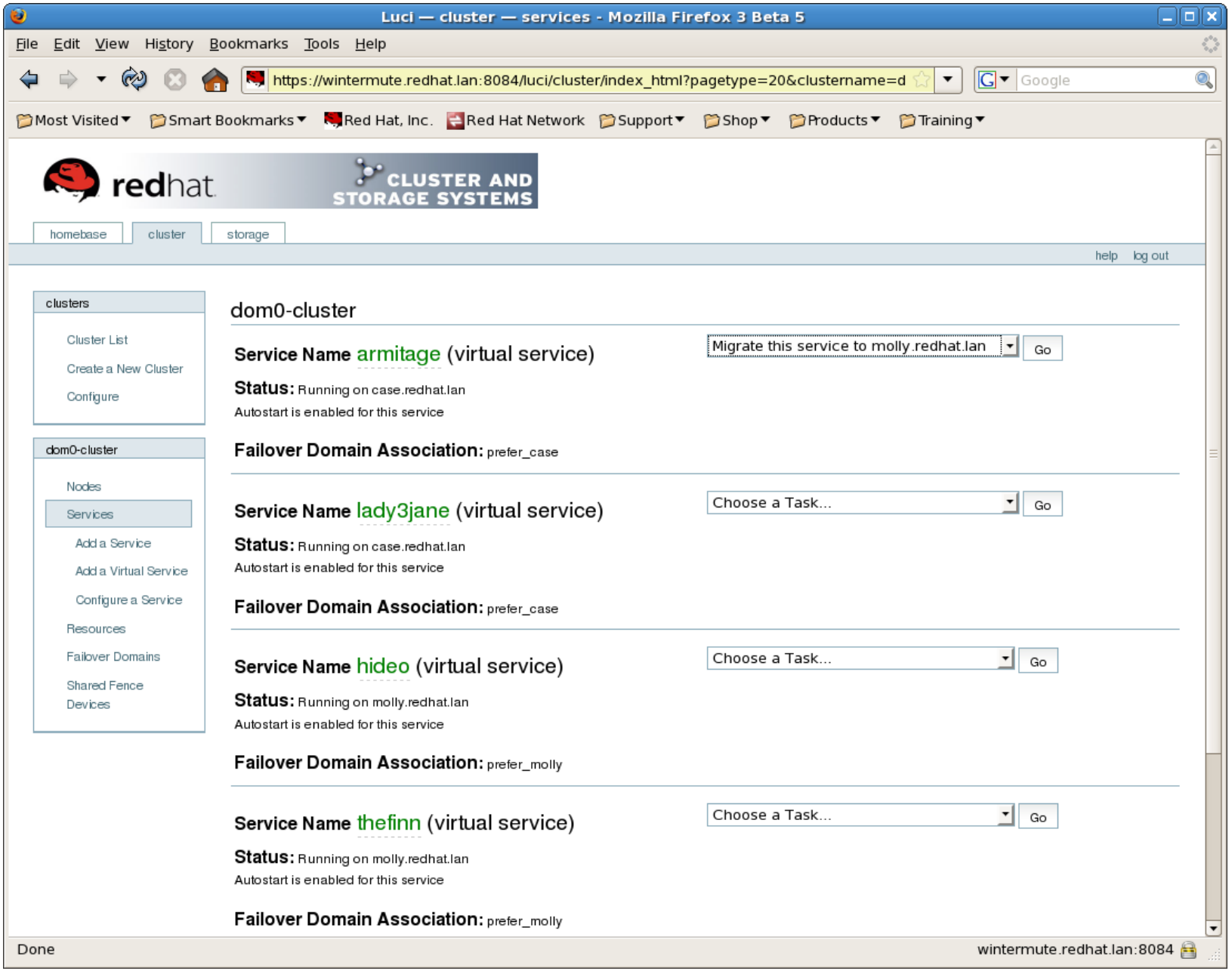
homebase
cluster
storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
dom0-cluster
Nodes
Services
Add a Service
Add a Virtual Service
Configure a Service
Resources
Failover Domains
Shared Fence Devices
dom0-cluster
Service Name armitage (virtual service)
Choose a Task...
Go
Status: Running on case.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_case
Service Name lady3jane (virtual service)
Choose a Task...
Go
Status: Running on case.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_case
Service Name hideo (virtual service)
Choose a Task...
Go
Status: Running on molly.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_molly
Service Name thefinn (virtual service)
Choose a Task...
Go
Status: Running on molly.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_molly
Done
wintermute.redhat.lan:8084

Define the domUs as cluster resources

- Test that Conga will migrate a domU to a different dom0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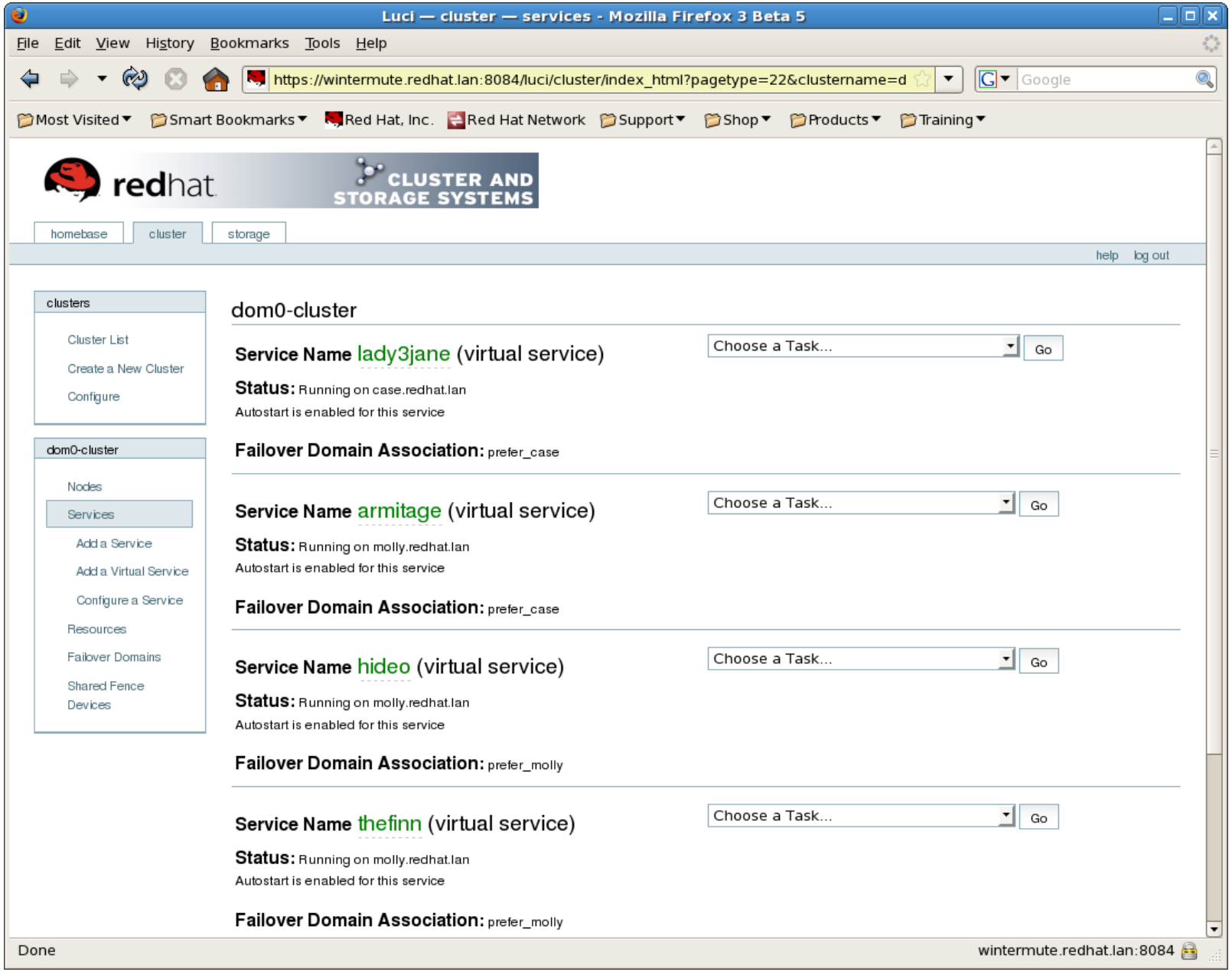
clusters
Cluster List
Create a New Cluster
Configure
dom0-cluster
Nodes
Services
Add a Service
Add a Virtual Service
Configure a Service
Resources
Failover Domains
Shared Fence Devices
dom0-cluster
Service Name armitage (virtual service)
Migrate this service to molly.redhat.lan
Go
Status: Running on case.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_case
Service Name lady3jane (virtual service)
Choose a Task...
Go
Status: Running on case.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_case
Service Name hideo (virtual service)
Choose a Task...
Go
Status: Running on molly.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_molly
Service Name thefinn (virtual service)
Choose a Task...
Go
Status: Running on molly.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_molly
Done
wintermute.redhat.lan:8084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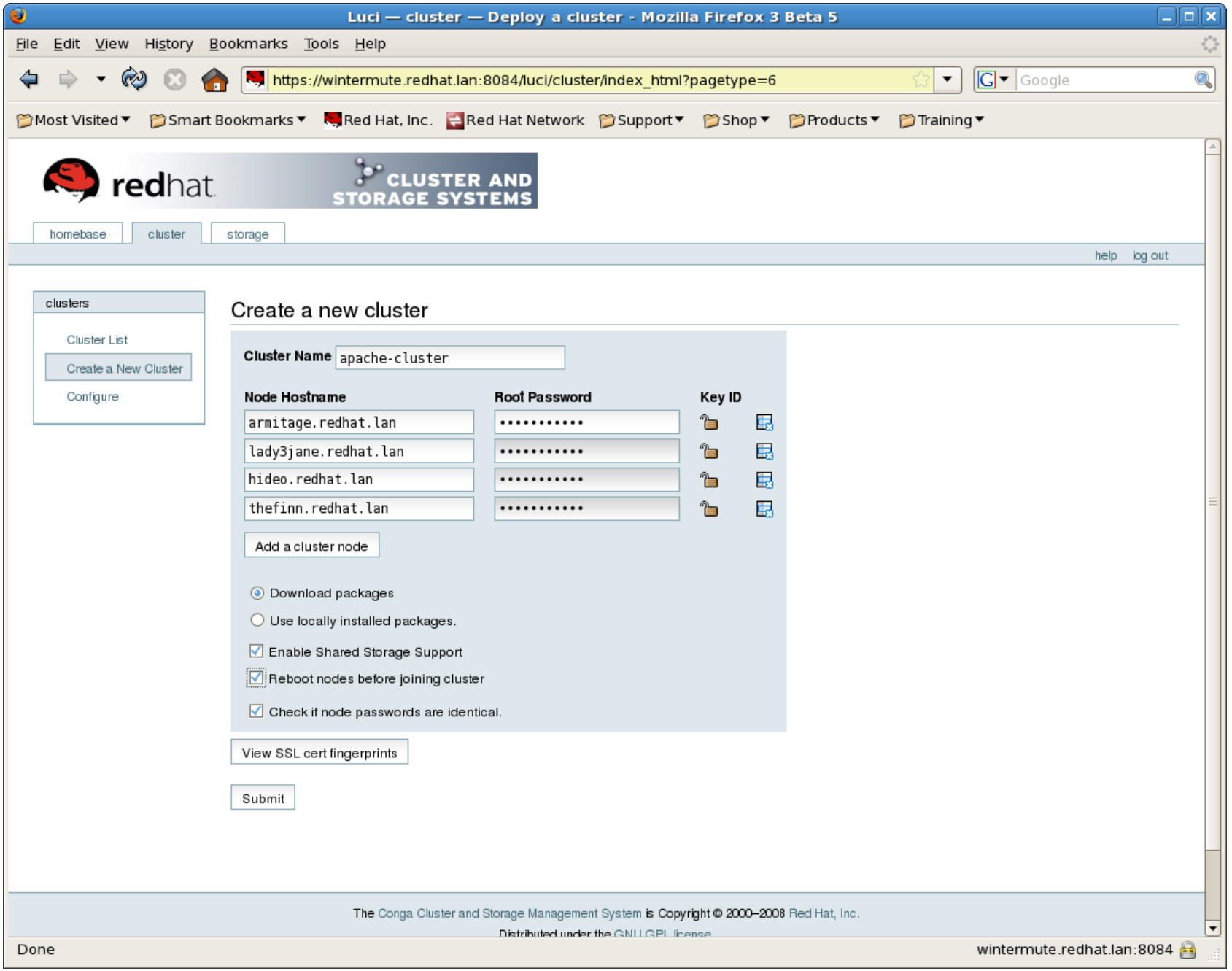
storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
dom0-cluster
Nodes
Services
Add a Service
Add a Virtual Service
Configure a Service
Resources
Failover Domains
Shared Fence Devices
dom0-cluster
Service Name lady3jane (virtual service)
Choose a Task...
Go
Status: Running on case.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_case
Service Name armitage (virtual service)
Choose a Task...
Go
Status: Running on molly.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_case
Service Name hideo (virtual service)
Choose a Task...
Go
Status: Running on molly.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_molly
Service Name thefinn (virtual service)
Choose a Task...
Go
Status: Running on molly.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_molly
Done
wintermute.redhat.lan:8084

Set up the Apache cluster

- Using similar steps as the dom0 cluster, set up a cluster of domUs
- Set up a prioritized failover domain which sets the service to prefer armitage, then hideo, then lady3jane, then thefinn


Luci — cluster — Deploy a cluster - Mozilla Firefox 3 Beta 5
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storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
Create a new cluster
Cluster Name
apache-cluster
Node Hostname
Root Password
Key ID
armitage.redhat.lan
lady3jane.redhat.lan
hideo.redhat.lan
thefinn.redhat.lan
Add a cluster node
Download packages
Use locally installed packages.
Enable Shared Storage Support
Reboot nodes before joining cluster
Check if node passwords are identical.
View SSL cert fingerprints
Submit
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Done
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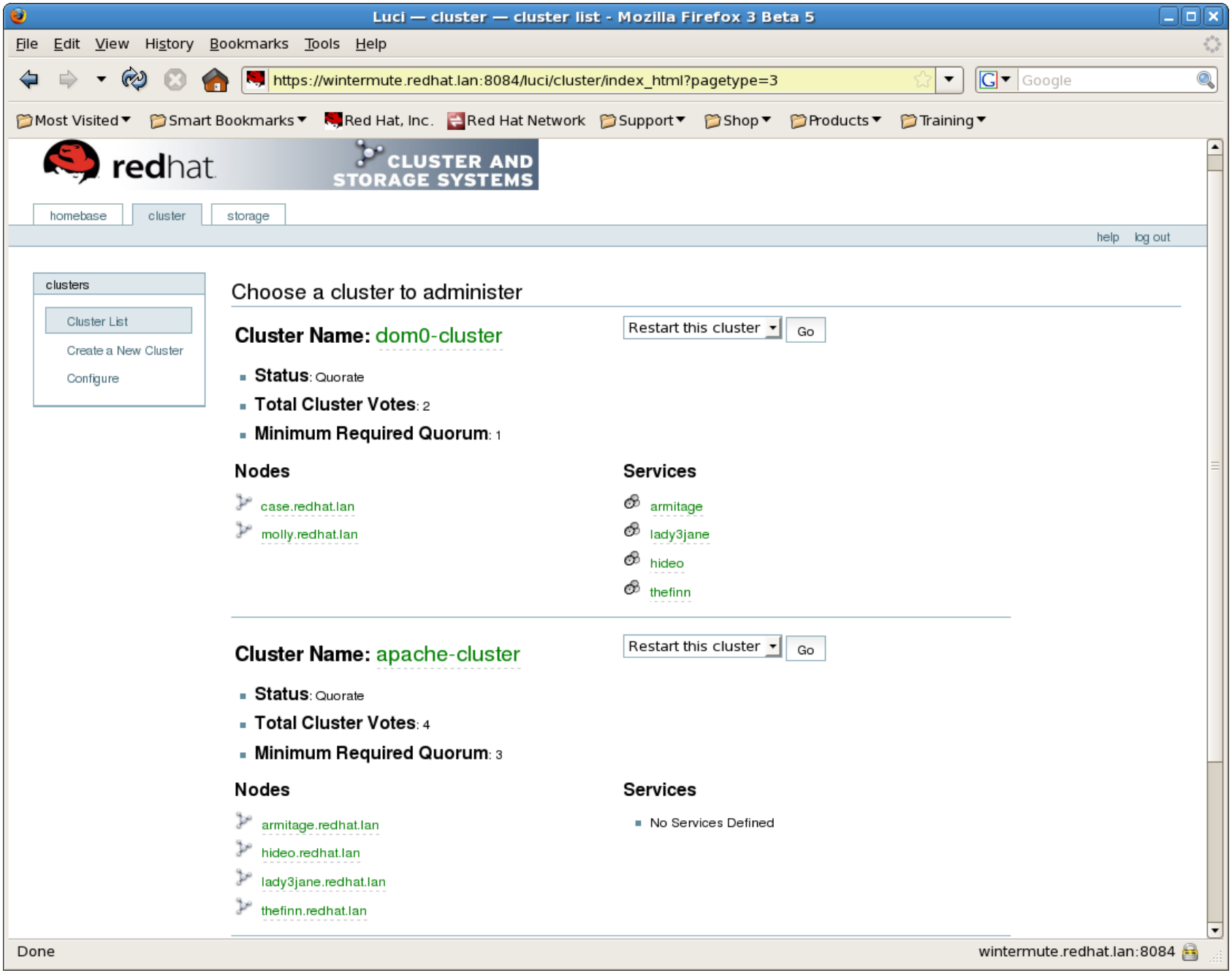
Luci — cluster — cluster list - Mozilla Firefox 3 Beta 5
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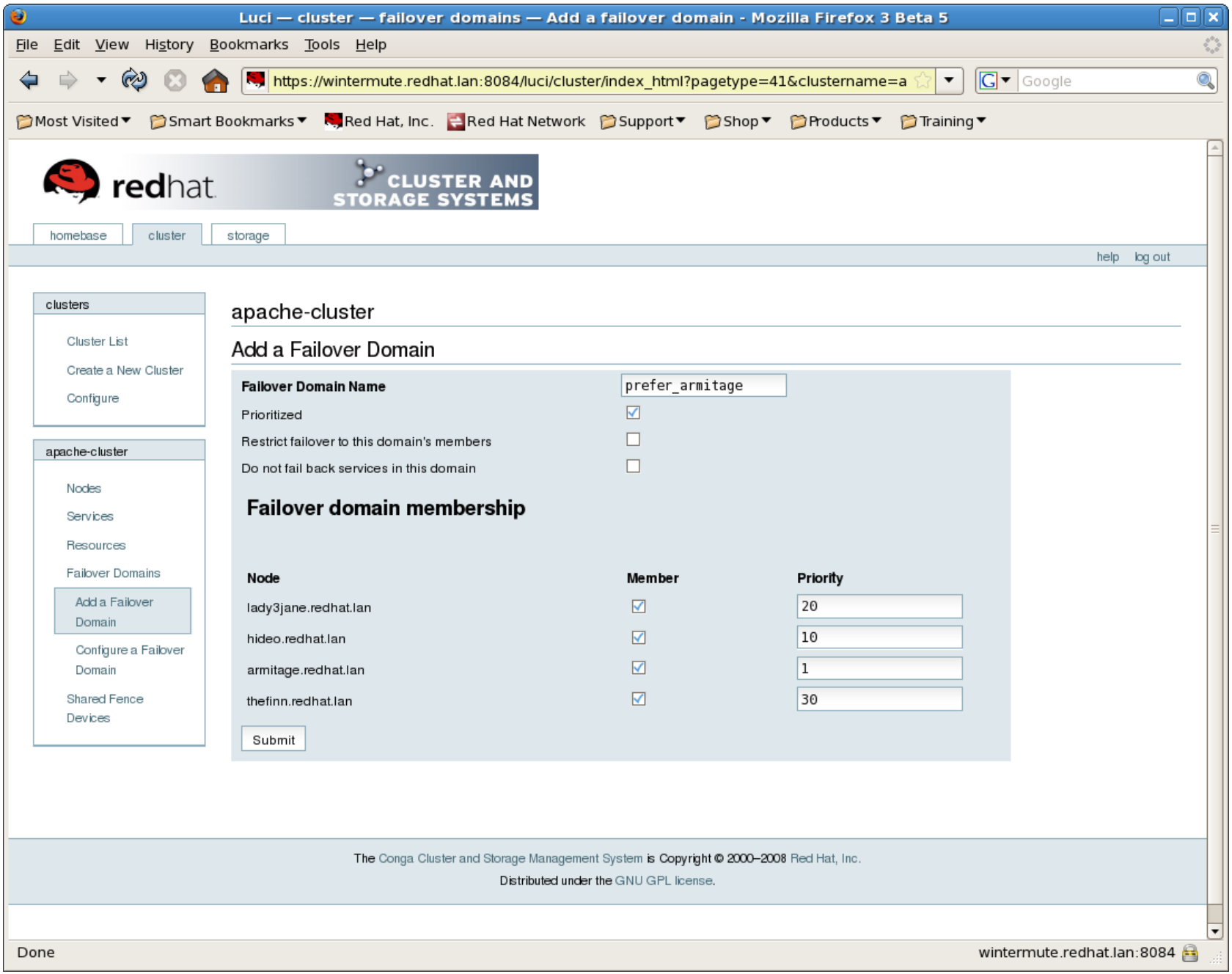
help log out
clusters
Cluster List
Create a New Cluster
Configure
Choose a cluster to administer
Cluster Name: dom0-cluster
Restart this cluster Go
Status: Quorate
Total Cluster Votes: 2
Minimum Required Quorum: 1
Nodes
case.redhat.lan
molly.redhat.lan
Services
armitage
lady3jane
hideo
thefinn
Cluster Name: apache-cluster
Restart this cluster Go
Status: Quorate
Total Cluster Votes: 4
Minimum Required Quorum: 3
Nodes
armitage.redhat.lan
hideo.redhat.lan
lady3jane.redhat.lan
thefinn.redhat.lan
Services
No Services Defined
Done
wintermute.redhat.lan:8084


Luci — cluster — failover domains — Add a failover domain - Mozilla Firefox 3 Beta 5
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Cluster List
Create a New Cluster
Configure
apache-cluster
Nodes
Services
Resources
Failover Domains
Add a Failover Domain
Configure a Failover Domain
Shared Fence Devices
apache-cluster
Add a Failover Domain
Failover Domain Name
prefer_armitage
Prioritized
Restrict failover to this domain's members
Do not fail back services in this domain
Failover domain membership
Node
Member
Priority
lady3jane.redhat.lan
20
hideo.redhat.lan
10
armitage.redhat.lan
1
thefinn.redhat.lan
30
Submit
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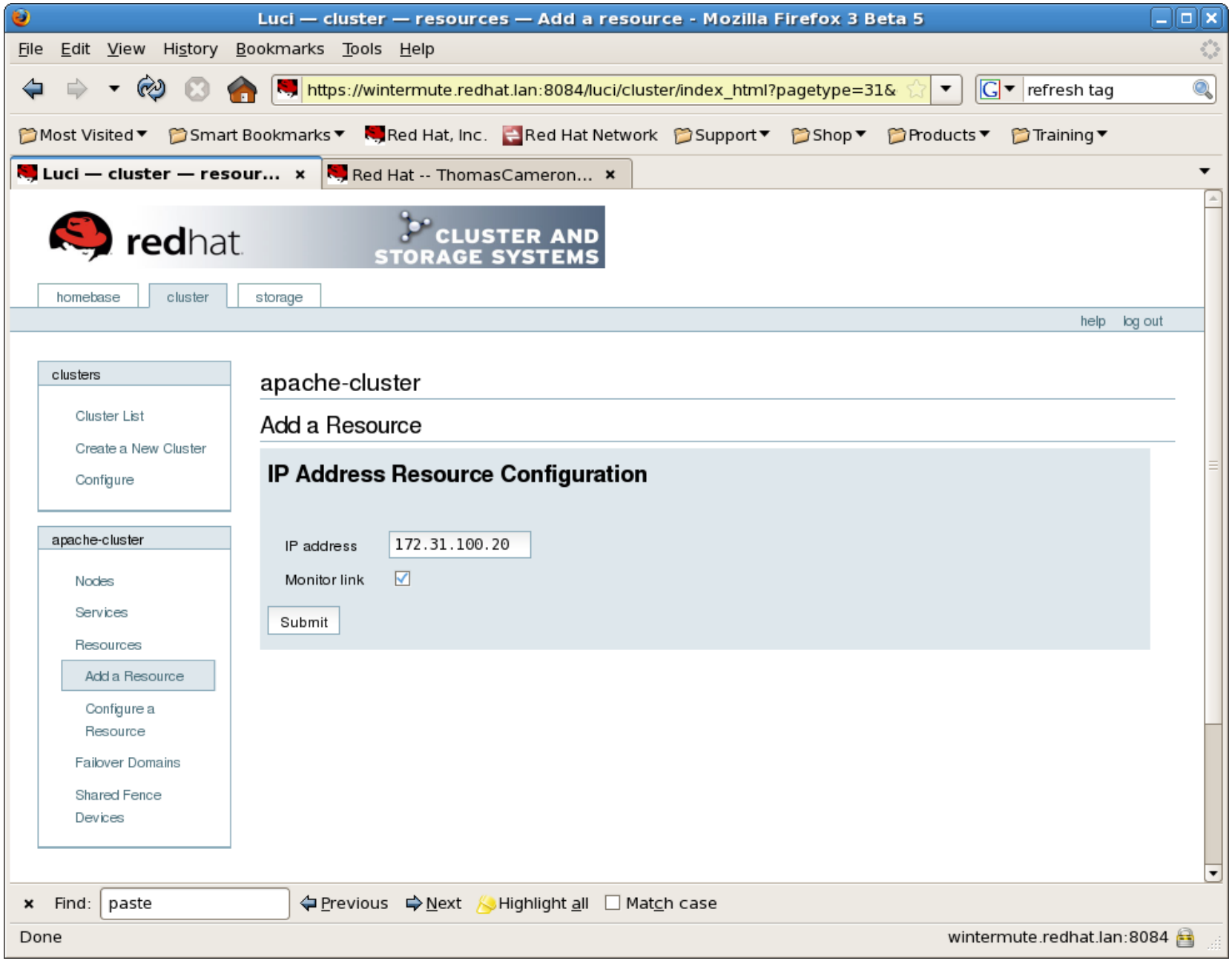
Set up the Apache cluster

- Define the following resources in apache-cluster
  - A script resource
    - `/etc/rc.d/init.d/httpd`
  - An ip address resource
    - `172.31.100.20`


Luci — cluster — resources — Add a resource - Mozilla Firefox 3 Beta 5
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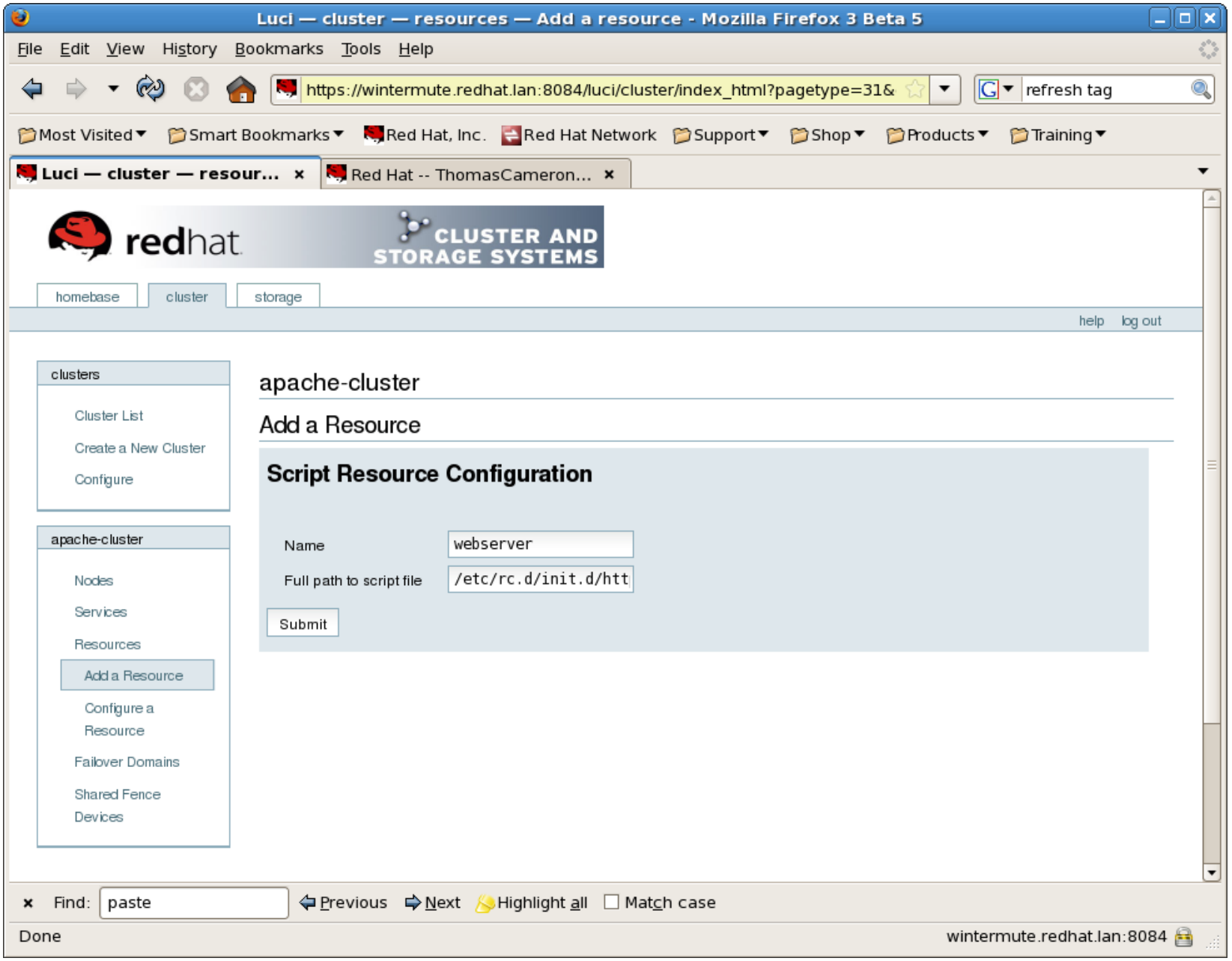
help log out
clusters
Cluster List
Create a New Cluster
Configure
apache-cluster
Nodes
Services
Resources
Add a Resource
Configure a Resource
Failover Domains
Shared Fence Devices
apache-cluster
Add a Resource
IP Address Resource Configuration
IP address 172.31.100.20
Monitor link
Submit
Find: paste
Previous Next Highlight all Match case
Done
wintermute.redhat.lan:8084


Luci — cluster — resources — Add a resource - Mozilla Firefox 3 Beta 5
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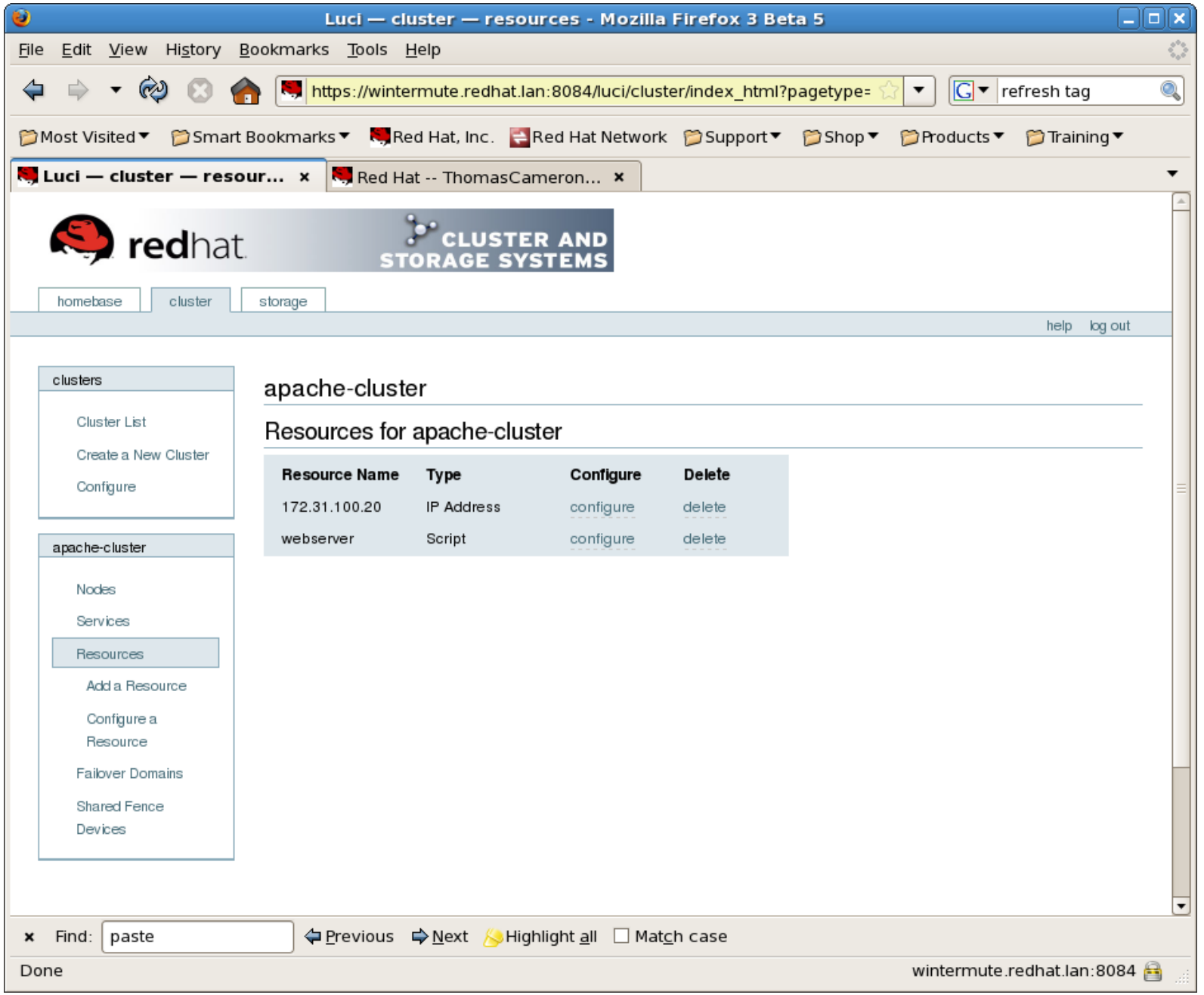
cluster
storage
help
log out
clusters
Cluster List
Create a New Cluster
Configure
apache-cluster
Nodes
Services
Resources
Add a Resource
Configure a Resource
Failover Domains
Shared Fence Devices
apache-cluster
Add a Resource
Script Resource Configuration
Name
webserver
Full path to script file
/etc/rc.d/init.d/htt
Submit
Find:
paste
Previous
Next
Highlight all
Match case
Done
wintermute.redhat.lan:8084


Luci — cluster — resources - Mozilla Firefox 3 Beta 5
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help
log out
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Cluster List
Create a New Cluster
Configure
apache-cluster
Nodes
Services
Resources
Add a Resource
Configure a Resource
Failover Domains
Shared Fence Devices
apache-cluster
Resources for apache-cluster
Resource Name
Type
Configure
Delete
172.31.100.20
IP Address
configure
delete
webserver
Script
configure
delete
Find: paste
Previous
Next
Highlight all
Match case
Done
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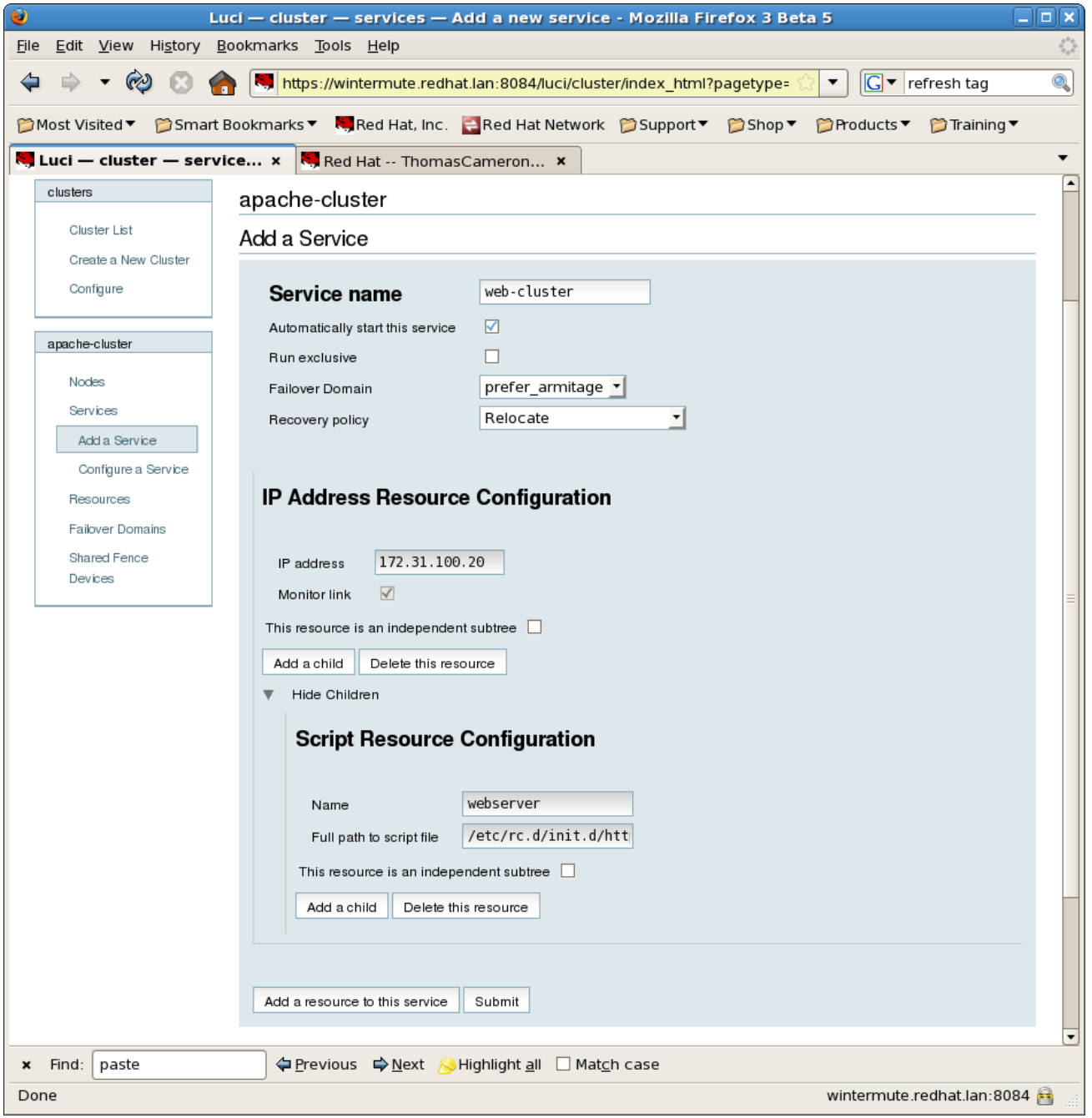
Set up the Apache cluster

- Assign those resources to a service
  - `web-cluster`
- The script resource should be a child of the ip address resource, as the ip address needs to be up before Apache will bind to it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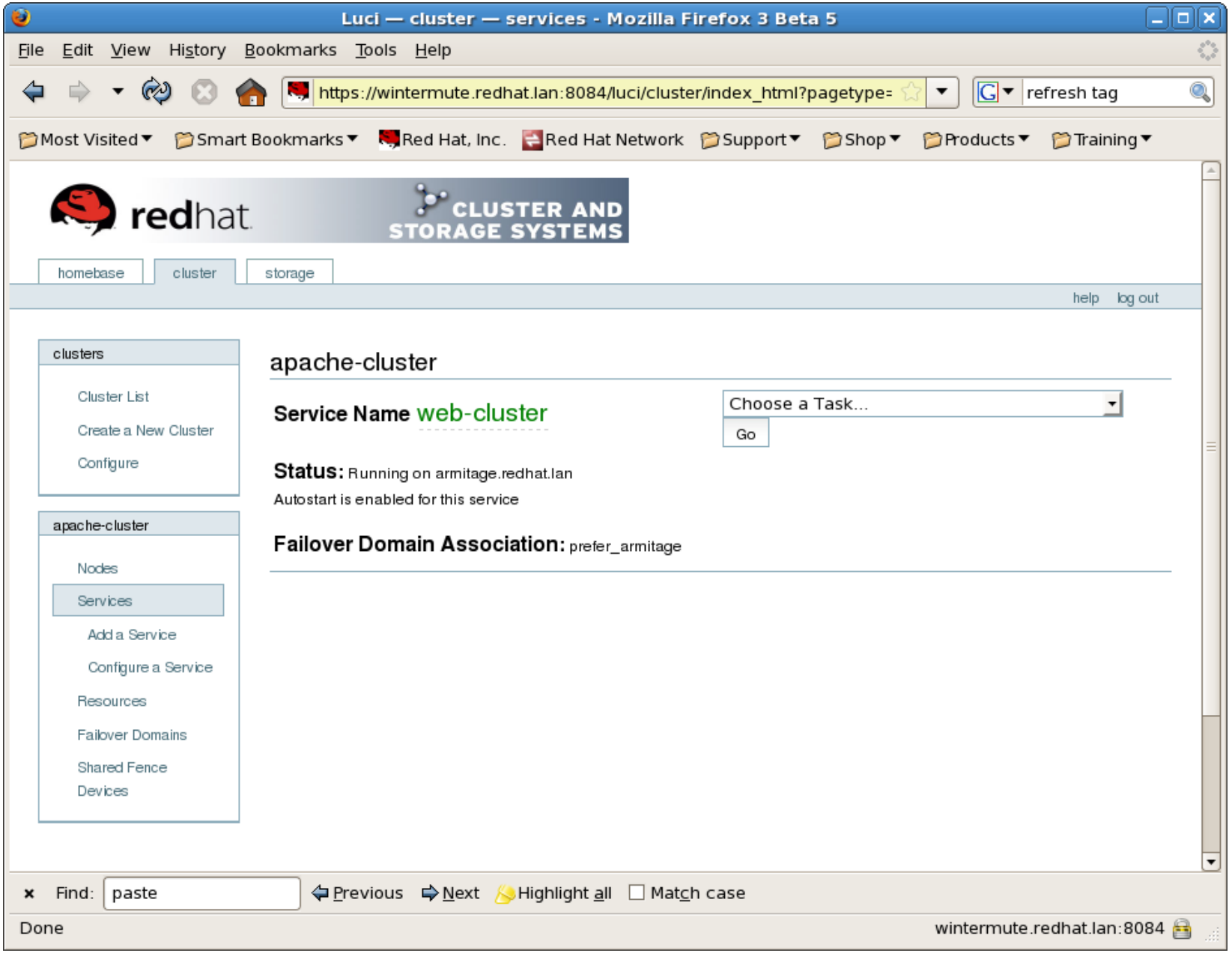
clusters
Cluster List
Create a New Cluster
Configure
apache-cluster
Nodes
Services
Add a Service
Configure a Service
Resources
Failover Domains
Shared Fence Devices
apache-cluster
Add a Service
Service name
web-cluster
Automatically start this service
Run exclusive
Failover Domain
prefer_armitage
Recovery policy
Relocate
IP Address Resource Configuration
IP address
172.31.100.20
Monitor link
This resource is an independent subtree
Add a child
Delete this resource
Hide Children
Script Resource Configuration
Name
webserver
Full path to script file
/etc/rc.d/init.d/htt
This resource is an independent subtree
Add a child
Delete this resource
Add a resource to this service
Submit
Find: paste
Previous
Next
Highlight all
Match case
Done
wintermute.redhat.lan:8084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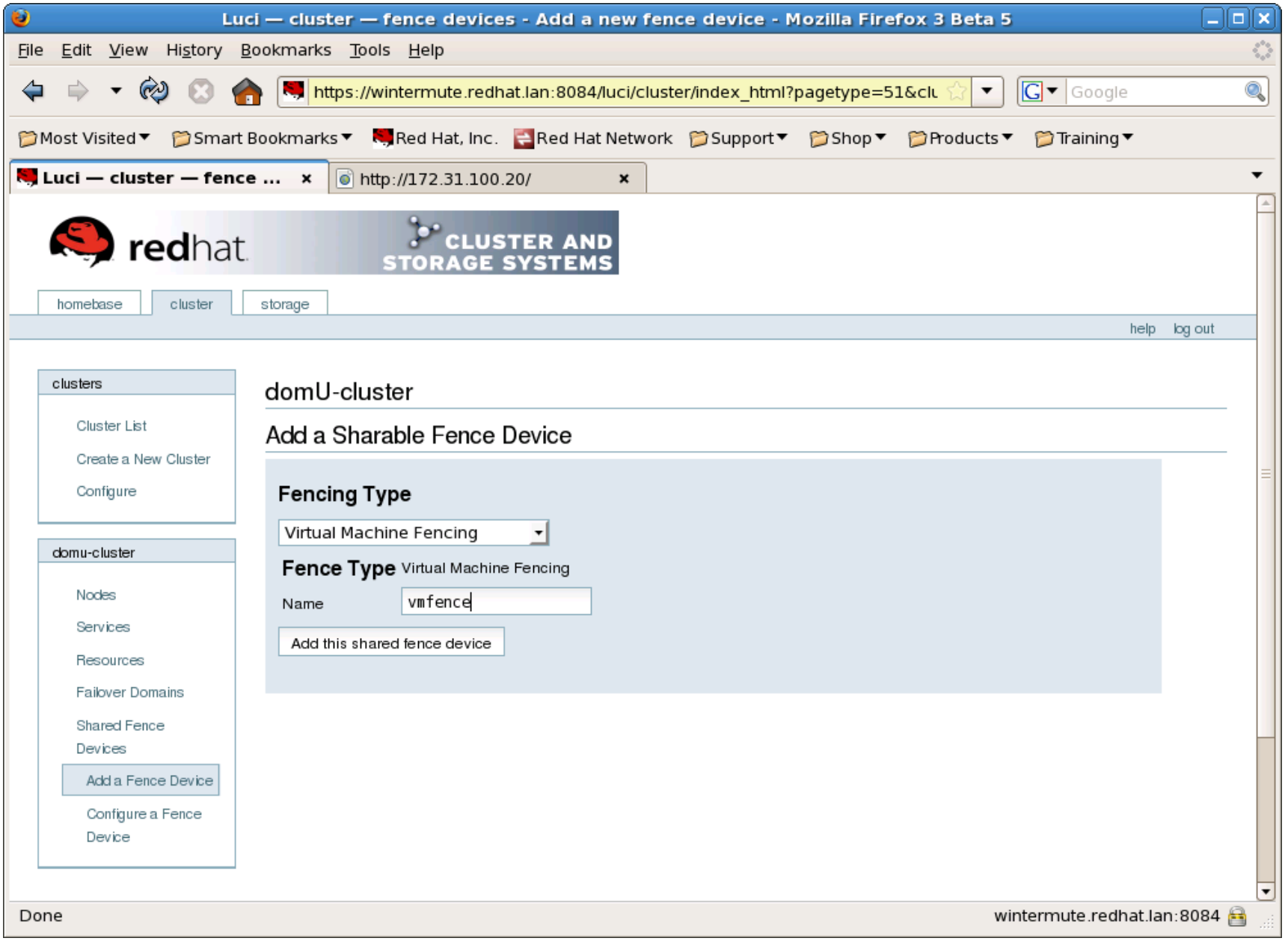
Cluster List
Create a New Cluster
Configure
apache-cluster
Nodes
Services
Add a Service
Configure a Service
Resources
Failover Domains
Shared Fence Devices
apache-cluster
Service Name web-cluster
Choose a Task...
Go
Status: Running on armitage.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_armitage
Find: paste
Previous
Next
Highlight all
Match case
Done
wintermute.redhat.lan:8084

Add a virtual fence device

- Go to the domU cluster
  - Shared fence devices
  - Add fence device
  - Virtual machine fencing
  - Choose a name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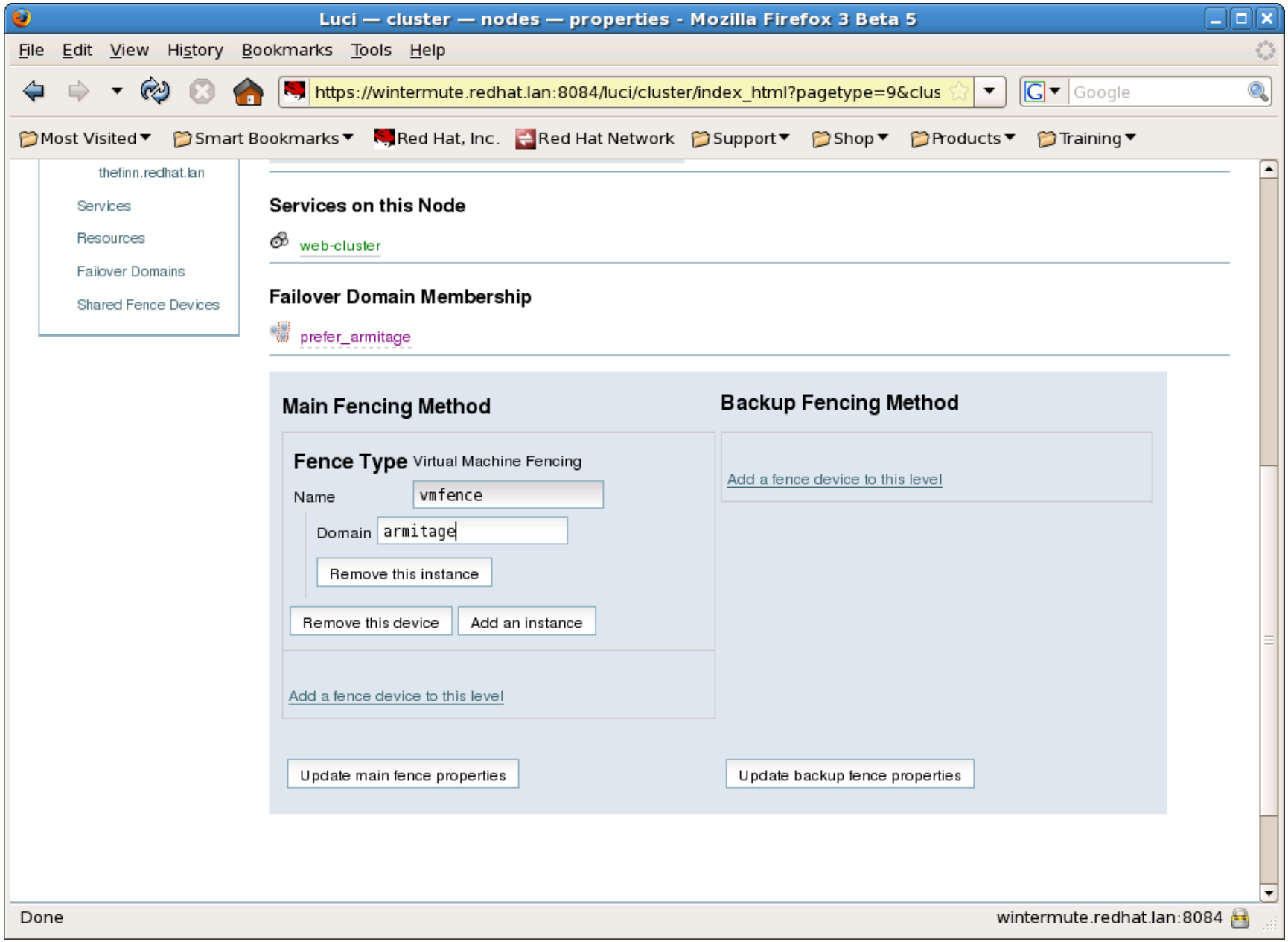
Cluster List
Create a New Cluster
Configure
domu-cluster
Nodes
Services
Resources
Failover Domains
Shared Fence Devices
Add a Fence Device
Configure a Fence Device
domU-cluster
Add a Sharable Fence Device
Fencing Type
Virtual Machine Fencing
Fence Type Virtual Machine Fencing
Name
vmfence
Add this shared fence device
Done
wintermute.redhat.lan:8084

Add a virtual fence device

- Go to a domU machine
- Fencing
- Add fence device to this level
- Select your fence device
- Type virtual domain name (domU name)
- Update main fence properties
- Repeat for each domU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thefinn.redhat.lan
Services
Resources
Failover Domains
Shared Fence Devices
Services on this Node
web-cluster
Failover Domain Membership
prefer_armitage
Main Fencing Method
Fence Type Virtual Machine Fencing
Name vmfence
Domain armitage
Remove this instance
Remove this device
Add an instance
Add a fence device to this level
Backup Fencing Method
Add a fence device to this level
Update main fence properties
Update backup fence properties
Done
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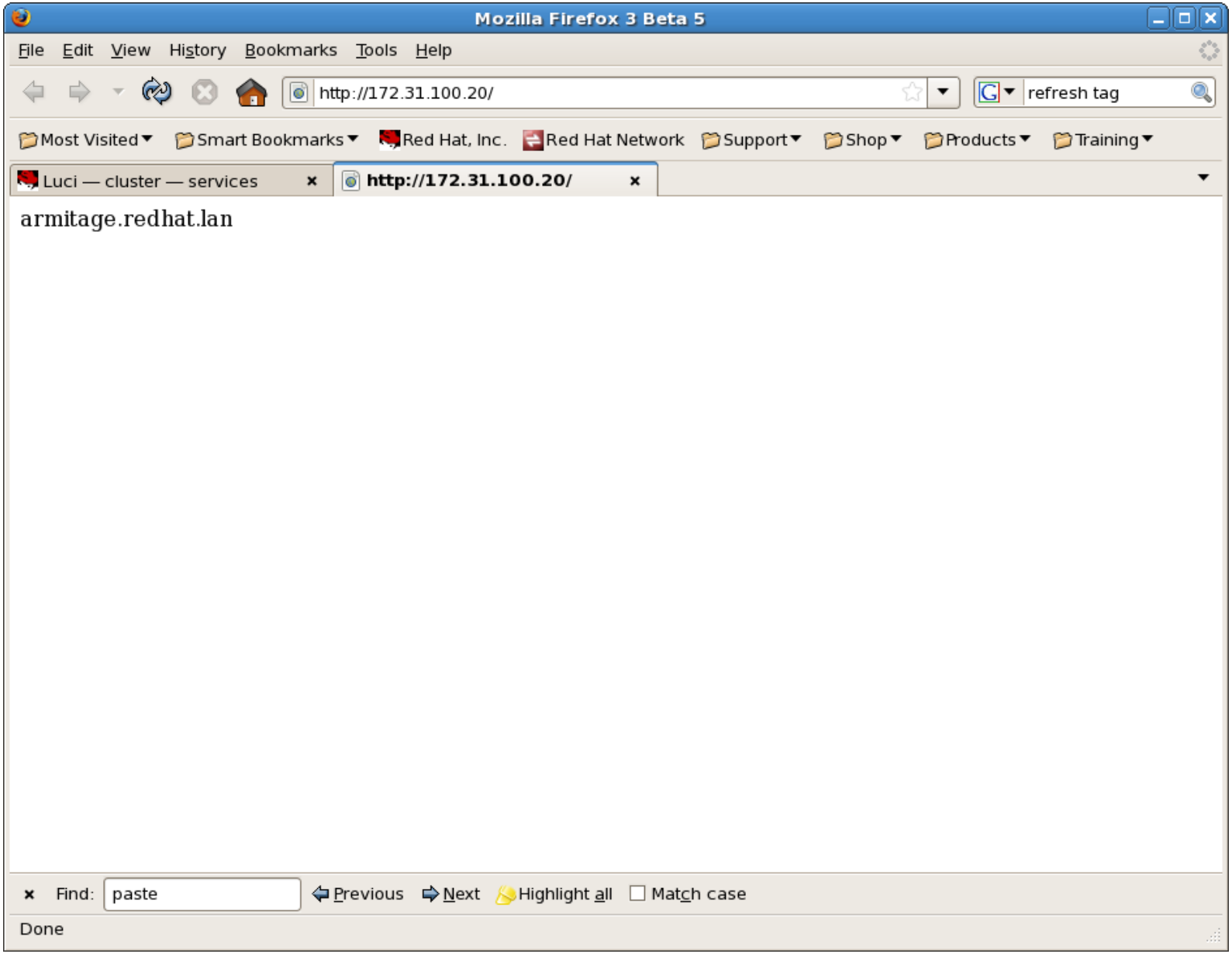
Set up the Apache cluster

- To test, you can do something simple like
  - `hostname > /var/www/html/index.html`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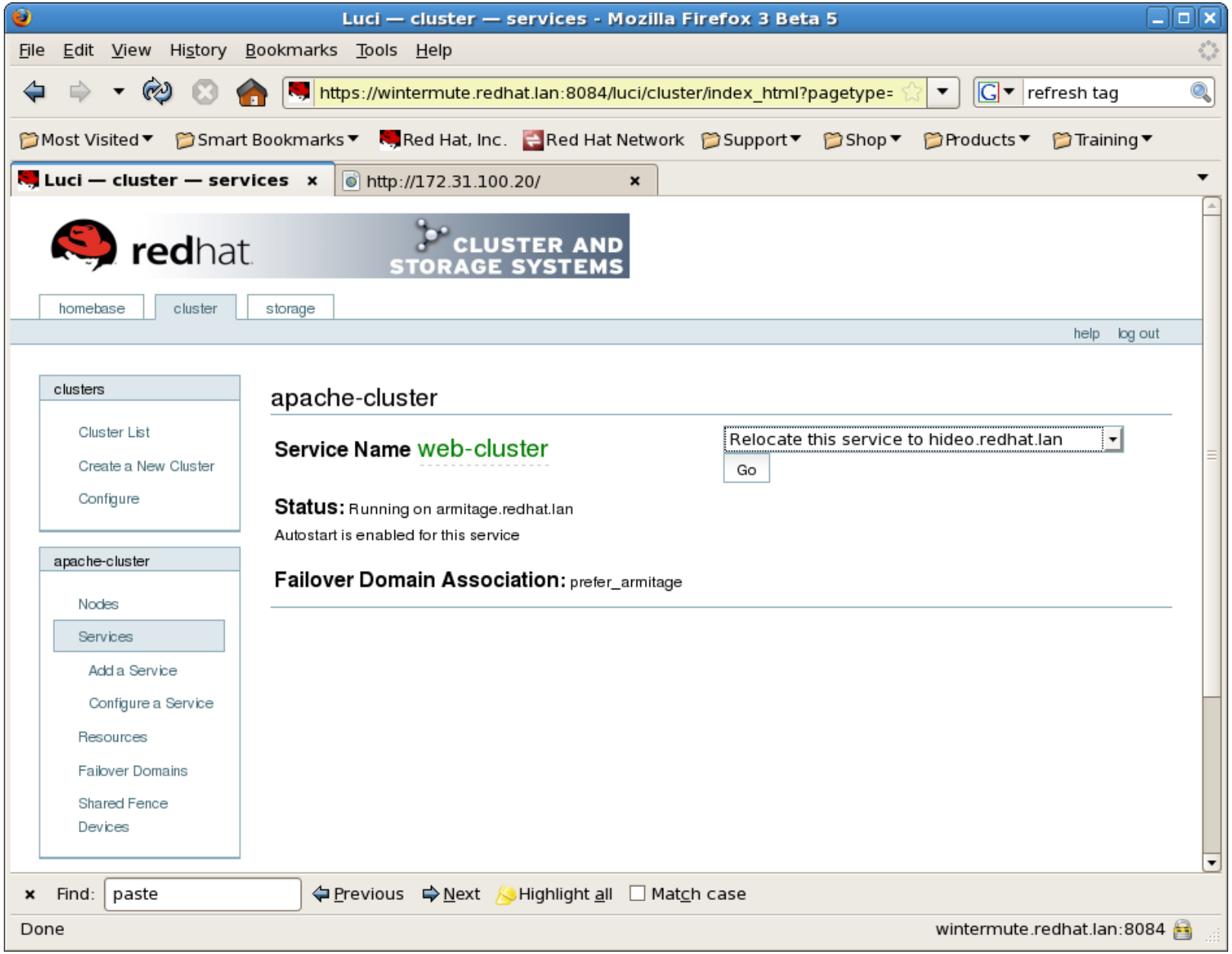
http://172.31.100.20/
armitage.redhat.lan
Find:
paste
Previous
Next
Highlight all
Match case
Done

Test the Apache cluster

- Fail the web-cluster service to another domU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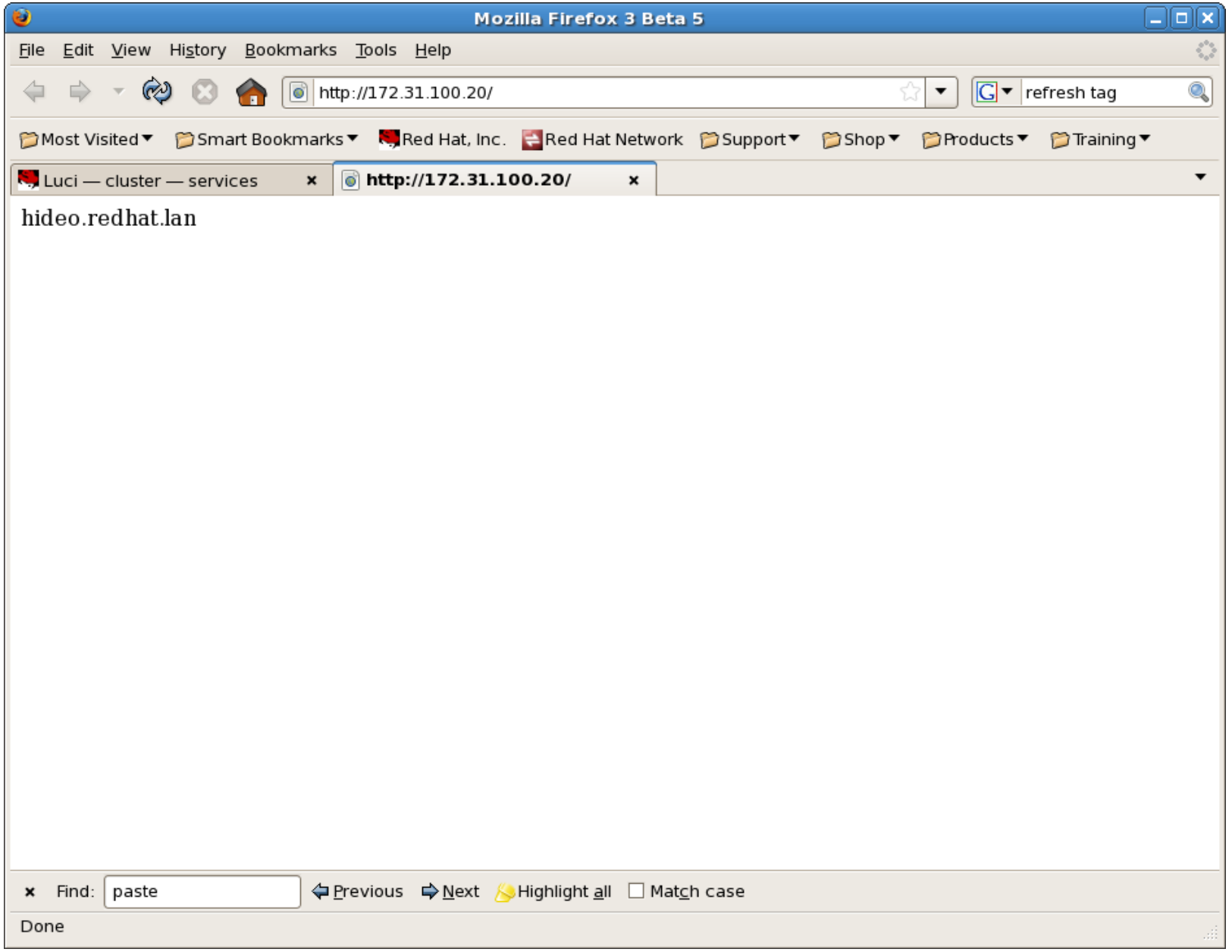
Cluster List
Create a New Cluster
Configure
apache-cluster
Nodes
Services
Add a Service
Configure a Service
Resources
Failover Domains
Shared Fence Devices
apache-cluster
Service Name web-cluster
Relocate this service to hideo.redhat.lan
Go
Status: Running on armitage.redhat.lan
Autostart is enabled for this service
Failover Domain Association: prefer_armitage
Find: paste
Previous
Next
Highlight all
Match case
Done
wintermute.redhat.lan:8084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Luci — cluster — services
http://172.31.100.20/
hideo.redhat.lan
Find: paste
Previous
Next
Highlight all
Match case
Done

Test the Apache cluster

- Or you can “kick the plug” out of the domU
  - `virsh destroy hideo`
  - `echo s > /proc/sysrq-trigger ; echo b > /proc/sysrq-trigger`

This presentation is available online at http://people.redhat.com/tcameron

- You can contact Thomas Cameron at tcameron@redhat.com
- You can contact Lon Hohberger at lhh@redhat.com

- Thank you very much for attending!

Questions?