

# Xen Roll: Users Guide



Version 5.3 Edition



**Xen Roll: Users Guide :**

Version 5.3 Edition

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# Preface

The Xen Roll installs and configures the VMs on Rocks Clusters.

A physical frontend can configure VMs on client nodes (*VM container* appliances). A VM container is a physical machine that houses and runs VMs.

The Xen Roll also supports building virtual clusters. The frontend can be installed as a *VM server* appliance and the client nodes can be installed as VM containers. Then a virtual frontend can be installed on the VM server while virtual compute nodes can be installed on the VM containers. All network traffic is encapsulated within a unique VLAN, that is, each virtual cluster has its own VLAN.

Please visit the xen site<sup>1</sup> to learn more about their release and the individual software components.

## Notes

1. <http://xen.org>

# Chapter 1. Overview

**Table 1-1. Summary**

Name	xen
Version	5.3
Maintained By	Rocks Group
Architecture	i386, x86_64
Compatible with Rocks™	5.3

**Table 1-2. Roll Compatibility**

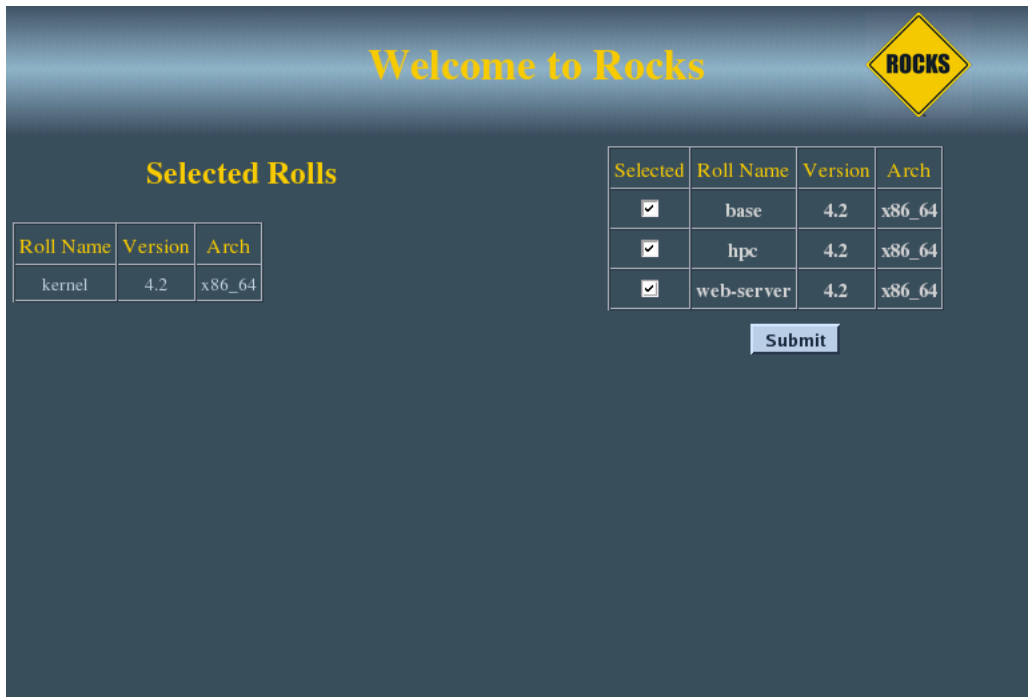
<b>Roll</b>	<b>Requires <sup>a</sup></b>	<b>Optional <sup>b</sup></b>	<b>Conflicts</b>
alpha		X	
area51		X	
base	X		
bio		X	
condor		X	
ganglia		X	
grid		X	
hpc		X	
java		X	
kernel	X		
os (disk 1)	X		
os (disk 2)	X		
os (disk 3)		X	
os (disk 4)		X	
os (disk 5)		X	
os (disk 6)		X	
os (disk 7)		X	
pbs		X	
service-pack		X	
sge		X	
viz		X	
web-server		X	
xen		X	

<b>Roll</b>	<b>Requires <sup>a</sup></b>	<b>Optional <sup>b</sup></b>	<b>Conflicts</b>
<p>Notes:</p> <p>a. You may also substitute your own OS CDs for the Rocks™ OS Roll CDs. In this case you must use all the CDs from your distribution and not use any of the Rocks™ OS Roll CDs.</p> <p>b. Only Rolls that have been verified as compatible with this Roll are listed. Other Rolls will likely work, but have not been tested by the maintainer of this Roll.</p>			

# Chapter 2. Installing

## 2.1. On a New Server

The xen Roll should be installed during the initial installation of your server (or cluster). This procedure is documented in section 1.2 of the Rocks™ usersguide. You should select the xen Roll from the list of available rolls when you see a screen that is similar to the one below.



The screenshot shows a dark blue background with the text "Welcome to Rocks" in yellow at the top center. To the right is a yellow diamond-shaped logo with the word "ROCKS" in black. Below the title, the heading "Selected Rolls" is displayed in yellow. There are two tables: a smaller one on the left and a larger one on the right. The larger table has four columns: "Selected", "Roll Name", "Version", and "Arch". It contains three rows, each with a checked checkbox, a roll name, the version "4.2", and the architecture "x86\_64". A "Submit" button is located below the larger table.

Roll Name	Version	Arch
kernel	4.2	x86_64

Selected	Roll Name	Version	Arch
<input checked="" type="checkbox"/>	base	4.2	x86_64
<input checked="" type="checkbox"/>	hpc	4.2	x86_64
<input checked="" type="checkbox"/>	web-server	4.2	x86_64

Submit



# Chapter 3. Using the Xen Roll

## 3.1. Installing a VM Server

A VM Server is machine that can house virtual frontend appliances. It is required to build a VM Server if you wish to build virtual clusters.

Building a VM Server is just like building a traditional frontend, except that you *must supply the Xen Roll during the frontend installation*. Follow the procedure *Install and Configure Your Frontend*<sup>1</sup> and be sure to supply the Xen Roll.

After you build the VM Server, you'll need to install VM Containers (see the next section).

## 3.2. Installing VM Containers

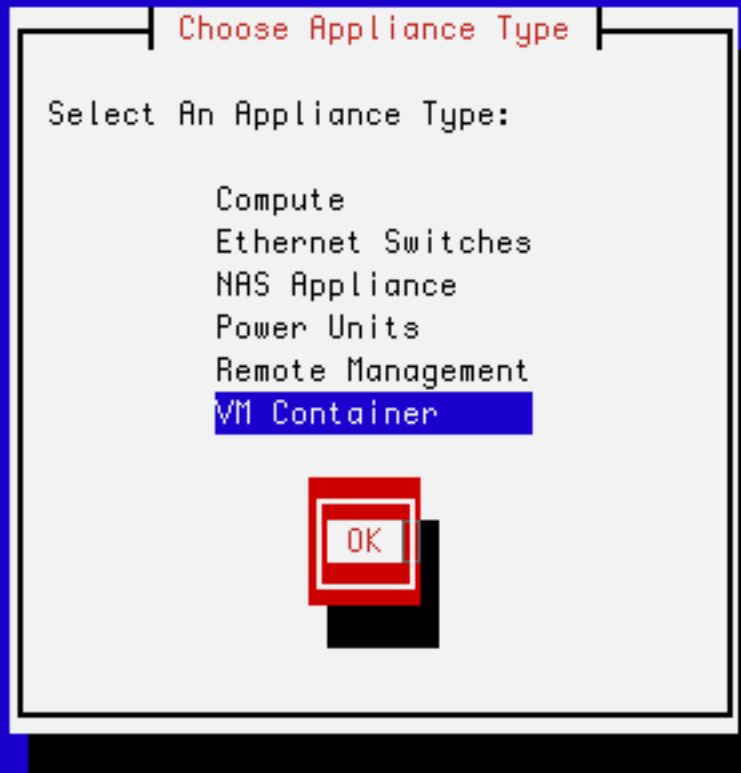
You will need to install a physical machine that will act as the "container" for your VMs. This method is very similar to the method for installing compute nodes.

On the frontend, execute:

```
# insert-ethers
```

You will see a screen that looks like:

```
Insert Ethernet Addresses -- version 5.0
Opened kickstart access to 10.0.0.0/255.0.0.0 network
```



Select the 'VM Container' appliance, then hit 'OK'.

Now PXE boot the physical machine that will be your VM container. Just like a compute node, the VM container will be recognized by insert-ethers and installed. The default name of the node will be `vm-container-X-Y`.

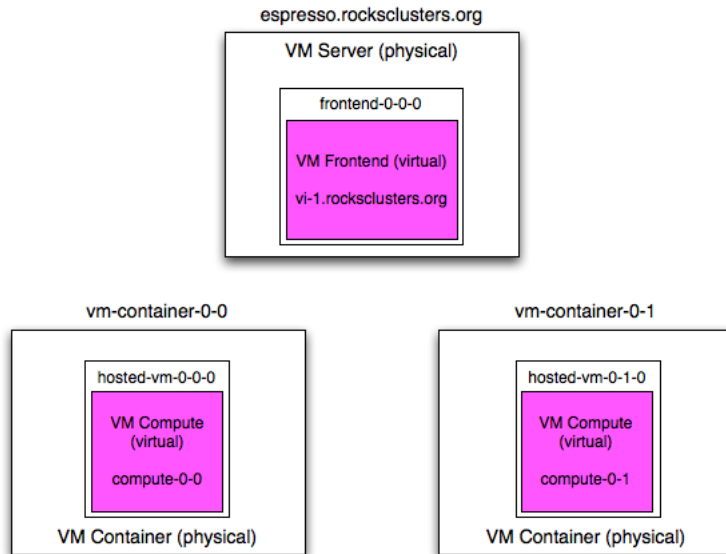
You can install as many VM containers as you like.

## 3.3. Installing Virtual Clusters

### 3.3.1. Installing a VM Frontend

After you install a VM Server and at least one VM Container, you are ready to install a virtual cluster.

We'll use the following illustration as a guide to help keep track of the names of the physical machines and the virtual machines.



In the above picture, "espresso.rocksclusters.org" is a physical machine. Also, "vm-container-0-0" and "vm-container-0-1" are physical machines that were kickstarted by "espresso". The machine "frontend-0-0-0" is a virtual machine that is hosted by "espresso". The machines "hosted-vm-0-0-0" and "hosted-vm-0-1-0" are VMs that are associated with "frontend-0-0-0" (they are all in the same VLAN). The names "frontend-0-0-0", "hosted-vm-0-0-0" and "hosted-vm-0-1-0" are names used by physical machine to control the VMs (e.g., to start and stop them).

The names in the virtual cluster look like the names in a traditional cluster -- the frontend is named "vi-1.rocksclusters.org" and its compute nodes are named "compute-0-0" and "compute-0-1". If you login to "vi-1.rocksclusters.org", you would be hard pressed to tell the difference between this virtual cluster and a traditional physical cluster.



You must select your own FQDN and IP address for your virtual frontend. The FQDN "vi-1.rocksclusters.org" and the IP address "137.110.119.118" are managed by UCSD and should not be used by you.

They are only used here to show you a concrete example.

First, we'll add a virtual cluster to the VM Server's database. In this example, we'll add a frontend with the FQDN of "vi-1.rocksclusters.org", IP of "137.110.119.118" and we'll associate 2 compute nodes with it:

```
# rocks add cluster fqdn="vi-1.rocksclusters.org" ip="137.110.119.118" num-computes=2
```

The above command will take some time and then output something similar to:

```
created frontend VM named: frontend-0-0-0
created compute VM named: hosted-vm-0-0-0
created compute VM named: hosted-vm-0-1-0
```

The command adds entries to the database for the above nodes and establishes a VLAN that will be used for the private network (eth0 inside the VM).

Info about all the defined clusters on the VM Server (including the physical cluster) can be obtained with the command: `rocks list cluster`:

```
# rocks list cluster
FRONTEND          CLIENT NODES      TYPE
espresso.rocksclusters.org: ----- physical
:                 vm-container-0-0 physical
:                 vm-container-0-1 physical
vi-1.rocksclusters.org: ----- VM
:                 hosted-vm-0-0-0   VM
:                 hosted-vm-0-1-0   VM
```

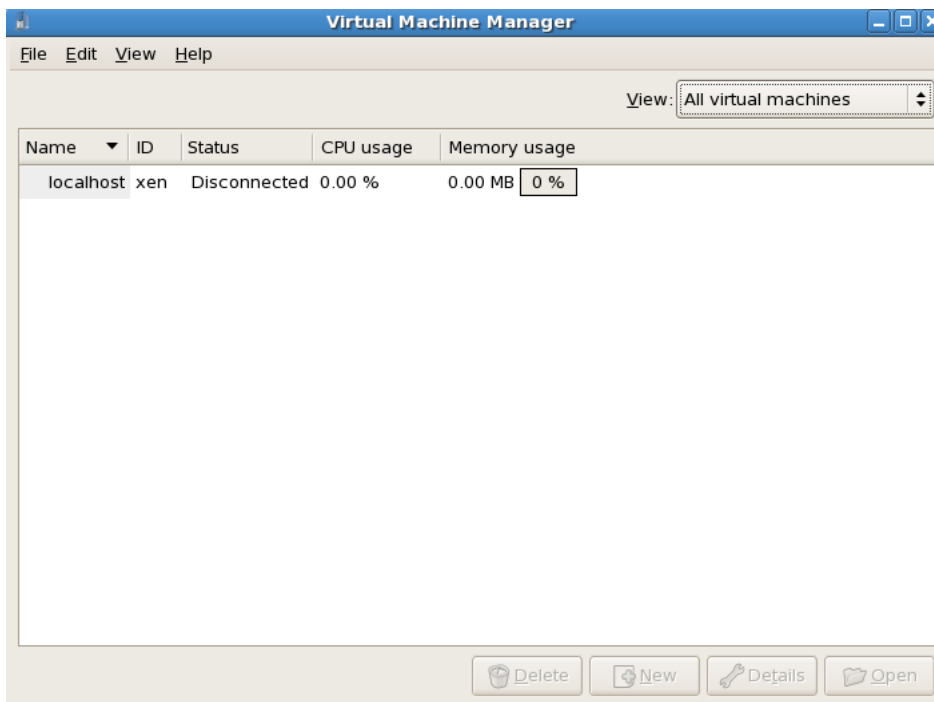
Now we need to install the VM frontend. This is done by "starting" the VM:

```
# rocks start host vm vi-1.rocksclusters.org install=yes
```

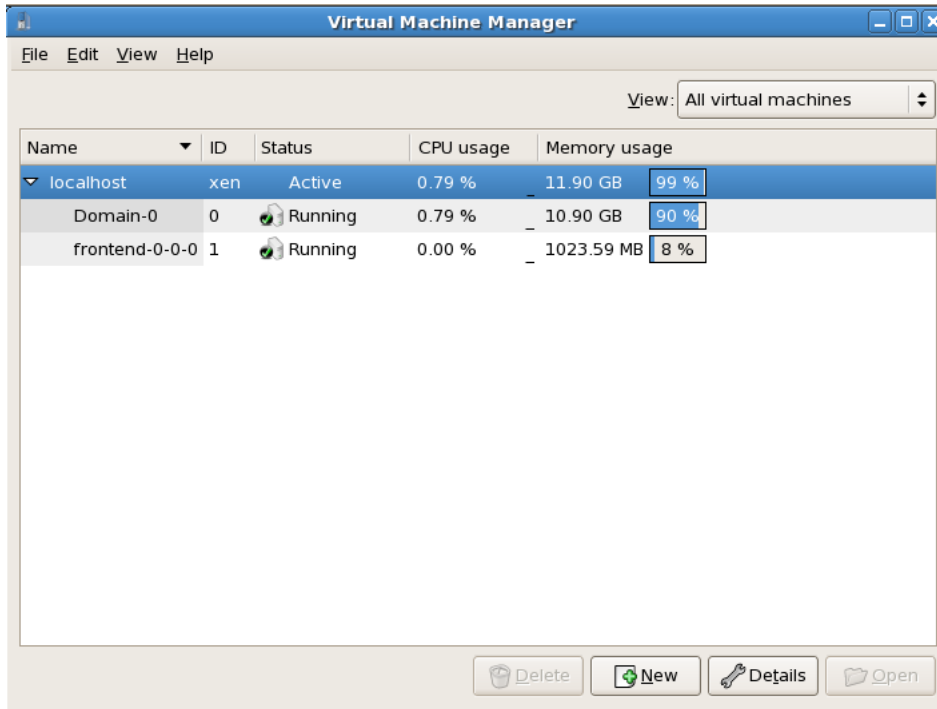
To interact with the VM frontend's console, you need to start "virt-manager"

```
# virt-manager
```

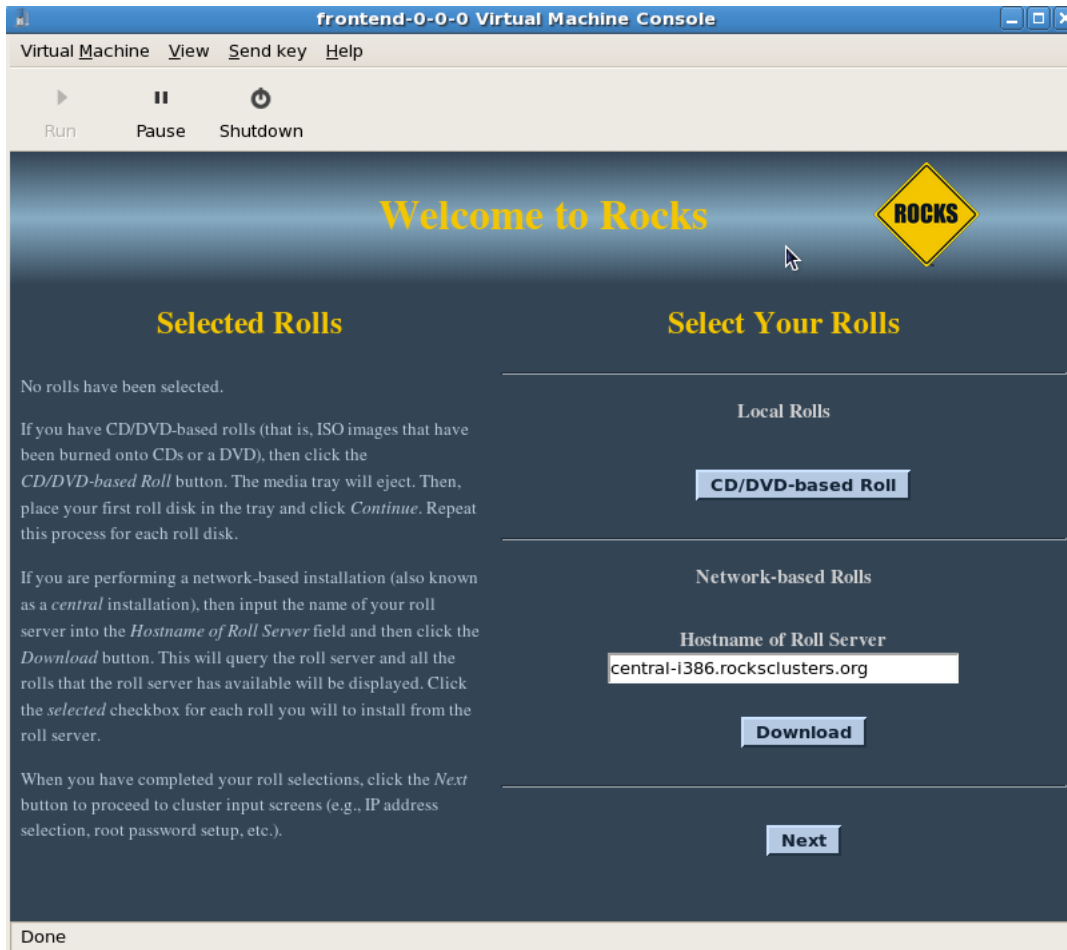
This will display a screen similar to:



Double click on the "localhost" entry and then you'll see:



To bring the up the console for the VM frontend, double click on "frontend-0-0-0". Now you should see the familiar frontend installation screen:



In the "Hostname of Roll Server" field, insert the FQDN of your VM Server (the name of the physical machine that is hosting the VM frontend). Then click "Download".

From here, you want to follow the standard procedure for bringing up a frontend<sup>2</sup> starting at Step 8.

After the VM frontend installs, it will reboot. After it reboots, login and then we'll begin installing VM compute nodes.

### 3.3.2. Installing VM Compute Nodes

Login to the VM frontend (the virtual machine named "vi-1.rocksclusters.org" in the example picture at the top of this page), and execute:

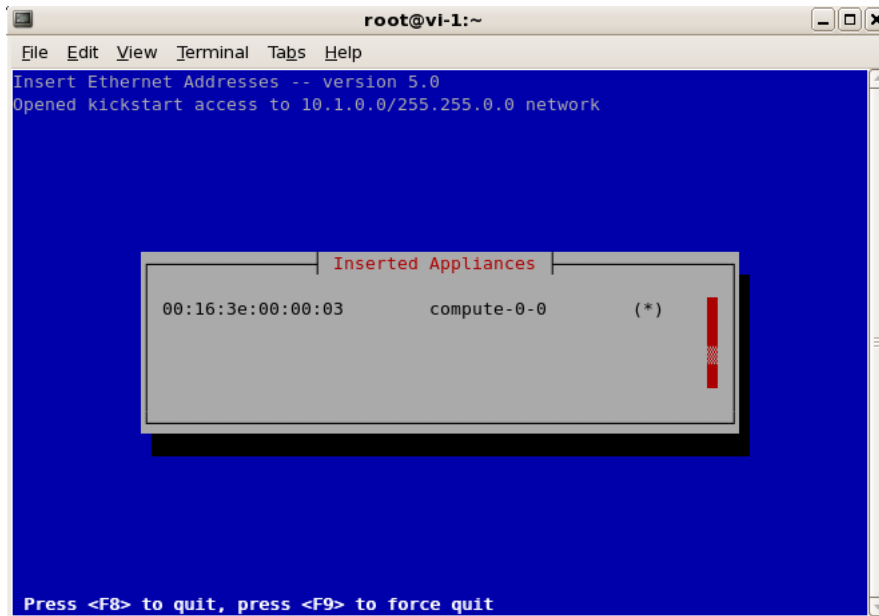
```
# insert-ethers
```

Select "Compute" as the appliance type.

Back on the VM Server, we'll need to start the first VM that hosts the VM compute node. In this example, the name is "hosted-vm-0-0-0".

```
# rocks start host vm hosted-vm-0-0-0 install=yes
```

Back in the VM frontend, you should see insert-ethers discover the VM compute node:



Repeat for each VM compute node.

You now have a virtual cluster up and running within your physical cluster.

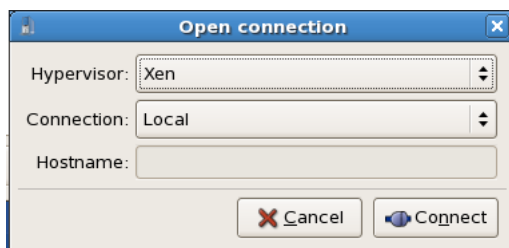
### 3.3.3. Connecting to a VM Compute Node's Console

You can connect to a virtual compute node's console in a manner similar to connecting to the virtual frontend's console. Again, bring up "virt-manager":

```
# virt-manager
```

We'll connect to the console for the virtual compute node "compute-0-0". In the example configuration described at the top of this page, The VM "compute-0-0" is hosted on the physical machine named "vm-container-0-0" so we'll need to tell "virt-manager" to open a connection to "vm-container-0-0".

Inside "virt-manager", click on "File" then "Open connection...". This brings up a window that looks like:

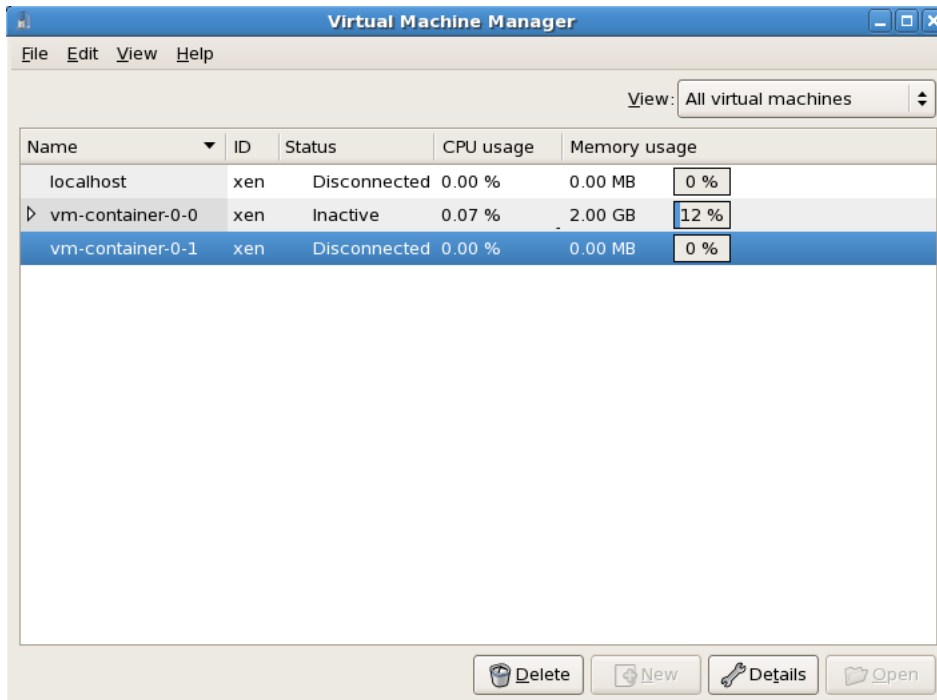


Now change the "Connection:" field to "Remote tunnel over SSH" and enter "vm-container-0-0" for the "Hostname:" field:



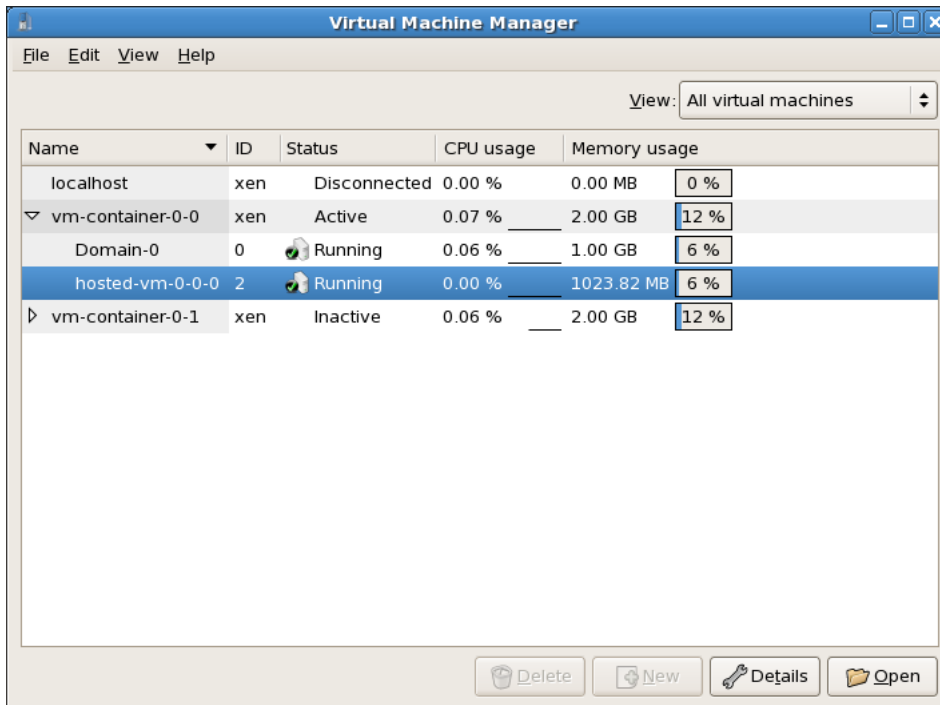
Then click "Connect".

In the "virt-manager" window, you should see something similar to:



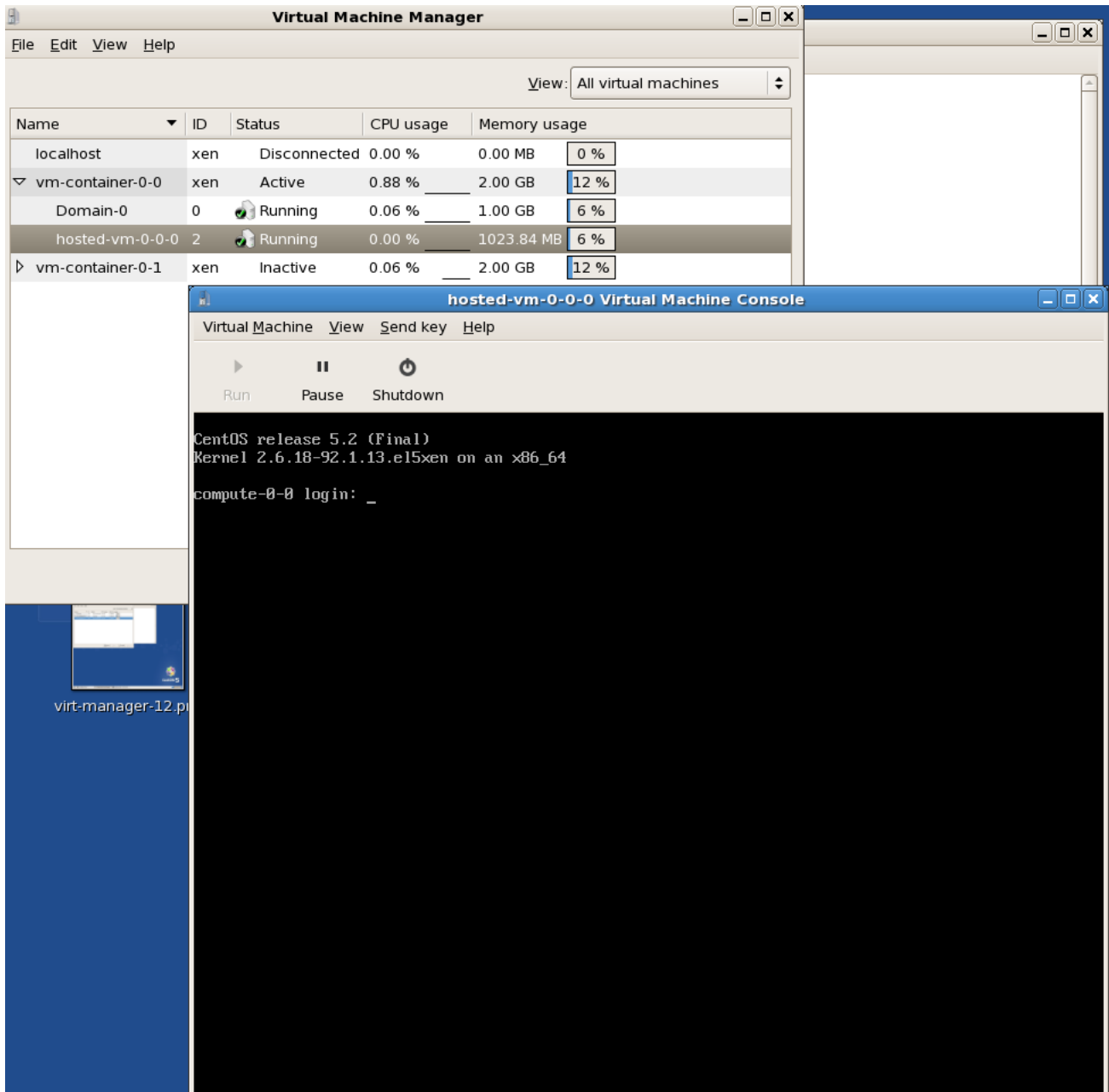
Double click on "vm-container-0-0" and then you'll see:





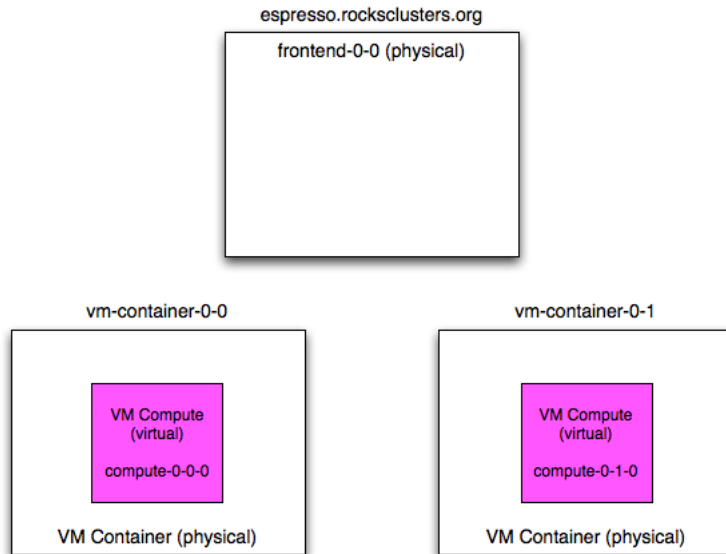
Now to connect to the compute node's console, double click on "hosted-vm-0-0-0". Recall that from the perspective of the physical frontend (the VM Server), "hosted-vm-0-0-0" is the name for the VM "compute-0-0" (again, see the figure at the top of this page).

You should now see the console for compute-0-0:



### 3.4. Physical Frontend with Virtual Compute Nodes

In this scenario, the frontend is a physical machine (not a VM) and the compute nodes are virtual machines.



In the above picture, "frontend-0-0" is a physical machine (with the public name of "espresso.rocksclusters.org"). The physical machine "frontend-0-0" controls two VM compute nodes named "compute-0-0-0" and "compute-0-1-0". This means that "compute-0-0-0" and "compute-0-1-0" are configured by "frontend-0-0". This is opposed to the "virtual cluster scenario" (Installing Virtual Clusters), where the virtual frontend ("frontend-0-0-0") configured the VM compute nodes, and the physical machine that housed "frontend-0-0-0" only started and stopped the virtual compute nodes.

### 3.4.1. Adding, Installing and Booting VMs with a Physical Frontend

In the common case, you will execute three Rocks commands over the lifetime of your VMs: add (to add VM info to the database), start (to boot or install a VM) and stop (to shutdown an installed VM).

To add a VM to the system, you need to associate a VM with a physical machine (i.e., a VM container) and you need to assign an appliance type to the VM. Here's an example:

```
# rocks add host vm vm-container-0-0 membership="Compute"
```

The above command will output a message similar to:

```
added VM compute-0-0-0 on physical node vm-container-0-0
```

This tells us that, in the database, the compute VM named "compute-0-0-0" has been assigned to the physical machine "vm-container-0-0".

The next step is to install the VM.

VMs are installed with the `start`. Here's how to install the VM that was added above:

```
# rocks start host vm compute-0-0-0
```



After running the command above, you may see the following message:

```
libvir: Xen Daemon error : POST operation failed: (xend.err "Error creating domain: Disk isn't accessible")
```

This is not a problem. The above means the file that will be used for the VMs disk space was not present when the VM was started. The "rocks start host vm" command eventually creates it and starts the VM. That is, while you may see the error message above, the VM is actually running and installing.

The above command will start the standard Rocks installation process for the VM named "compute-0-0-0". After the installation process initializes the network inside the VM, you can monitor the installation just like a physical machine installation by executing:

```
# rocks-console compute-0-0-0
```

After the installation completes, the VM will reboot. After the VM boots, you can interact with the VM just like any other physical machine.

## Notes

1. </roll-documentation/base/5.3/install-frontend.html>
2. </roll-documentation/base/5.3/install-frontend.html>

# Chapter 4. Command Reference

## 4.1. add

### 4.1.1. add cluster

**rocks add cluster** {fqdn} {ip} {num-computes} [container-hosts=*string*] [cpus-per-compute=*string*] [disk-per-compute=*string*] [disk-per-frontend=*string*] [fqdn=*string*] [ip=*string*] [mem-per-compute=*string*] [num-computes=*string*] [vlan=*string*]

Add a VM-based cluster to an existing physical cluster.

#### arguments

fqdn

The FQDN for the virtual frontend.

ip

The IP address for the virtual frontend.

num-computes

The number of compute nodes VMs to associate with the frontend.

#### parameters

[container-hosts=*string*]

A list of VM container hosts that will be used to hold the VM compute nodes. This must be a space-separated list (e.g., container-hosts="vm-container-0-0 vm-container-0-1"). The default is to allocate the compute nodes in a round robin fashion across all the VM containers.

[cpus-per-compute=*string*]

The number of CPUs to allocate to each VM compute node. The default is 1.

[disk-per-compute=*string*]

The size of the disk (in gigabytes) to allocate to each VM compute node. The default is 36.

[disk-per-frontend=*string*]

The size of the disk (in gigabytes) to allocate to the VM frontend node. The default is 36.

[fqdn=*string*]

Can be used in place of the fqdn argument.

[ip=*string*]

Can be used in place of the ip argument.

[mem-per-compute=*string*]

The amount of memory (in megabytes) to allocate to each VM compute node. The default is 1024.

[num-computes=*string*]

Can be used in place of the num-computes argument.

[vlan=*string*]

The VLAN ID to assign to this cluster. All network communication between the nodes of the virtual cluster will be encapsulated within this VLAN. The default is the next free VLAN ID.

## examples

```
# rocks add cluster vm.cluster.org 1.2.3.4 2
```

Create one frontend VM and assign it the name 'vm.cluster.org' with the IP address '1.2.3.4' and create 2 compute node VMs.

### 4.1.2. add host vm

**rocks add host vm** {host...} {membership} [cpus=*string*] [disk=*string*] [disk-size=*string*] [ip=*string*] [mac=*string*] [mem=*string*] [membership=*string*] [name=*string*] [num-macs=*string*] [slice=*string*] [subnet=*string*] [sync-config=*bool*] [vlan=*string*]

Add a VM specification to the database.

## arguments

host

One or more physical host names.

membership

The membership to assign to the VM.

## parameters

[cpus=*string*]

The number of CPUs to assign to this VM. The default is: 1.

[disk=*string*]

A disk specification for this VM. The default is:

file:./<largest-partition-on-physical-node>/xen/disks/<vm-name>.hda,hda,w

`[disksize=string]`

The amount of disk space in gigabytes to assign to the disk specification. The default is: 36.

`[ip=string]`

The IP address to assign to the VM. If no IP address is provided, then one will be automatically assigned.

`[mac=string]`

A MAC address to assign to this VM. If no MAC address is specified, the next free MAC address will be selected.

`[mem=string]`

The amount of memory in megabytes to assign to this VM. The default is: 1024.

`[membership=string]`

Can be used in place of the membership argument.

`[name=string]`

The name to assign to the VM (e.g., 'compute-0-0-0').

`[num-macs=string]`

The number of MAC addresses to automatically assign to this VM. The default is 1.

`[slice=string]`

The 'slice' id on the physical node. Each VM on a physical node has a unique slice number. The default is the next available free slice number.

`[subnet=string]`

The subnet to associate to this VM. The default is: private.

`[sync-config=bool]`

Decides if 'rocks sync config' should be run after the VM is added. The default is: yes.

`[vlan=string]`

The vlan ID to set for each interface. If you supply multiple MACs (e.g., 'num-macs' > 1), you can specify multiple vlan IDs by a comma separated list (e.g., `vlan="3,4,5"`). To not specify a vlan for a MAC, use the keyword 'none'. For example, if you want to specify a vlan ID for interface 1 and 3, but not interface 2, type: `vlan="3,none,5"`. The default is to not assign a vlan ID.

## examples

```
# rocks add host vm
```

Create a default VM.

```
# rocks add host vm mem=4096
```

Create a VM and allocate 4 GB of memory to it.

## 4.2. create

### 4.2.1. create host vm

**rocks create host vm** {host...}

Create a VM slice on a physical node. This command will configure a VM and install it. This can be used for the initial setup of a VM or to reconfigure an existing VM.

#### arguments

host

A list of one or more VM host names.

#### examples

```
# rocks create host vm compute-0-0-0
```

Create VM host compute-0-0-0.

## 4.3. dump

### 4.3.1. dump host vm

**rocks dump host vm** [host...]

Dump host VM information as Rocks commands.

#### arguments

[host]

Zero, one or more host names. If no host names are supplied, information for all hosts will be listed.

#### examples

```
$ rocks dump host vm compute-0-0-0
```

Dump VM info for compute-0-0-0.

```
$ rocks dump host vm
```

Dump VM info for all configured virtual machines.



**related commands**

add host vm

**4.4. list****4.4.1. list cluster**

**rocks list cluster** [cluster...] [status=*bool*]

Lists a cluster, that is, for each frontend, all nodes that are associated with that frontend are listed.

**arguments**

[cluster]

Zero, one or more frontend names. If no frontend names are supplied, information for all clusters will be listed.

**parameters**

[status=*bool*]

If true, then for each VM-based cluster node, output the VM's status (e.g., 'active', 'paused', etc.).

**examples**

```
$ rocks list cluster frontend-0-0
```

List the cluster associated with the frontend named 'frontend-0-0'.

```
$ rocks list cluster
```

List all clusters.

**4.4.2. list host vm**

**rocks list host vm** [host...] [showdisks=*bool*] [status=*bool*]

Lists the VM configuration for hosts.

**arguments**`[host]`

Zero, one or more host names. If no host names are supplied, information for all hosts will be listed.

**parameters**`[showdisks=bool]`

If true, then output VM disk configuration. The default is 'false'.

`[status=bool]`

If true, then output each VM's status (e.g., 'active', 'paused', etc.).

**examples**

```
$ rocks list host vm compute-0-0
```

List the VM configuration for compute-0-0.

```
$ rocks list host vm compute-0-0 compute-0-1
```

List the VM configuration for compute-0-0 and compute-0-1.

## 4.5. move

### 4.5.1. move host vm

```
rocks move host vm {host} {physhost} {file}
```

Move a VM from its current physical node to another.

**arguments**`host`

The name of the VM host to move.

`physhost`

The name of the physical host in which to move the VM.

`file`

The name of the file that stores the running VM's state.

## examples

```
# rocks move host vm compute-0-0-0 vm-container-1-0
```

Move VM host compute-0-0-0 to physical host vm-container-1-0.

## 4.6. pause

### 4.6.1. pause host vm

```
rocks pause host vm {host...}
```

Pauses a VM slice on a physical node.

#### arguments

host

A list of one or more VM host names.

## examples

```
# rocks pause host vm compute-0-0-0
```

Pause VM host compute-0-0-0.

## 4.7. remove

### 4.7.1. remove cluster

```
rocks remove cluster [cluster...]
```

Remove a virtual cluster.

#### arguments

[cluster]

One or more virtual frontend names.

## examples

```
# rocks rmeove cluster frontend-0-0-0
```

Remove the cluster associated with the frontend named 'frontend-0-0'.

## 4.7.2. remove host vm

```
rocks remove host vm {host...}
```

Remove the configuration info in the database for the supplied hosts.

## arguments

host

A list of one or more VM host names.

## examples

```
# rocks remove host vm compute-0-0-0
```

Remove the configuration info in the database for compute-0-0-0.

## 4.8. report

### 4.8.1. report host vm

```
rocks report host vm {host}
```

Outputs a configuration file used by rocks-pygrub in order to boot a VM.

## arguments

host

One VM host name (e.g., compute-0-0-0).

## examples

```
$ rocks report host vm compute-0-0-0
```

Create the VM configuration file for host compute-0-0-0

```
$ rocks report host vm compute-0-0-0
```

Create the VM configuration file for host compute-0-0-0.

## 4.8.2. report host xen bridge

```
rocks report host xen bridge
```

Generates the Xen networking bridge configuration script for a host.

### examples

```
$ rocks report host xen bridge
```

## 4.9. restore

### 4.9.1. restore host vm

```
rocks restore host vm {host...} {file}
```

Restore a VM on a physical node. This command restores a previously saved VM.

### arguments

host

A list of one or more VM host names.

file

The file name the saved VM state is stored in. If you don't supply this parameter, then the default file name is: `/<largest-partition-on-physical-host>/xen/disks/<vm-name%gt;.saved`. For example, on a physical node with the default partitioning, the file that contains the state for VM compute-0-0-0 is: `/state/partition1/xen/disks/compute-0-0-0.saved`

### examples

```
# rocks restore host vm compute-0-0-0
```

Restore VM host compute-0-0-0.

## 4.10. resume

### 4.10.1. resume host vm

**rocks resume host vm** {host...}

Resume a paused VM slice on a physical node.

#### arguments

host

A list of one or more VM host names.

#### examples

```
# rocks resume host vm compute-0-0-0
```

Resume paused VM host compute-0-0-0.

## 4.11. save

### 4.11.1. save host vm

**rocks save host vm** {host...} {file}

Save a VM on a physical node. This command saves a currently running VM, then halts the VM. This saved state can be used to restart the VM with the command 'rocks restore host vm'.

#### arguments

host

A list of one or more VM host names.

file

The file name the saved VM state will be stored in. If you don't supply this parameter, then the default file name will be: /<largest-partition-on-physical-host>/xen/disks/<vm-name>.saved. For example, on a physical node with the default partitioning, the saved file for VM compute-0-0-0 will be named:  
/state/partition1/xen/disks/compute-0-0-0.saved

## examples

```
# rocks save host vm compute-0-0-0
    Save VM host compute-0-0-0.
```

## 4.12. set

### 4.12.1. set host vm

#### rocks set host vm

```
{host} [disk=string] [disksize=string] [mem=string] [physnode=string] [slice=string] [virt-
type=string]
```

Change the VM configuration for a specific VM.

#### arguments

host

One or more VM host names.

#### parameters

[disk=*string*]

A VM disk specification. More than one disk can be supplied. Each disk specification must be separated by a space.

[disksize=*string*]

The size of the VM disk in gigabytes.

[mem=*string*]

The amount of memory in megabytes to assign to this VM.

[physnode=*string*]

The physical machine this VM should run on.

[slice=*string*]

The slice ID for this VM.

[virt-type=*string*]

Set the virtualization type for this VM. This can be 'para' or 'hardware'.

## examples

```
# rocks set host vm compute-0-0-0 mem=4096
```

Change the memory allocation for VM compute-0-0-0 to 4 GB.

## 4.13. start

### 4.13.1. start host vm

```
rocks start host vm {host...}
```

Boots a VM slice on a physical node.

### arguments

host

A list of one or more VM host names.

## examples

```
# rocks start host vm compute-0-0-0
```

Start VM host compute-0-0-0.

```
# rocks start host vm compute-0-0-0
```

Start VM host compute-0-0-0.

## 4.14. stop

### 4.14.1. stop host vm

```
rocks stop host vm {host...}
```

Destroy a VM slice on a physical node.

### arguments

host

A list of one or more VM host names.



## examples

```
# rocks stop host vm compute-0-0-0
```

Stop VM host compute-0-0-0. This is equivalent to a 'hard power off', (i.e., pulling the power cord from a node).

## 4.15. sync

### 4.15.1. sync host network xen

```
rocks sync host network xen
```

Reconfigure and restart the network for the named hosts.

## examples

```
# rocks sync host network compute-0-0
```

Reconfigure and restart the network on compute-0-0.

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www.rocksclusters.org  
version 5.2 (Chimichanga)

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-- Keir Fraser (on behalf of the Xen team)

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