

# Base Roll: Users Guide



Version 5.0 Edition



**Base Roll: Users Guide:**

Version 5.0 Edition

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# Preface

Since May 2000, the Rocks group has been addressing the difficulties of deploying manageable clusters. We have been driven by one goal: *make clusters easy*. By *easy* we mean easy to deploy, manage, upgrade and scale. We are driven by this goal to help deliver the computational power of clusters to a wide range of scientific users. It is clear that making stable and manageable parallel computing platforms available to a wide range of scientists will aid immensely in improving the state of the art in parallel tools.

# Chapter 1. Overview

**Table 1-1. Summary**

Name	base
Version	5.0
Maintained By	Rocks Group
Architecture	i386, x86_64, ia64
Compatible with Rocks™	5.0

**Table 1-2. Roll Compatibility**

Roll	Requires <sup>a</sup>	Optional <sup>b</sup>	Conflicts
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	

Notes:

- 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.
- 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.



# Chapter 2. Installing a Rocks Cluster

## 2.1. Getting Started

This chapter describes the steps to build your cluster and install its software.

### 2.1.1. Supported Hardware

Processors

- x86 (ia32, AMD Athlon, etc.)
- x86\_64 (AMD Opteron and EM64T)

Networks

- Ethernet



Specialized networks and components (e.g., Myrinet, Infiniband, nVidia GPU) are also supported. Hardware requirements and software (Rocks Rolls) can be found on the respective vendor web sites.

### 2.1.2. Minimum Hardware Requirements

Frontend Node

- **Disk Capacity:** 20 GB
- **Memory Capacity:** 1 GB
- **Ethernet:** 2 physical ports (e.g., "eth0" and "eth1")
- **BIOS Boot Order:** CD, Hard Disk

Compute Node

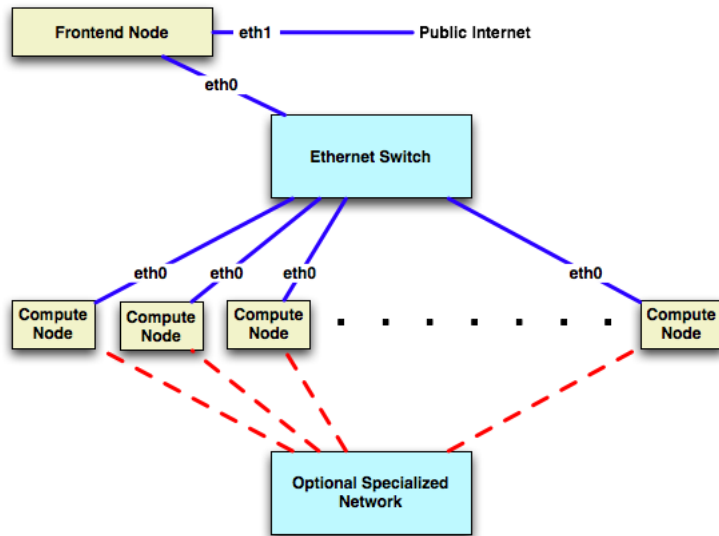
- **Disk Capacity:** 20 GB
- **Memory Capacity:** 1 GB
- **Ethernet:** 1 physical port (e.g., "eth0")
- **BIOS Boot Order:** PXE (Network Boot), CD, Hard Disk

### 2.1.3. Physical Assembly

The first thing to manage is the physical deployment of a cluster. Much research exists on the topic of how to physically construct a cluster. A majority of the O'Reilly Book<sup>1</sup> *Building Linux Clusters* is devoted to the physical setup of a cluster, how to choose a motherboard, etc. Finally, the book *How to Build a Beowulf* also has some good tips on physical construction.

We favor rack-mounted equipment because of its relative reliability and density. There are Rocks clusters, however, that are built from mini-towers. Choose what makes sense for you.

The following diagram shows how the frontend and compute nodes must be connected:



On the compute nodes, the Ethernet interface that Linux maps to `eth0` must be connected to the cluster's Ethernet switch. This network is considered *private*, that is, all traffic on this network is physically separated from the external public network (e.g., the internet).

On the frontend, at least two ethernet interfaces are required. The interface that Linux maps to `eth0` must be connected to the same ethernet network as the compute nodes. The interface that Linux maps to `eth1` must be connected to the external network (e.g., the internet or your organization's intranet).

## 2.2. Install and Configure Your Frontend

This section describes how to install your Rocks cluster frontend.



The minimum requirement to bring up a frontend is to have the following rolls:

- Kernel/Boot Roll CD
- Base Roll CD
- Web Server Roll CD

- OS Roll CD - Disk 1
- OS Roll CD - Disk 2

The Core Meta Roll CD can be substituted for the individual Base and Web-Server Rolls.

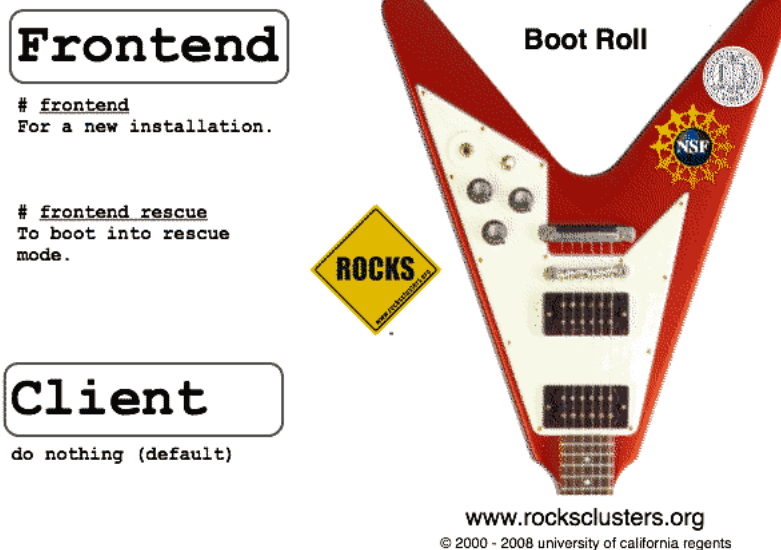
Additionally, the official Red Hat Enterprise Linux 5 update 1 CDs can be substituted for the OS Rolls. Also, any *true* rebuild of RHEL 5 update 1 can be used -- distributions known to work are: CentOS 5 update 1 and Scientific Linux 5 update 1. If you substitute the OS Rolls with one of the above distributions, you must supply *all* the CDs from the distribution (which usually is 6 or 7 CDs).

1. Insert the Kernel/Boot Roll CD into your frontend machine and reset the frontend machine.



For the remainder of this section, we'll use the example of installing a *bare-bones* frontend, that is, we'll be using the Kernel/Boot Roll, Core Roll, OS - Disk 1 Roll and the OS - Disk 2 Roll.

2. After the frontend boots off the CD, you will see:



boot: frontend\_

When you see the screen above, type:

```
frontend
```



The "boot:" prompt arrives and departs the screen quickly. It is easy to miss. If you do miss it, the node will assume it is a *compute* appliance, and the frontend installation will fail and you will have to restart the installation (by rebooting the node).



If the installation fails, very often you will see a screen that complains of a missing `/tmp/ks.cfg` kickstart file. To get more information about the failure, access the kickstart and system log by pressing `Ctrl-Alt-F3` and `Ctrl-Alt-F4` respectively.

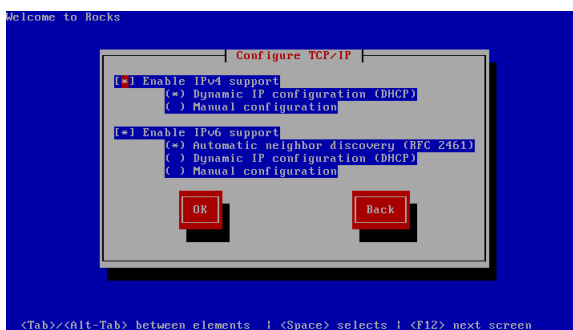
After you type `frontend`, the installer will start running.

3.

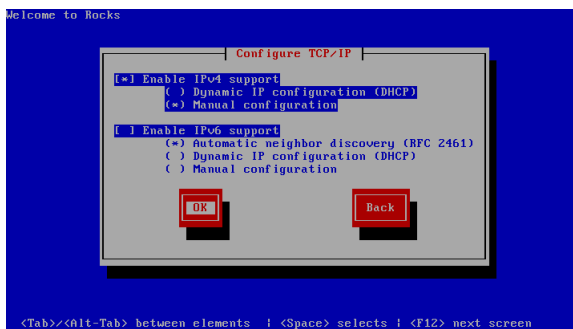


All screens in this step may not appear during your installation. You will only see these screens if there is not a DNS server on your public network that answers the frontend's DHCP request.

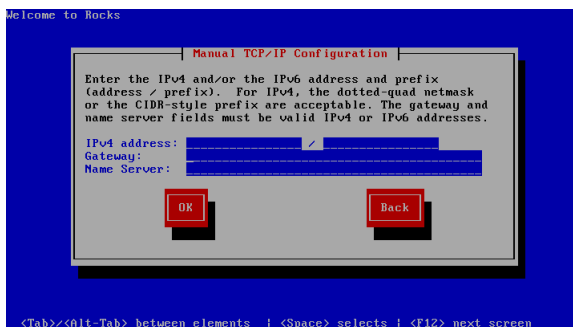
If you see the screen below:



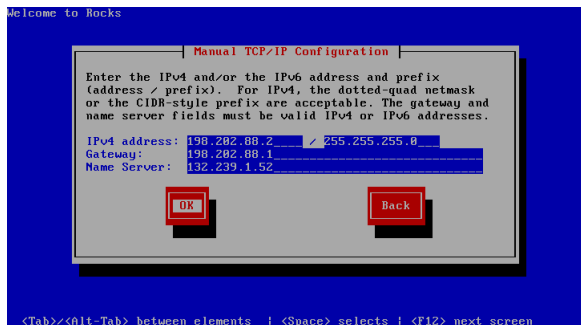
You'll want to: 1) enable IPv4 support, 2) select manual configuration for the IPv4 support (no DHCP) and, 3) disable IPv6 support. The screen should look like:



After your screen looks like the above, hit "OK". Then you'll see the "Manual TCP/IP Configuration" screen:

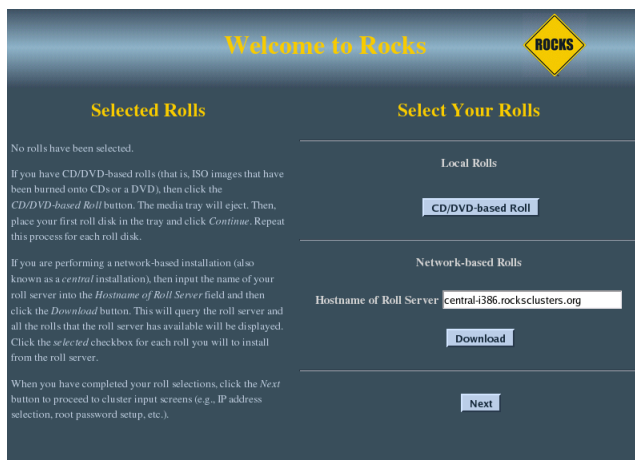


In this screen, enter the *public* IP configuration. Here's an example of the public IP info we entered for one our frontends:



After you fill in the public IP info, hit "OK".

4. Soon, you'll see a screen that looks like:



From this screen, you'll select your rolls.

In this procedure, we'll only be using CD media, so we'll only be clicking on the 'CD/DVD-based Roll' button.

Click the 'CD/DVD-based Roll' button.

5. The CD will eject and you will see this screen:

**Welcome to Rocks**

**ROCKS**

**Selected Rolls**

No rolls have been selected.

Insert the Roll CD/DVD

**Continue**

If you have CD/DVD-based rolls (that is, ISO images that have been burned onto CDs or a DVD), then click the *CD/DVD-based Roll* button. The media tray will eject. Then, place your first roll disk in the tray and click *Continue*. Repeat this process for each roll disk.

If you are performing a network-based installation (also known as a *central* installation), then input the name of your roll server into the *Hostname of Roll Server* field and then click the *Download* button. This will query the roll server and all the rolls that the roll server has available will be displayed. Click the *selected* checkbox for each roll you will to install from the roll server.

When you have completed your roll selections, click the *Next* button to proceed to cluster input screens (e.g., IP address selection, root password setup, etc.).

Put your first roll in the CD tray (for the first roll, since the Kernel/Boot Roll is already in the tray, simply push the tray back in).

Click the 'Continue' button.

6. The Kernel/Boot Roll will be discovered and display the screen:

**Welcome to Rocks**

**ROCKS**

**Selected Rolls**

No rolls have been selected.

Selected	Roll Name	Version	Arch
<input checked="" type="checkbox"/>	kernel	4.3	i386

**Submit**

If you have CD/DVD-based rolls (that is, ISO images that have been burned onto CDs or a DVD), then click the *CD/DVD-based Roll* button. The media tray will eject. Then, place your first roll disk in the tray and click *Continue*. Repeat this process for each roll disk.

If you are performing a network-based installation (also known as a *central* installation), then input the name of your roll server into the *Hostname of Roll Server* field and then click the *Download* button. This will query the roll server and all the rolls that the roll server has available will be displayed. Click the *selected* checkbox for each roll you will to install from the roll server.

When you have completed your roll selections, click the *Next* button to proceed to cluster input screens (e.g., IP address selection, root password setup, etc.).

Select the Kernel/Boot Roll by checking the 'Selected' box and clicking the 'Submit' button.

7. This screen shows you have properly selected the Kernel/Boot Roll.

The screenshot shows the 'Welcome to Rocks' installation interface. At the top, it says 'Welcome to Rocks' in yellow text next to a yellow diamond logo with the word 'ROCKS' inside. Below this, there are two main sections: 'Selected Rolls' and 'Select Your Rolls'.

**Selected Rolls**

Roll Name	Version	Arch	Id
kernel	4.3	i386	Disk 1

**Select Your Rolls**

Local Rolls

CD/DVD-based Roll

Network-based Rolls

Hostname of Roll Server:

Download

Next

Repeat steps 3-5 for the Base Roll, Web Server Roll and the OS rolls.

8. When you have selected all the rolls associated with a *bare-bones* frontend, the screen should look like:

## Welcome to Rocks

**Selected Rolls**

No rolls have been selected.

If you have CD/DVD-based rolls (that is, ISO images that have been burned onto CDs or a DVD), then click the *CD/DVD-based Roll* button. The media tray will eject. Then, place your first roll disk in the tray and click *Continue*. Repeat this process for each roll disk.

If you are performing a network-based installation (also known as a *central* installation), then input the name of your roll server into the *Hostname of Roll Server* field and then click the *Download* button. This will query the roll server and all the rolls that the roll server has available will be displayed. Click the *selected* checkbox for each roll you will to install from the roll server.

When you have completed your roll selections, click the *Next* button to proceed to cluster input screens (e.g., IP address selection, root password setup, etc.).

Selected	Roll Name	Version	Arch
<input type="checkbox"/>	base	5.0	i386
<input type="checkbox"/>	kernel	5.0	i386
<input type="checkbox"/>	os	5.0	i386
<input type="checkbox"/>	web-server	5.0	i386

**Submit**

Done

When you are done with roll selection, click the 'Next' button.

9. Then you'll see the *Cluster Information* screen:

## Welcome to Rocks

**Cluster Information**

**Help**

**Fully-Qualified Host Name:**  
This must be the fully-qualified domain name (required).

**Cluster Name:**  
The name of the cluster (optional).

**Certificate Organization:**  
The name of your organization. Used when building a certificate for this host (optional).

**Certificate Locality:**  
Your city (optional).

**Certificate State:**  
Your state (optional).

**Certificate Country:**

**Fully-Qualified Host Name:** cluster.hpc.org

**Cluster Name:** Our Cluster

**Certificate Organization:** SDSC

**Certificate Locality:** San Diego

**Certificate State:** California

**Certificate Country:** US

**Contact:** admin@place.org

**URL:** http://www.place.org/

**Latitude/Longitude:** N32.87 W117.22

**Back** **Next**





The one important field in this screen is the *Fully-Qualified Host Name* (all other fields are optional).

Choose your hostname carefully. The hostname is written to dozens of files on both the frontend and compute nodes. If the hostname is changed after the frontend is installed, several cluster services will no longer be able to find the frontend machine. Some of these services include: SGE, Globus, NFS, AutoFS, and Apache.

If you plan on adding the Grid Roll (or other Globus PKI services) the hostname must be the primary FQDN for your host.

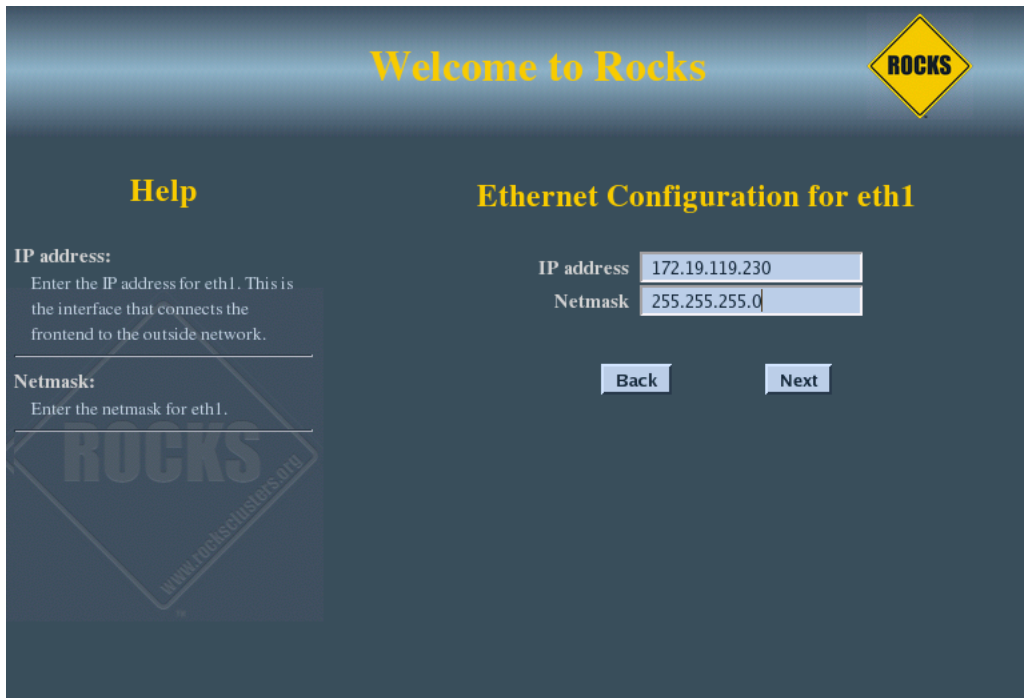
Fill out the form, then click the 'Next' button.

- The private cluster network configuration screen allows you to set up the networking parameters for the ethernet network that connects the frontend to the compute nodes.



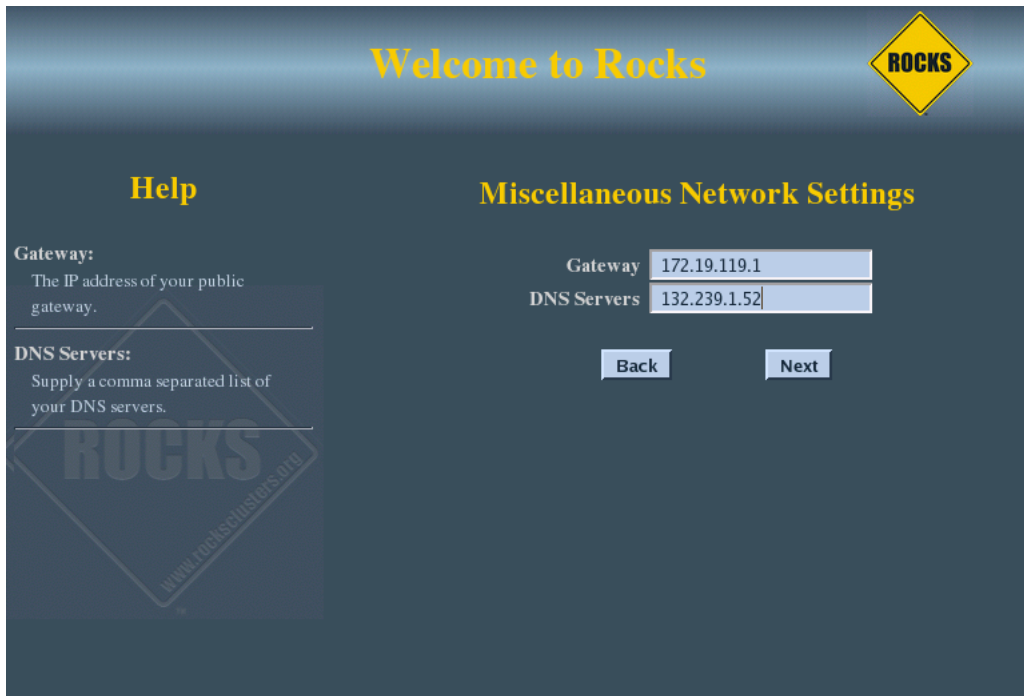
It is recommended that you accept the defaults (by clicking the 'Next' button). But for those who have unique circumstances that requires different values for the internal ethernet connection, we have exposed the network configuration parameters.

- The public cluster network configuration screen allows you to set up the networking parameters for the ethernet network that connects the frontend to the outside network (e.g., the internet).

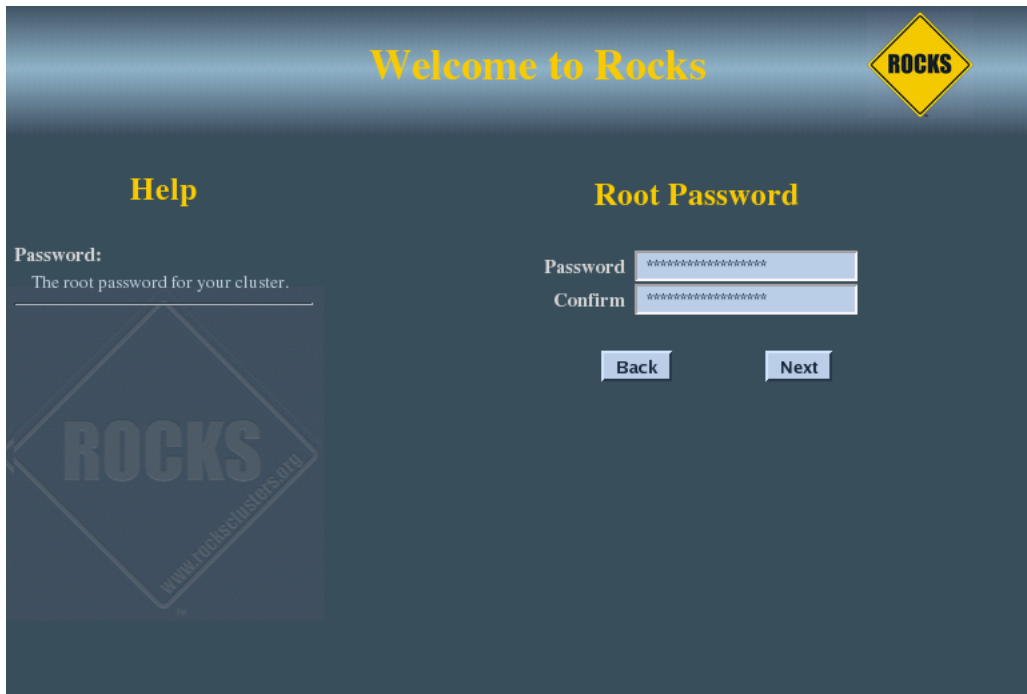


The above window is an example of how we configured the external network on one of our frontend machines.

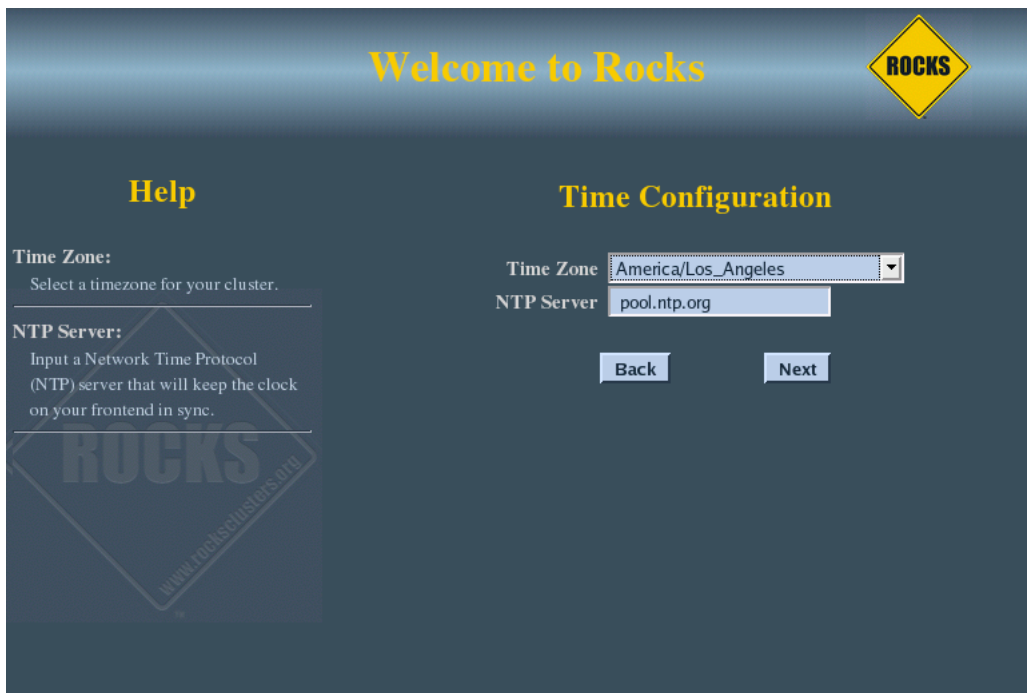
12. Configure the the *Gateway* and *DNS* entries:



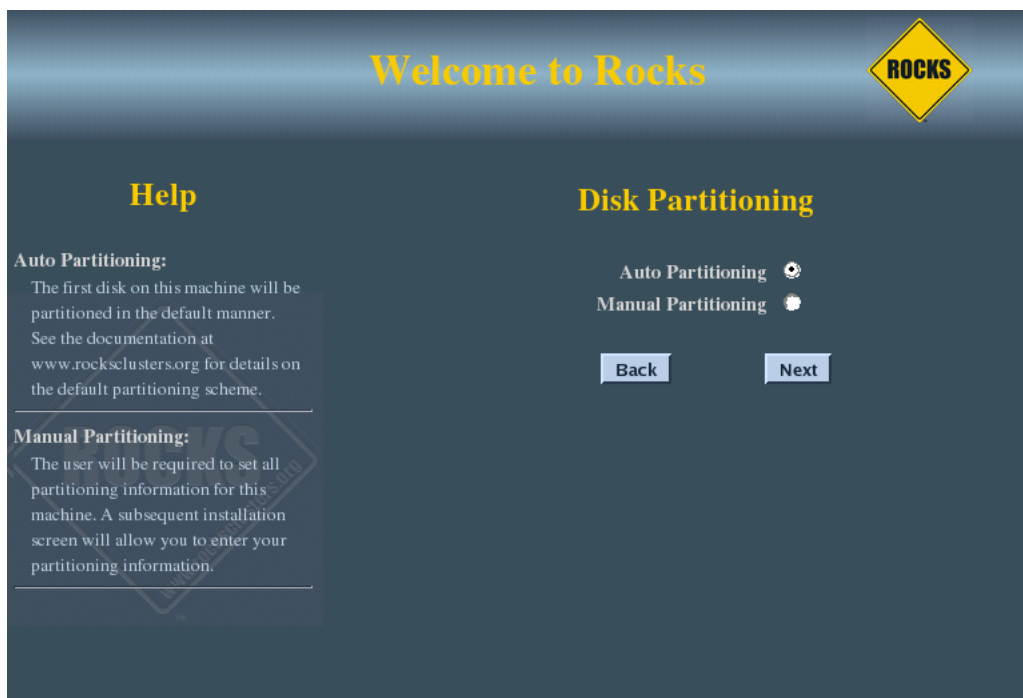
13. Input the root password:



14. Configure the time:



15. The disk partitioning screen allows you to select *automatic* or *manual* partitioning.



To select automatic partitioning, click the `Auto Partitioning` radio button. This will repartition and reformat the first discovered hard drive that is connected to the frontend. All other drives connected to the frontend will be left untouched.

The first discovered drive will be partitioned like:

**Table 2-1. Frontend -- Default Root Disk Partition**

Partition Name	Size
/	8 GB
/var	4 GB
swap	1 GB
/export (symbolically linked to /state/partition1)	<i>remainder of root disk</i>



When you use automatic partitioning, the installer will repartition and reformat the *first hard drive* that the installer discovers. All previous data on this drive will be erased. All other drives will be left untouched.

The drive discovery process uses the output of `cat /proc/partitions` to get the list of drives.

For example, if the node has an IDE drive (e.g., "hda") and a SCSI drive (e.g., "sda"), generally the IDE drive is the first drive discovered.

But, there are instances when a drive you don't expect is the first discovered drive (we've seen this with certain fibre channel connected drives). If you are unsure on how the drives will be discovered in a multi-disk frontend, then use manual partitioning.

16. If you selected manual partitioning, then you will now see Red Hat's manual partitioning screen:

**Disk Setup**

Choose where you would like Rocks to be installed.

If you do not know how to partition your system or if you need help with using the manual partitioning tools, refer to the product documentation.

If you used automatic partitioning, you can either accept the current partition settings (click **Next**), or modify the setup using the manual partitioning tool.

If you are manually partitioning your system, you can see your current hard drive(s) and partitions displayed below. Use the partitioning tool to add, edit, ...

Drive `/dev/hda` (76317 MB) (Model: WDC WD800BB-22JHC0)

Device	Mount Point/RAID/Volume	Type	Format	Size (MB)	Start	End
Hard Drives						
/dev/hda						
/dev/hda1	/	ext3	✓	8001	1	1020
/dev/hda2	/var	ext3	✓	4001	1021	1530
/dev/hda3		swap		996	1531	1657
/dev/hda4						
/dev/hda5	/export	ext3		63319	1658	9729

Hide RAID device/LVM Volume Group members

Hide Help Release Notes Back Next

Above is an example of creating a '/', '/var', swap and '/export' partitions.



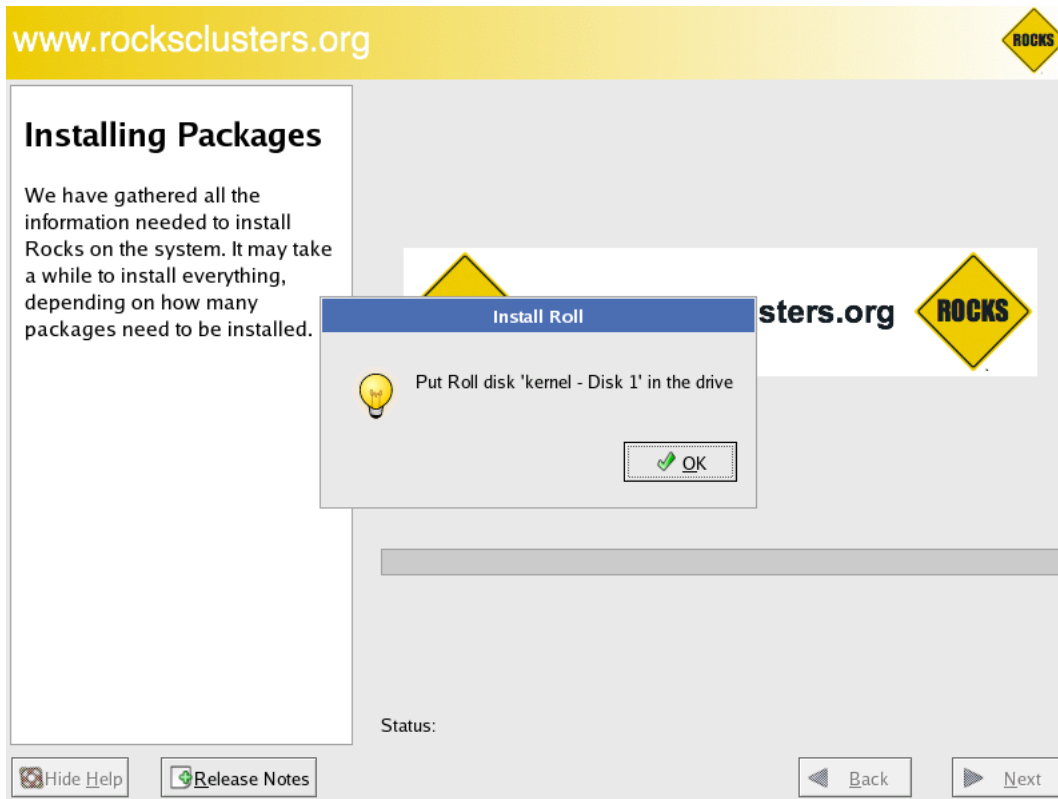
If you select manual partitioning, you must specify at least 8 GBs for the root partition and you must create a separate `/export` partition.



LVM is not supported by Rocks.

When you finish describing your partitions, click the 'Next' button.

17. The frontend will format its file systems, then it will ask for each of the roll CDs you added at the beginning of the frontend installation.



In the example screen above, insert the Kernel/Boot Roll into the CD tray and click 'OK'.

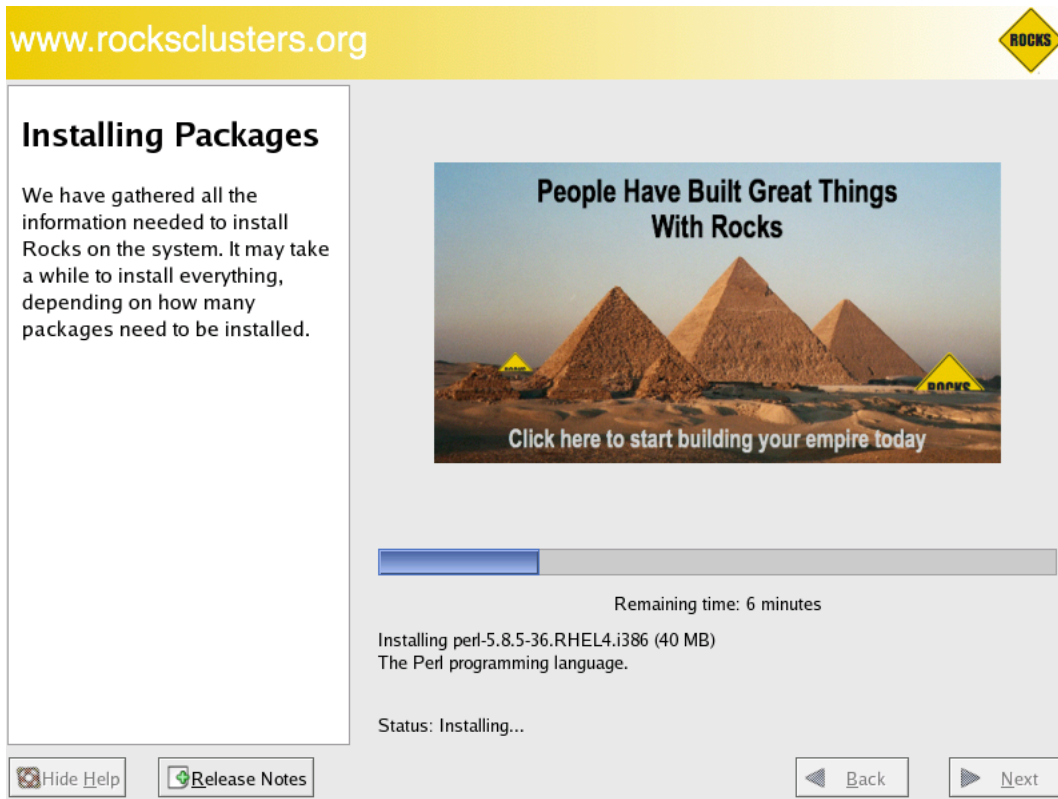
The contents of the CD will now be copied to the frontend's hard disk.

Repeat this step for each roll you supplied in steps 3-5.



After all the Rolls are copied, no more user interaction is required.

18. After the last roll CD is copied, the packages will be installed:



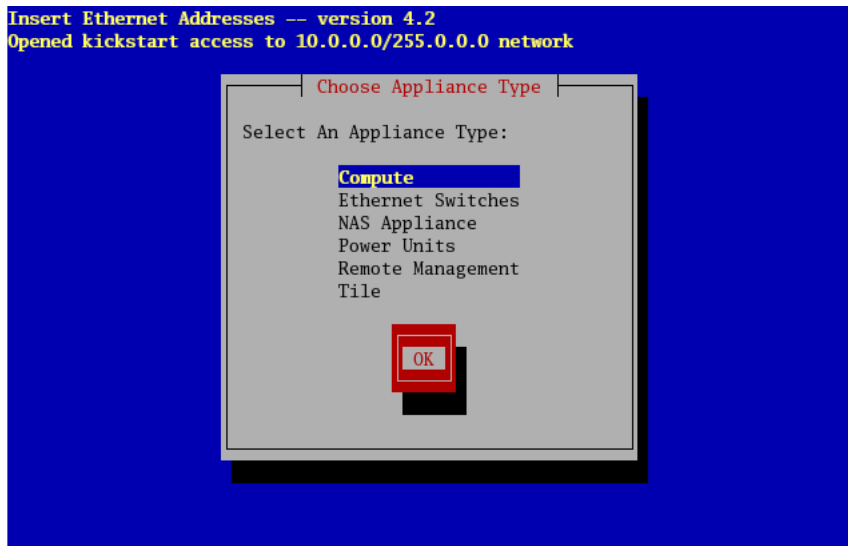
19. Finally, the boot loader will be installed and post configuration scripts will be run in the background. When they complete, the frontend will reboot.

## 2.3. Install Your Compute Nodes

1. Login to the frontend node as `root`.
2. Run the program which captures compute node DHCP requests and puts their information into the Rocks MySQL database:

```
# insert-ethers
```

This presents a screen that looks like:



If your frontend and compute nodes are connected via a managed ethernet switch, you'll want to select 'Ethernet Switches' from the list above. This is because the default behavior of many managed ethernet switches is to issue DHCP requests in order to receive an IP address that clients can use to configure and monitor the switch.

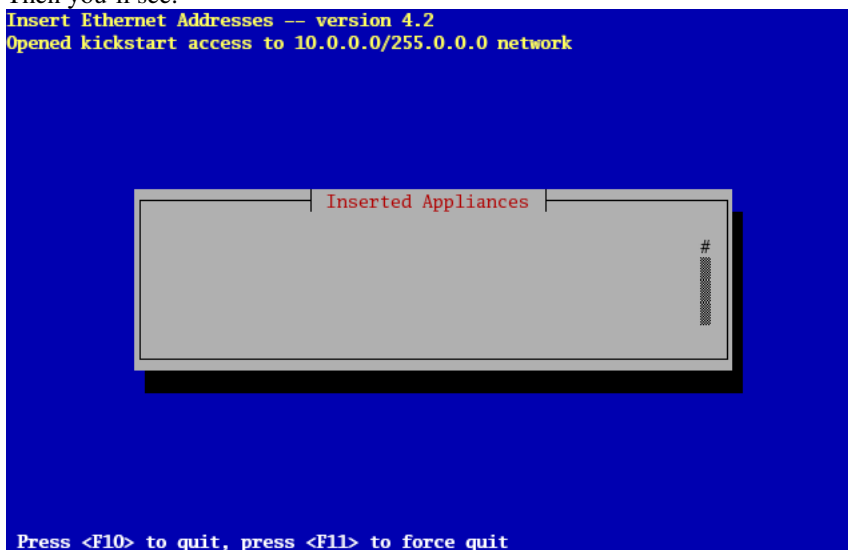
When `insert-ethers` captures the DHCP request for the managed switch, it will configure it as an ethernet switch and store that information in the MySQL database on the frontend.

As a side note, you may have to wait several minutes before the ethernet switch broadcasts its DHCP request. If after 10 minutes (or if `insert-ethers` has correctly detected and configured the ethernet switch), then you should quit `insert-ethers` by hitting the F8 key.

Now, restart `insert-ethers` and continue reading below to configure your compute nodes.

Take the default selection, `Compute`, hit 'Ok'.

3. Then you'll see:





This indicates that `insert-ethers` is waiting for new compute nodes.

4. Power up the first compute node.



The BIOS boot order of your compute nodes should be: PXE (Network Boot), CD, Hard Disk.

If you can't configure PXE to be the first boot device on your compute nodes, then you'll need to boot your compute nodes with the Kernel Roll CD.

If you don't have a CD drive in your compute nodes and if the network adapters in your compute nodes don't support PXE, see Using a Floppy to PXE boot.

5. When the frontend machine receives the DHCP request from the compute node, you will see something similar to:

```

Insert Ethernet Addresses -- version 4.2
Opened kickstart access to 10.0.0.0/255.0.0.0 network

Inserted Appliances
Discovered New Appliance
Discovered a new appliance with MAC (00:13:72:ba:c8:df)

Press <F10> to quit, press <F11> to force quit

```

This indicates that `insert-ethers` received the DHCP request from the compute node, inserted it into the database and updated all configuration files (e.g., `/etc/hosts`, `/etc/dhcpd.conf` and DNS).

The above screen will be displayed for a few seconds and then you'll see the following:

```

Insert Ethernet Addresses -- version 4.2
Opened kickstart access to 10.0.0.0/255.0.0.0 network

Inserted Appliances
00:13:72:ba:c8:df      compute-0-0      ( )  #
                                                                █

Press <F10> to quit, press <F11> to force quit

```

In the above image, insert-ethers has discovered a compute node. The "(" next to compute-0-0 indicates the node has not yet requested a kickstart file. You will see this type of output for each compute node that is successfully identified by insert-ethers.

```

Insert Ethernet Addresses -- version 4.2
Opened kickstart access to 10.0.0.0/255.0.0.0 network

Inserted Appliances
00:13:72:ba:c8:df      compute-0-0      (* ) #
                                                                █

Press <F10> to quit, press <F11> to force quit

```

*Figure:* The compute node has successfully requested a kickstart file from the frontend. If there are no more compute nodes, you may now quit insert-ethers. Kickstart files are retrieved via HTTPS. If there was an error during the transmission, the error code will be visible instead of "\*".

- At this point, you can monitor the installation by using `rocks-console`. Just extract the name of the installing compute node from the `insert-ethers` output (in the example above, the compute node name is `compute-0-0`), and execute:

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

- After you've installed all the compute nodes in a cabinet, quit `insert-ethers` by hitting the 'F8' key.
- After you've installed all the compute nodes in the first cabinet and you wish to install the compute nodes in the next cabinet, just start `insert-ethers` like:

```
# insert-ethers --cabinet=1
```

This will name all new compute nodes like `compute-1-0`, `compute-1-1`, ...

## 2.4. Upgrade or Reconfigure Your Existing Frontend

This procedure describes how to use a Restore Roll to upgrade or reconfigure your existing Rocks cluster.



If your Rocks frontend is running Rocks version 4.3 and you wish to upgrade it to version 5.0, you first need to install the `rocks-devel-env` package:

For `i386`, execute:

```
# rpm -ivh --force http://www.rocksclusters.org/ftp-site/pub/rocks/rocks-4.3/upgrade/rocks-devel-env-4.3-1.
# rpm -ivh --force http://www.rocksclusters.org/ftp-site/pub/rocks/rocks-4.3/upgrade/rocks-command-4.3-0.i3
# rpm -ivh --force http://www.rocksclusters.org/ftp-site/pub/rocks/rocks-4.3/upgrade/rocks-pylib-4.3-0.noar
```

For `x86_64`, execute:

```
# rpm -ivh --force http://www.rocksclusters.org/ftp-site/pub/rocks/rocks-4.3/upgrade/rocks-devel-env-4.3-1.
# rpm -ivh --force http://www.rocksclusters.org/ftp-site/pub/rocks/rocks-4.3/upgrade/rocks-command-4.3-0.x8
# rpm -ivh --force http://www.rocksclusters.org/ftp-site/pub/rocks/rocks-4.3/upgrade/rocks-pylib-4.3-0.noar
```

Now we'll create a Restore Roll for your frontend. This roll will contain site-specific info that will be used to quickly reconfigure your frontend (see the section below for details).

```
# cd /export/site-roll/rocks/src/roll/restore
# make roll
```

The above command will output a roll ISO image that has the name of the form:

`hostname-restore-date-0.arch.disk1.iso`. For example, on the `i386`-based frontend with the FQDN of `rocks-45.sdsc.edu`, the roll will be named like:

```
rocks-45.sdsc.edu-restore-2006.07.24-0.i386.disk1.iso
```

Burn your restore roll ISO image to a CD.

Reinstall the frontend by putting the Rocks Boot CD in the CD tray (generally, this is the Kernel/Boot Roll) and rebooting the frontend.

At the `boot` prompt, type:

```
frontend
```

At this point, the installation follows the same steps as a *normal* frontend installation (See the section: Install Frontend) -- with two exceptions:

1. On the first user-input screen (the screen that asks for 'local' and 'network' rolls), be sure to supply the Restore Roll that you just created.

2. You will be forced to manually partition your frontend's root disk.



You must reformat your `/` partition, your `/var` partition and your `/boot` partition (if it exists).

Also, be sure to assign the mountpoint of `/export` to the partition that contains the users' home areas. Do NOT erase or format this partition, or you will lose the user home directories. Generally, this is the largest partition on the first disk.

After your frontend completes its installation, the last step is to force a re-installation of all of your compute nodes. The following will force a PXE (network install) reboot of all your compute nodes.

```
# ssh-agent $SHELL
# ssh-add
# tentakel -g compute '/boot/kickstart/cluster-kickstart-pxe'
```

## 2.4.1. Restore Roll Internals

By default, the Restore Roll contains two sets of files: system files and user files, and some user scripts. The system files are listed in the 'FILES' directive in the file:

```
/export/site-roll/rocks/src/roll/restore/src/system-files/version.mk.
```

```
FILES          = /etc/passwd /etc/shadow /etc/gshadow /etc/group \
                /etc/exports /etc/auto.home /etc/motd
```

The user files are listed in the 'FILES' directive in the file:

```
/export/site-roll/rocks/src/roll/restore/version.mk.
```

```
FILES          += /etc/X11/xorg.conf
```

If you have other files you'd like saved and restored, then append them to the 'FILES' directive in the file

```
/export/site-roll/rocks/src/roll/restore/version.mk, then rebuild the restore roll.
```

If you'd like to add your own post sections, you can add the name of the script to the 'SCRIPTS' directive of the

```
/export/site-roll/rocks/src/roll/restore/version.mk file.
```

```
SCRIPTS += /export/apps/myscript.sh /export/apps/myscript2.py
```

This will add the shell script `/export/apps/myscript.sh`, and the python script `/export/apps/myscript2.py` in the post section of the `restore-user-files.xml` file.



If you'd like to run the script in "nochroot" mode, add

```
# nochroot
```

as the first comment in your script file after the interpreter line, if one is present.

For example

```
#!/bin/bash
#nochroot
echo "This is myscript.sh"
```

or

```
#nochroot
echo "This is myscript.sh"
```

will run the above code in the "nochroot" mode during installation. As opposed to

```
echo "This is myscript.sh"
#nochroot
```

or

```
#!/bin/bash
echo "This is myscript.sh"
```

will NOT run the script under "nochroot" mode.

All the files under `/export/home/install/site-profiles` are saved and restored. So, any user modifications that are added via the XML node method will be preserved.

The networking info for all node interfaces (e.g., the frontend, compute nodes, NAS appliances, etc.) are saved and restored. This is accomplished via the 'rocks dump' command.

## 2.5. Installing a Frontend over the Network

This section describes installing a Rocks frontend from a "Central" server over the wide area network, a process called WAN kickstart. The client frontend will retrieve Rocks Rolls and configuration over the Internet, and use these to install itself.

1. First, boot the node that will be your new frontend with the Kernel/Boot Roll CD (see steps 1 and 2 in the section "Install Frontend").
2. Then you'll see the screen as described in step 3 in the section "Install Frontend". Enter the FQDN of your central server in the *Hostname of Roll Server* text box (don't change this value if you want to use the default central server) then and click the `Download` button.

You'll see a screen that lists all the rolls available on the central server. Here's an example:

**Welcome to Rocks**

**Selected Rolls**

No rolls have been selected.

If you have CD/DVD-based rolls (that is, ISO images that have been burned onto CDs or a DVD), then click the *CD/DVD-based Roll* button. The media tray will eject. Then, place your first roll disk in the tray and click *Continue*. Repeat this process for each roll disk.

If you are performing a network-based installation (also known as a *central installation*), then input the name of your roll server into the *Hostname of Roll Server* field and then click the *Download* button. This will query the roll server and all the rolls that the roll server has available will be displayed. Click the *selected* checkbox for each roll you will to install from the roll server.

When you have completed your roll selections, click the *Next* button to proceed to cluster input screens (e.g., IP address selection, root password setup, etc.).

Selected	Roll Name	Version	Arch
<input type="checkbox"/>	CentOS	4.3	i386
<input type="checkbox"/>	area51	4.2	i386
<input type="checkbox"/>	base	4.2	i386
<input type="checkbox"/>	bio	4.2	i386
<input type="checkbox"/>	condor	4.2	i386
<input type="checkbox"/>	ganglia	4.2	i386
<input type="checkbox"/>	grid	4.2	i386
<input type="checkbox"/>	hpc	4.2	i386
<input type="checkbox"/>	java	4.2	i386
<input type="checkbox"/>	kernel	4.2	i386
<input type="checkbox"/>	sge	4.2	i386
<input type="checkbox"/>	updates	4.3	i386
<input type="checkbox"/>	viz	4.2	i386
<input type="checkbox"/>	vizagra.rocksclusters.org-restore	2006.08.08	i386
<input type="checkbox"/>	web-server	4.2	i386

Submit

3. Now, select the rolls from the central server. To select a roll, click the checkbox next to roll. For example, this screen shows the *area51*, *base*, *bio* and *viz* rolls selected:

**Welcome to Rocks**

**Selected Rolls**

No rolls have been selected.

If you have CD/DVD-based rolls (that is, ISO images that have been burned onto CDs or a DVD), then click the *CD/DVD-based Roll* button. The media tray will eject. Then, place your first roll disk in the tray and click *Continue*. Repeat this process for each roll disk.

If you are performing a network-based installation (also known as a *central installation*), then input the name of your roll server into the *Hostname of Roll Server* field and then click the *Download* button. This will query the roll server and all the rolls that the roll server has available will be displayed. Click the *selected* checkbox for each roll you will to install from the roll server.

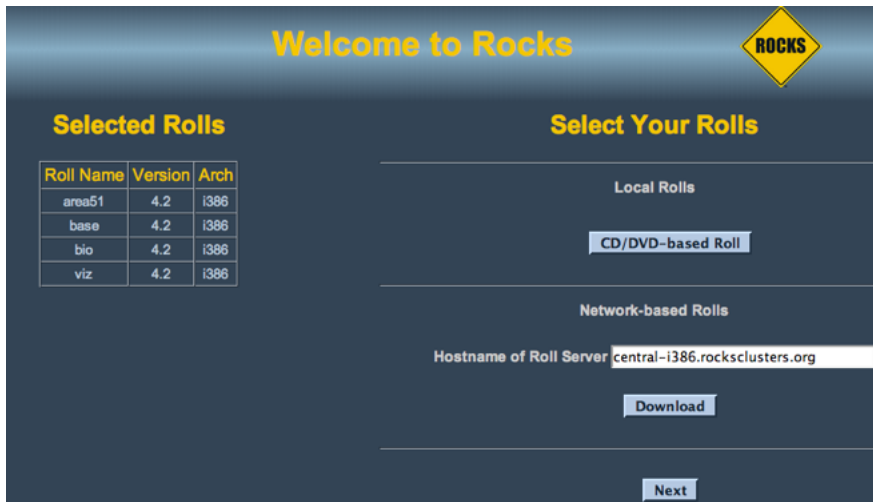
When you have completed your roll selections, click the *Next* button to proceed to cluster input screens (e.g., IP address selection, root password setup, etc.).

Selected	Roll Name	Version	Arch
<input type="checkbox"/>	CentOS	4.3	i386
<input checked="" type="checkbox"/>	area51	4.2	i386
<input checked="" type="checkbox"/>	base	4.2	i386
<input checked="" type="checkbox"/>	bio	4.2	i386
<input type="checkbox"/>	condor	4.2	i386
<input type="checkbox"/>	ganglia	4.2	i386
<input type="checkbox"/>	grid	4.2	i386
<input type="checkbox"/>	hpc	4.2	i386
<input type="checkbox"/>	java	4.2	i386
<input type="checkbox"/>	kernel	4.2	i386
<input type="checkbox"/>	sge	4.2	i386
<input type="checkbox"/>	updates	4.3	i386
<input checked="" type="checkbox"/>	viz	4.2	i386
<input type="checkbox"/>	vizagra.rocksclusters.org-restore	2006.08.08	i386
<input type="checkbox"/>	web-server	4.2	i386

Submit

Click the *Submit* button to continue.

4. Now you'll see a screen similar to the screen below. This screen indicates that the *area51*, *base*, *bio* and *viz* rolls have been selected.



- To select more rolls from another server, go to step 1 and enter a different FQDN.
- If you'd like to include CD-based rolls with your Network-based rolls, click the *CD/DVD-based Roll* button and follow the instructions in the section "Install Frontend" starting at step 4.
- When you are finished installing CD-based rolls, you will enter into the familiar Rocks installation windows. These may change depending on what rolls you have selected. Again the section "Install Frontend" has details for this process.
- The installer will then retrieve the chosen rolls, rebuild the distribution with all rolls included, then install the packages. Finally, the installer will proceed with the post-section and other elements of a standard frontend install.

Your frontend should now be installed and ready to initialize compute nodes (see section Install Compute Nodes).

## 2.6. Enabling Public Web Access to Your Frontend

To permanently enable selected web access to the cluster from other machines on the public network, follow the steps below. Apache's access control directives will provide protection for the most sensitive parts of the cluster web site, however some effort will be necessary to make effective use of them.



HTTP (web access protocol) is a clear-text channel into your cluster. Although the Apache webserver is mature and well tested, security holes in the PHP engine have been found and exploited. Opening web access to the outside world by following the instructions below will make your cluster more prone to malicious attacks and breakins.

- Edit the `/etc/sysconfig/iptables` file. Uncomment the lines as indicated in the file.

```
...
# Uncomment the lines below to activate web access to the cluster.
#-A INPUT -m state --state NEW -p tcp --dport https -j ACCEPT
```

```
#-A INPUT -m state --state NEW -p tcp --dport www -j ACCEPT  
... other firewall directives ...
```

2. Restart the iptables service. You must execute this command as the root user.

```
$ service iptables restart
```

3. Test your changes by pointing a web browser to `http://my.cluster.org/`, where "my.cluster.org" is the DNS name of your frontend machine.



If you cannot connect to this address, the problem is most likely in your network connectivity between your web browser and the cluster. Check that you can ping the frontend machine from the machine running the web browser, that you can ssh into it, etc.

## Notes

1. <http://www.oreilly.com>



# Chapter 3. Customizing your Rocks Installation

## 3.1. Adding Packages to Compute Nodes

Put the package you want to add in:

```
/home/install/contrib/5.0/arch/RPMS
```

Where *arch* is your architecture ("i386" or "x86\_64").

Create a new XML configuration file that will *extend* the current `compute.xml` configuration file:

```
# cd /home/install/site-profiles/5.0/nodes
# cp skeleton.xml extend-compute.xml
```

Inside `extend-compute.xml`, add the package name by changing the section from:

```
<package> <!-- insert your package name here --> </package>
```

to:

```
<package> your package </package>
```



It is important that you enter the *base name* of the package in `extend-compute.xml` and not the full name.

For example, if the package you are adding is named `XFree86-100dpi-fonts-4.2.0-6.47.i386.rpm`, input `XFree86-100dpi-fonts` as the package name in `extend-compute.xml`.

```
<package>XFree86-100dpi-fonts</package>
```

If you have multiple packages you'd like to add, you'll need a separate `<package>` tag for each. For example, to add both the 100 and 75 dpi fonts, the the following lines should be in `extend-compute.xml`:

```
<package>XFree86-100dpi-fonts</package>
<package>XFree86-75dpi-fonts</package>
```

Also, make sure that you remove any package lines which do not have a package in them. For example, the file should NOT contain any lines such as:

```
<package> <!-- insert your package name here --> </package>
```

Now build a new Rocks distribution. This will bind the new package into a RedHat compatible distribution in the directory `/home/install/rocks-dist/...`

```
# cd /home/install
# rocks-dist dist
```

Now, reinstall your compute nodes.

### 3.1.1. Adding Specific Architecture Packages to Compute Nodes

Often on x86\_64-based clusters, one wants to add the x86\_64 and i386 version of a package to compute nodes. To do this, in your `extend-compute.xml` file, supply the section:

```
<package>pkg.x86_64</package>
<package>pkg.i386</package>
```

Where *pkg* is the basename of the package.

Now build a new Rocks distribution.

```
# cd /home/install
# rocks-dist dist
```

Now, reinstall your compute nodes.

## 3.2. Customizing Configuration of Compute Nodes

Create a new XML configuration file that will *extend* the current `compute.xml` configuration file:

```
# cd /home/install/site-profiles/5.0/nodes/
# cp skeleton.xml extend-compute.xml
```

Inside `extend-compute.xml`, add your configuration scripts that will be run in the *post configuration* step of the Red Hat installer.

Put your bash scripts in between the tags `<post>` and `</post>`:

```
<post>
<!-- insert your scripts here -->
</post>
```

To apply your customized configuration scripts to compute nodes, rebuild the distribution:

```
# cd /home/install
# rocks-dist dist
```

Then, reinstall your compute nodes.

### 3.3. Adding Applications to Compute Nodes

If you have code you'd like to share among the compute nodes, but your code isn't in an RPM (or in a roll), then this procedure describes how you can share it with NFS.

On the frontend, go to the directory `/export/apps`.

```
# cd /export/apps
```

Then add the files you'd like to share within this directory.

All files will be available on the compute nodes under: `/share/apps`. For example:

```
# cd /export/apps
# touch myapp
# ssh compute-0-0
# cd /share/apps
# ls
myapp
```

### 3.4. Configuring Additional Ethernet Interfaces

For compute nodes, Rocks uses the first ethernet interface (`eth0`) for management (e.g., reinstallation), monitoring (e.g., Ganglia) and message passing (e.g., MPICH over ethernet). Often, compute nodes have more than one ethernet interface. This procedure describes how to configure them.

Additional ethernet interfaces are configured from the frontend via the Rocks command line. It modifies entries in the networks table on the frontend to add information about an extra interface on a node.

Once you have the information in the networks table, every time you reinstall, the additional NIC will be configured.

Suppose you have a compute node with one configured network (`eth0`) and one unconfigured network (`eth1`):

```
# rocks list host interface compute-1-1
SUBNET  IFACE  MAC                IP                NETMASK  GATEWAY  MODULE  NAME
private eth0   00:0e:0c:5d:7e:5e  10.255.255.251   255.0.0.0  -----  e1000   compute-1-1
----- eth1   00:30:1b:b2:ea:61  -----         -----  -----  tg3     -----
```

We'll configure `eth1` with the following network info and associate `eth1` with the public subnet:

- IP address = 192.168.1.1
- Gateway = 192.168.1.254
- Name = fast-1-1

```
# rocks set host interface ip compute-1-1 eth1 192.168.1.1
# rocks set host interface gateway compute-1-1 eth1 192.168.1.254
# rocks set host interface name compute-1-1 eth1 fast-1-1
# rocks set host interface subnet compute-1-1 eth1 public
```

The interface `eth1` is now configured:

```
# rocks list host interface compute-1-1
```

```

SUBNET  IFACE  MAC                IP                NETMASK          GATEWAY          MODULE  NAME
private eth0   00:0e:0c:5d:7e:5e  10.255.255.251  255.0.0.0       -----  e1000  compute-1-1
public  eth1   00:30:1b:b2:ea:61  192.168.1.1    255.255.255.0  192.168.1.254  tg3     fast-1-1

```

After specifying new network settings to a node, you will need to reinstall the node in order for the changes to take effect.

## 3.5. Compute Node Disk Partitioning

### 3.5.1. Default Disk Partitioning

The default root partition is 8 GB, the default swap partition is 1 GB, and the default /var partition is 4 GB. The remainder of the root disk is setup as the partition `/state/partition1`.

Only the root disk (the first discovered disk) is partitioned by default. To partition all disks connected to a compute node, see the section [Forcing the Default Partitioning Scheme for All Disks on a Compute Node](#).

**Table 3-1. Compute Node -- Default Root Disk Partition**

Partition Name	Size
/	8 GB
swap	1 GB
/var	4 GB
/state/partition1	<i>remainder of root disk</i>



After the initial installation, all data in the file systems labeled `/state/partitionX` will be preserved over reinstallations.

### 3.5.2. Customizing Compute Node Disk Partitions

In Rocks, to supply custom partitioning to a node, one must write code in a `<pre>` section and the code must create a file named `/tmp/user_partition_info`. Red Hat kickstart partitioning directives should be placed inside `/tmp/user_partition_info`. This allows users to fully program their cluster nodes' partitions. In the examples below, we'll explore what this means.

#### 3.5.2.1. Single Disk Example

Create a new XML node file that will *replace* the current `partition.xml` XML node file:

```
# cd /home/install/site-profiles/5.0/nodes/
# cp skeleton.xml replace-partition.xml
```

Inside `replace-partition.xml`, add the following section right after the `<main>` section:

```
<pre>
echo "clearpart --all --initlabel --drives=hda
part / --size 8000 --ondisk hda
part swap --size 1000 --ondisk hda
part /mydata --size 1 --grow --ondisk hda" > /tmp/user_partition_info
</pre>
```

The above example uses a bash script to populate `/tmp/user_partition_info`. This will set up an 8 GB root partition, a 1 GB swap partition, and the remainder of the drive will be set up as `/mydata`. Additional drives on your compute nodes can be setup in a similar manner by changing the `--ondisk` parameter.

In the above example, the syntax of the data in `/tmp/user_partition_info` follows directly from Red Hat's kickstart. For more information on the `part` keyword, see Red Hat Enterprise Linux 5 Installation Guide : Kickstart Options<sup>1</sup>.



User-specified partition mountpoint names (e.g., `/mydata`) cannot be longer than 15 characters.

Then apply this configuration to the distribution by executing:

```
# cd /home/install
# rocks-dist dist
```

To reformat compute node `compute-0-0` to your specification above, you'll need to first remove the partition info for `compute-0-0` from the database:

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

Then you'll need to remove the file `.rocks-release` from the first partition of *each disk* on the compute node. Here's an example script:

```
for i in `df | awk '{print $6}'`
do
  if [ -f $i/.rocks-release ]
  then
    rm -f $i/.rocks-release
  fi
done
```

Save the above script as `/home/install/sbin/nukeit.sh` and then execute:

```
# ssh compute-0-0 'sh /home/install/sbin/nukeit.sh'
```

Then, reinstall the node:

```
# ssh compute-0-0 '/boot/kickstart/cluster-kickstart'
```

### 3.5.2.2. Software Raid Example

If you would like to use software RAID on your compute nodes, inside `replace-partition.xml` add a section that looks like:

```
<pre>
echo "clearpart --all --initlabel --drives=hda,hdb
part / --size 8000 --ondisk hda
part swap --size 1000 --ondisk hda

part raid.00 --size=10000 --ondisk hda
part raid.01 --size=10000 --ondisk hdb

raid /mydata --level=1 --device=md0 raid.00 raid.01" > /tmp/user_partition_info
</pre>
```

Then apply this configuration to the distribution by executing:

```
# cd /home/install
# rocks-dist dist
```

To reformat compute node `compute-0-0` to your specification above, you'll need to first remove the partition info for `compute-0-0` from the database:

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

Then you'll need to remove the file `.rocks-release` from the first partition of *each disk* on the compute node. Here's an example script:

```
for i in `df | awk '{print $6}'`
do
  if [ -f $i/.rocks-release ]
  then
    rm -f $i/.rocks-release
  fi
done
```

Save the above script as `/home/install/sbin/nukeit.sh` and then execute:

```
# ssh compute-0-0 'sh /home/install/sbin/nukeit.sh'
```

Then, reinstall the node:

```
# ssh compute-0-0 '/boot/kickstart/cluster-kickstart'
```

### 3.5.2.3. Programmable Partitioning

Some issues with the above two examples are that 1) you must know the name of the disk device (e.g., `hda`) and, 2) the partitioning will be applied to all nodes. We can avoid these issues by writing a python program that emits node-specific partitioning directives.

In the next example, we'll use some Rocks partitioning library code to dynamically determine the name of the boot disk.

```
<pre arg="--interpreter /opt/rocks/bin/python">

import rocks_partition

membership = '<var name='Node_Membership' />'
nodename = '<var name="Node_Hostname"/>'

def doDisk(file, disk):
    file.write('clearpart --all --initlabel --drives=%s\n' % disk)
    file.write('part / --size=6000 --fstype=ext3 --ondisk=%s\n' % disk)
    file.write('part /var --size=2000 --fstype=ext3 --ondisk=%s\n' % disk)
    file.write('part swap --size=2000 --ondisk=%s\n' % disk)
    file.write('part /mydata --size=1 --grow --fstype=ext3 --ondisk=%s\n'
               % disk)

#
# main
#
p = rocks_partition.RocksPartition()
disks = p.getDisks()

if len(disks) == 1:
    file = open('/tmp/user_partition_info', 'w')
    doDisk(file, disks[0])
    file.close()
</pre>
```

The function `getDisks()` returns a list of discovered disks. In the code sample above, if only one disk is discovered on the node, then the function `doDisk` is called which outputs partitioning directives for a single disk. This code segment will work for nodes with IDE or SCSI controllers. For example, a node with a IDE controller will name its disks `hdX` and a node with SCSI controllers will name its disks `sdX`. But, the code segment above doesn't care how the node names its drives, it only cares if one drive is discovered.

The next example shows how a node can automatically configure a node for software raid when it discovers 2 disks. But, if the node only discovers 1 disk, it will output partitioning info appropriate for a single-disk system.

```
<pre arg="--interpreter /opt/rocks/bin/python">

import rocks_partition

membership = '<var name='Node_Membership' />'
nodename = '<var name="Node_Hostname"/>'

def doRaid(file, disks):
    file.write('clearpart --all --initlabel --drives=%s\n'
               % ','.join(disks))

    raidparts = []

    for disk in disks:
        if disk == disks[0]:
            part = 'part / --size=6000 --fstype=ext3 ' + \
                  '--ondisk=%s\n' % disk
```

```

        file.write(part)

        part = 'part /var --size=2000 --fstype=ext3 ' + \
              '--ondisk=%s\n' % disk
        file.write(part)

        part = 'part raid.%s --size=5000 --ondisk=%s\n' % (disk, disk)
        file.write(part)

        raidparts.append('raid.%s' % disk)

    raid = 'raid /bigdisk --fstype=ext3 --device=md0 --level=1 %s\n' \
          % ' '.join(raidparts)
    file.write(raid)

def doDisk(file, disk):
    file.write('clearpart --all --initlabel --drives=%s\n' % disk)
    file.write('part / --size=6000 --fstype=ext3 --ondisk=%s\n' % disk)
    file.write('part /var --size=2000 --fstype=ext3 --ondisk=%s\n' % disk)
    file.write('part swap --size=2000 --ondisk=%s\n' % disk)
    file.write('part /mydata --size=1 --grow --fstype=ext3 --ondisk=%s\n'
              % disk)

#
# main
#
p = rocks_partition.RocksPartition()
disks = p.getDisks()

file = open('/tmp/user_partition_info', 'w')

if len(disks) == 2:
    doRaid(file, disks)
elif len(disks) == 1:
    doDisk(file, disks[0])

file.close()

</pre>

```

If the node has 2 disks (if `len(disks) == 2:`), then call `doRaid()` to configure a software raid 1 over the 2 disks. If the node has 1 disk then call `doDisk()` and output partitioning directives for a single disk.

In the next example, we show how to output user-specified partitioning info for only one specific node (compute-0-0). All other nodes that execute this pre section will get the default Rocks partitioning.

```

<pre arg="--interpreter /opt/rocks/bin/python">

import rocks_partition

membership = '<var name='Node_Membership' />'
nodename = '<var name="Node_Hostname" />'

```



```

def doRaid(file, disks):
    file.write('clearpart --all --initlabel --drives=%s\n'
              % ','.join(disks))

    raidparts = []

    for disk in disks:
        if disk == disks[0]:
            part = 'part / --size=6000 --fstype=ext3 ' + \
                  '--ondisk=%s\n' % disk
            file.write(part)

            part = 'part /var --size=2000 --fstype=ext3 ' + \
                  '--ondisk=%s\n' % disk
            file.write(part)

            part = 'part raid.%s --size=5000 --ondisk=%s\n' % (disk, disk)
            file.write(part)

            raidparts.append('raid.%s' % disk)

    raid = 'raid /bigdisk --fstype=ext3 --device=md0 --level=1 %s\n' \
          % ','.join(raidparts)
    file.write(raid)

def doDisk(file, disk):
    file.write('clearpart --all --initlabel --drives=%s\n' % disk)
    file.write('part / --size=6000 --fstype=ext3 --ondisk=%s\n' % disk)
    file.write('part /var --size=2000 --fstype=ext3 --ondisk=%s\n' % disk)
    file.write('part swap --size=2000 --ondisk=%s\n' % disk)
    file.write('part /mydata --size=1 --grow --fstype=ext3 --ondisk=%s\n'
              % disk)

#
# main
#
p = rocks_partition.RocksPartition()
disks = p.getDisks()

if nodename in [ 'compute-0-0' ]:
    file = open('/tmp/user_partition_info', 'w')

    if len(disks) == 2:
        doRaid(file, disks)
    elif len(disks) == 1:
        doDisk(file, disks[0])

    file.close()

```

### 3.5.3. Forcing the Default Partitioning Scheme for All Disks on a Compute Node

This procedure describes how to force all the disks connected to a compute node back to the default Rocks partitioning scheme regardless of the current state of the disk drive on the compute node. the Rocks compute node default partitioning scheme.

The root disk will be partitioned as described in Default Partitioning and all remaining disk drives will have one partition with the name `/state/partition2`, `/state/partition3`, ...

For example, the following table describes the default partitioning for a compute node with 3 SCSI drives.

**Table 3-2. A Compute Node with 3 SCSI Drives**

Device Name	Mountpoint	Size
/dev/sda1	/	8 GB
/dev/sda2	swap	1 GB
/dev/sda3	/var	4 GB
/dev/sda4	/state/partition1	<i>remainder of root disk</i>
/dev/sdb1	/state/partition2	<i>size of disk</i>
/dev/sdc1	/state/partition3	<i>size of disk</i>

Create a new XML configuration file that will *replace* the current `partition.xml` configuration file:

```
# cd /home/install/site-profiles/5.0/nodes/
# cp skeleton.xml replace-partition.xml
```

Inside `replace-partition.xml`, add the following section:

```
<pre>
echo "rocks force-default" > /tmp/user_partition_info
</pre>
```

Then apply this configuration to the distribution by executing:

```
# cd /home/install
# rocks-dist dist
```

To reformat compute node `compute-0-0` to your specification above, you'll need to first remove the partition info for `compute-0-0` from the database:

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

Then you'll need to remove the file `.rocks-release` from the first partition of *each disk* on the compute node. Here's an example script:

```
for i in `df | awk '{print $6}'`
do
  if [ -f $i/.rocks-release ]
```

```

then
  rm -f $i/.rocks-release
fi
done

```

Save the above script as `/home/install/sbin/nukeit.sh` and then execute:

```
# ssh compute-0-0 'sh /home/install/sbin/nukeit.sh'
```

Then, reinstall the node:

```
# ssh compute-0-0 '/boot/kickstart/cluster-kickstart'
```

After you have returned all the compute nodes to the default partitioning scheme, then you'll want to remove `replace-partition.xml` in order to allow Rocks to preserve all non-root partition data.

```
# rm /home/install/site-profiles/5.0/nodes/replace-partition.xml
```

Then apply this update to the distribution by executing:

```
# cd /home/install
# rocks-dist dist
```

### 3.5.4. Forcing Manual Partitioning Scheme on a Compute Node

This procedure describes how to force a compute node to always display the manual partitioning screen during install. This is useful when you want full and explicit control over a node's partitioning.

Create a new XML configuration file that will *replace* the current `partition.xml` configuration file:

```
# cd /home/install/site-profiles/5.0/nodes/
# cp skeleton.xml replace-partition.xml
```

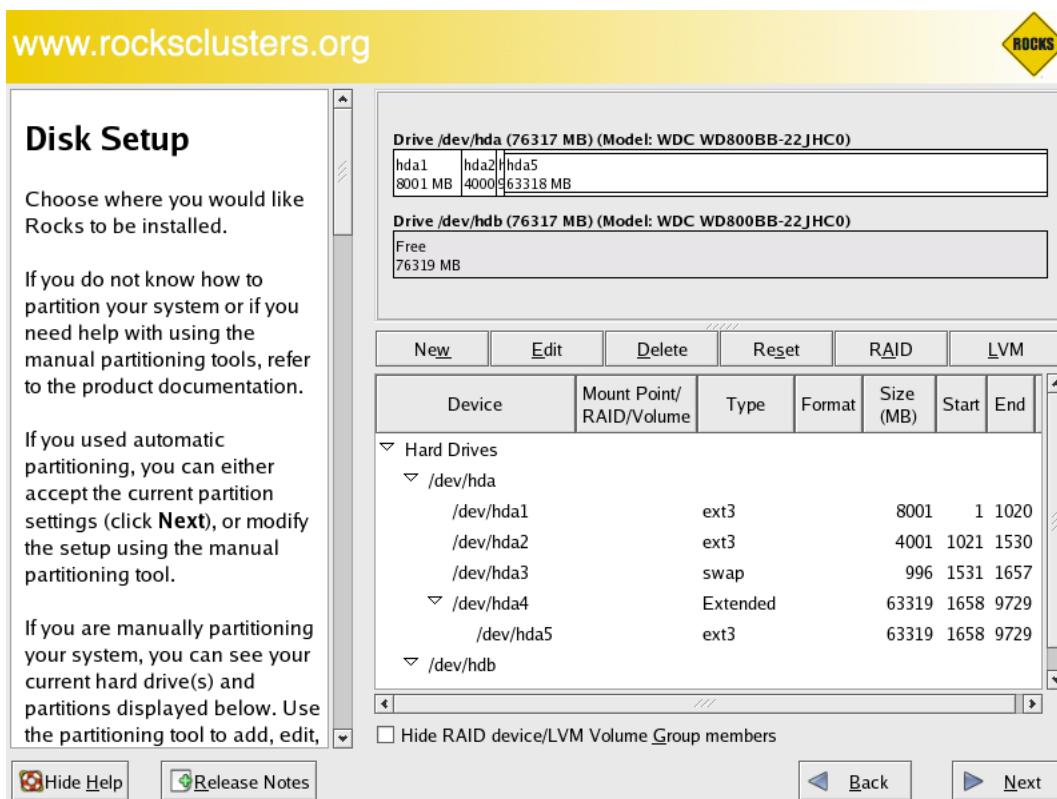
Inside `replace-partition.xml`, add the following section:

```
<pre>
echo "rocks manual" > /tmp/user_partition_info
</pre>
```

Then apply this configuration to the distribution by executing:

```
# cd /home/install
# rocks-dist dist
```

The next time you install a compute node, you will see the screen:



To interact with the above screen, from the frontend execute the command:

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

## 3.6. Creating a Custom Kernel RPM

### 3.6.1. Creating a Custom Kernel RPM using kernel.org's Source

- On the frontend, check out the Rocks source code. See Access to Rocks Source Code for details.
- Change into the directory:

```
# cd rocks/src/roll/kernel/src/kernel.org
```

- Download the kernel source tarball from kernel.org. For example:

```
# wget http://www.kernel.org/pub/linux/kernel/v2.6/linux-2.6.24.4.tar.gz
```

- Create a kernel "config" file and put it in config-<version>

You can create the config file by using the following procedure:

```
# tar xzf linux-2.6.24.4.tar.gz
# cd linux-2.6.24.4
# make menuconfig
```

Configure the kernel anyway you need, and after the configuration is over choose to save the configuration in an alternative location. Enter the name of the file as `../config-2.6.24.4`. Finally, exit the configuration and remove the `linux-2.6.24.4` directory.



The `<version>` number must match the version number of the kernel source. For example, if you downloaded `linux-2.6.24.4.tar.gz`, the name of the config file must be `config-2.6.24.4`.

- Update `version.mk`.

The file `version.mk` has the following contents:

```
NAME           = kernel
RELEASE        = 1

VERSION        = 2.6.24.4
PAE            = 0
XEN            = 0
```

The `VERSION` value must match that of the linux kernel tarball you downloaded (e.g., 2.6.24.4).

If you are building a kernel for an i386 system that has more than 4 GB, you'll need to set the PAE (page address extension) flag. This will name the resulting kernel `kernel-PAE*rpm`. If the anaconda installer detects more than 4 GB memory, then it will install the kernel-PAE RPM and not the kernel RPM.

```
PAE            = 1
```

If you are building a kernel that contains Xen support, then set the XEN flag. This will name the resulting kernel `kernel-xen*rpm`.

```
XEN            = 1
```

It is illegal to set both the PAE and XEN flags.

If you want to build a kernel that the installer will use, then you must unset both the PAE and XEN flags (the default configuration of `version.mk`). This will name the resulting kernel `kernel*rpm`.



If you want to build a custom kernel for both the installer and for the running system and the running system requires either the kernel-PAE or kernel-xen RPM, then you'll have to execute this procedure twice: once to build the installer kernel (PAE = 0 and XEN = 0) and once to build the kernel that will be used on the running system (PAE = 1 or XEN = 1).

- Build the kernel:

```
# make rpm
```

- Copy the resulting RPMs into the current distribution:

```
# cp ../../RPMS/<arch>/kernel*rpm /home/install/contrib/5.0/<arch>/RPMS/
```

Where `<arch>` is i386 or x86\_64.

- Rebuild the distribution:

```
# cd /home/install
# rocks-dist dist
```

- Test the new kernel by reinstalling a compute node:

```
# shoot-node compute-0-0
```

- If the kernel works to your satisfaction, reinstall all the compute nodes that you want to run the new kernel.

## 3.7. Enabling RSH on Compute Nodes

The default Rocks configuration does not enable rsh commands or login to compute nodes. Instead, Rocks uses ssh as a drop in replacement for rsh. There may be some circumstances where ssh does not have exactly the same semantics of rsh. Further, there may be some users that cannot modify their application to switch from rsh to ssh. If you are one of these users you may wish to enable rsh on your cluster.



Enabling rsh on your cluster has serious security implications. While it is true rsh is limited to the private-side network this does not mean it is as secure as ssh.

Enabling rsh is done by modifying the default kickstart graph. First copy the default `rsh.xml` into the site customization directory:

```
# cp /home/install/rocks-dist/lan/arch/build/graphs/default/base-rsh.xml \
/home/install/site-profiles/5.0/graphs/default/
```

Where *arch* is your architecture ("i386" or "x86\_64").

Now edit `/home/install/site-profiles/5.0/graphs/default/base-rsh.xml` and change the following:

```
<!-- Uncomment to enable RSH on your cluster

<edge from="client">
    <to>xinetd</to>
    <to>rsh</to>
</edge>

-->
```

Follow the instruction and uncomment this block. This will force all appliance types that reference the client class (compute nodes, NAS nodes, ...) to enable an rsh service that trusts all hosts on the private side network. This uncommented block should look like this:

```
<edge from="client">
    <to>xinetd</to>
    <to>rsh</to>
</edge>
```

To apply this configuration to the compute nodes, rebuild the distribution:

```
# cd /home/install
# rocks-dist dist
```

Then, reinstall your compute nodes.

## 3.8. Adding a New Appliance Type to the Cluster

This procedure describes how to add a new appliance type to your cluster. This is useful when you want a subset of compute nodes to have specific behavior that is different from the rest of the compute nodes. For example, if you want all the nodes in cabinet 1 to be configured differently from the rest of the compute nodes.

Before you begin, you'll want to be comfortable with the Rocks XML framework that is used to produce a configuration graph. Details on this framework are found in the Reference Guide<sup>2</sup>.

First, you'll need to create a new node XML file. This file will contain the configuration scripts and/or packages that will be applied to each of your appliances. Let's call it `my-compute.xml`. This file should be created in the directory `/home/install/site-profiles/5.0/nodes`. Below is the contents of the file:

```
<?xml version="1.0" standalone="no"?>

<kickstart>

<description>
My specialized compute node
</description>

<changelog>
</changelog>

<post>

<file name="/etc/motd" mode="append">
My Compute Appliance
</file>

</post>

</kickstart>
```

Now, we'll link the above file into the existing XML configuration graph. We'll simply point the above XML node to the existing `compute.xml` node. In object-oriented terms, we are inheriting all the functionality of the compute appliance and then extending it.

To link `my-compute.xml` to `compute.xml`, in the directory

`/home/install/site-profiles/5.0/graphs/default`, create the file `my-appliance.xml` and have it contain:

```
<?xml version="1.0" standalone="no"?>

<graph>
```

```

<description>
</description>

<changelog>
</changelog>

<edge from="my-compute">
  <to>compute</to>
</edge>

<order gen="kgen" head="TAIL">
  <tail>my-compute</tail>
</order>

</graph>

```

To apply the changes above to the current distribution, execute:

```

# cd /home/install
# rocks-dist dist

```

Now we need to add an entry into the Rocks MySQL database. This is accomplished with the rocks command line:

```

# /opt/rocks/bin/rocks add appliance my-compute membership='My Compute' \
  short-name='mc' node='my-compute'

```

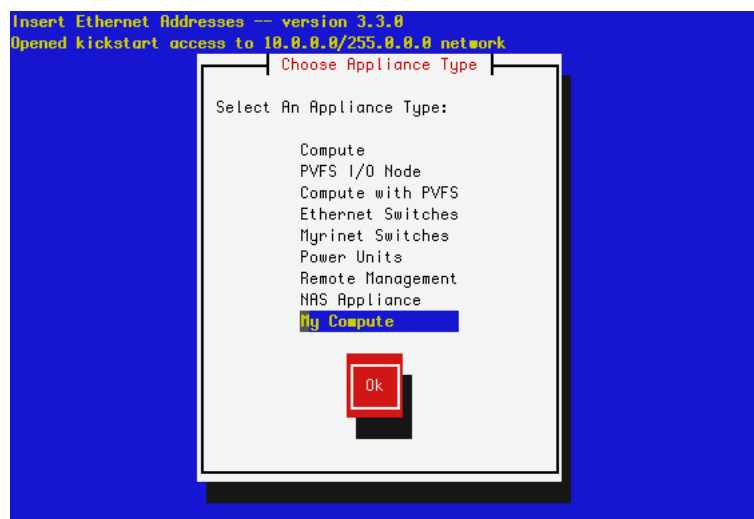
Now let's retarget an existing compute node. We'll use `insert-ethers` to accomplish this task. First, ask `insert-ethers` to replace `compute-0-0`:

```

# insert-ethers --replace compute-0-0

```

This displays the screen:



Select *My Compute* then hit *Ok*. This removes `compute-0-0` from the database and the next node that asks to be configured (that is, the next node that sends out a DHCP request) will be assigned the name `my-compute-0-0`. To see this in action, instruct `compute-0-0` to reinstall itself:



```
# shoot-node compute-0-0
```

Eventually, you'll see `insert-ethers` report that it discovered `my-compute-0-0`. After the node installs, it will be configured as a *my-appliance*. You can login to the node by executing:

```
# ssh my-compute-0-0
```

Your custom appliance can be applied to any new node in your system by starting `insert-ethers` as instructed above, then by booting a new node in configuration mode (by forcing it to PXE boot or by booting the node with the Kernel/Boot Roll).

## 3.9. Adding a Device Driver

This section describes how to add a device driver to the installation environment (*initrd.img*). This enables the installation environment to use the new driver as well as installing the device driver into the running environment (that is, after the node has installed).

This feature is enabled by `ddiskit`<sup>3</sup> which is maintained by Jon Masters at Red Hat.

1. Set up a build environment:

```
# cd /export
# cvs -d:pserver:anonymous@src.rocksclusters.org:/export/cvs checkout rocks-5.0
```

2. Go to the directory which holds the device driver code:

```
# cd /export/rocks-5.0/rocks/src/roll/kernel/src/rocks-boot/enterprise/5/images/drivers
```

3. In this directory, you'll see some example drivers. Let's look at the *e1000* driver:

```
# cd e1000
```

4. If you want to supply a new version of the driver, you'll have to download the e1000 source tarball and copy the \*.c and \*.h files from the tarball to this directory. Make sure all the \*.c and \*.h files are listed at the top of the *Makefile*:

```
MODULES := e1000
```

```
SOURCES := e1000_main.c e1000_hw.c e1000_ethtool.c e1000_param.c
```

```
HEADERS := e1000.h e1000_hw.h e1000_osdep.h
```

5. You'll need to make sure the proper PCI ids are in the file *pcitable*. For example, to test on one of our Dell SC1425's, we added the line:

```
0x8086 0x1076 "e1000" "Intel|82541GI/PI Gigabit Ethernet Controller (rev 05)"
```

6. Now we'll need to specify to the device driver building code that the e1000 driver should be built. To do this, edit the file *subdirs*:

```
# cd ..
# vi subdirs
```

7. Change the section from:

```
#
# put a list of all the driver directories that you'd like to build.
```

```
#
# for example, to build the 'e1000' driver, uncomment the line below:
#e1000

to:

#
# put a list of all the driver directories that you'd like to build.
#
# for example, to build the 'e1000' driver, uncomment the line below:
e1000
```

#### 8. Build the *rocks-boot* package:

```
# cd /export/rocks-5.0/rocks/src/roll/kernel/src/rocks-boot
# make rpm
```

#### 9. When this completes, copy the binary RPMs into a directory where the distribution building utility (*rocks-dist*) will find and include them:

```
# cp /export/rocks-5.0/rocks/src/roll/kernel/RPMS/x86_64/rocks-boot* \
/home/install/contrib/5.0/x86_64/RPMS/
```



If you are building on an i386 system, change the above x86\_64 references to i386.

#### 10. Rebuild the distro:

```
# cd /home/install
# rocks-dist dist
```

#### 11. Install the newly created *initrd.img* and its matching kernel *vmlinuz* so PXE booted nodes will get the new device drivers:

```
# cd /home/install
# rpm -Uvh --force rocks-dist/lan/x86_64/RedHat/RPMS/rocks-boot-4*.rpm
# cp /boot/kickstart/default/initrd.img /tftpboot/pxelinux/
# cp /boot/kickstart/default/vmlinuz /tftpboot/pxelinux/
```

#### 12. Now PXE boot a node. This node will load your new driver and will install this driver into the running environment.

### 3.9.1. Adding a New Device Driver (That Isn't One of the Example Drivers)

If the name of your device driver you wish to add is not one of the example device drivers (e.g., *ata\_piix*, *cciss*, *e1000*, *sk98lin*, or *tg3*), then you'll need to create a new directory and populate it with the appropriate files.

For help on how to populate your new driver directory, see:

`/export/rocks-5.0/rocks/src/roll/kernel/src/rocks-boot/enterprise/5/images/drivers/INSTALL.`

The rest of the build process follows the same procedure as above starting at step 6 where you'll have to add the name of your new driver to the file *subdirs*.

## 3.10. Extending DNS

Rocks provides a mechanism to put external hostnames under the DNS control of your cluster. Generally, external hosts have names served by site-wide DNS servers. However if there is no external DNS server available, you may want to use your frontend's DNS server to handle the name to IP mappings for certain non-cluster nodes.

Since the DNS configuration file is automatically generated Rocks, you cannot add static configuration to the standard zone files in `/var/named`. Instead, you need to put local name mappings in the file:

```
/var/named/rocks.domain.local
```

And reverse mappings (IP to name) in:

```
/var/named/reverse.rocks.domain.local
```

To add the mappings in the above `.local` files to the running configuration, execute:

```
# insert-ethers --update
```

These files are in the BIND configuration format, just like the standard `rocks.domain` and `reverse.rocks.domain` files.



Your external hosts will have names in the `.local` cluster domain.



Errors in your local DNS files will cause the entire local cluster domain naming to fail. Proceed with caution.

## Notes

1. [http://www.redhat.com/docs/manuals/enterprise/RHEL-5-manual/en-US/RHEL510/Installation\\_Guide/s1-kickstart2-options.html](http://www.redhat.com/docs/manuals/enterprise/RHEL-5-manual/en-US/RHEL510/Installation_Guide/s1-kickstart2-options.html)
2. <http://www.rocksclusters.org/rocks-documentation/reference-guide/5.0/>
3. <http://dup.et.redhat.com/ddiskit/>

# Chapter 4. Community Resources

## 4.1. Access to Rocks Source Code

To checkout the source:

```
put in mercurial stuff here
```

### 4.1.1. Read-Write Access to the Source

To get write access to the head of the source tree, send a note to [source@rocksclusters.org](mailto:source@rocksclusters.org).

## 4.2. All Past Rocks Releases

All past Rocks releases can be found at <ftp.rocksclusters.org>.

## 4.3. Email Discussion List

Send a note to our email discussion list.

## 4.4. Office Hours

Call us on Skype.

## 4.5. Rocks Wiki

Contribute to the wiki.

## 4.6. Training Material

Rocks slides.

## 4.7. Rocks License

Put license here

### **4.7.1. Commercial Companies Who Wish to License Rocks**

The Rocks Logo and the name "Rocks" are registered trademarks with the United States Patent and Trademark Office.

Commercial companies that wish to use the name "Rocks" or the logo in a product name or marketing material, are required to get written permission from the Technology Transfer and Intellectual Property Services Office at UCSD (email: [invent@ucsd.edu](mailto:invent@ucsd.edu)).

### **4.7.2. Non-Attribution Commercial License**

Katz gets all legal here.

## **4.8. Rocks Foundation**

Rocks Foundation. Non-profit. Cafepress.

# Chapter 5. Administration Examples

## 5.1. Introduction to the Rocks Command Line

In Rocks 4.3 the Rocks command line was introduced to provide a more uniform interface to the underlying structures used to control system configuration and behaviour. Wherever possible, Rocks uses a SQL database (MySQL currently) to hold information about nodes, partitioning information, boot parameters and other information. Based on information in the database, various configuration files are rewritten. The re-generation of configuration files occurs everytime a node is added or deleted from the cluster. The re-generation of configuration files can also be forced. A large fraction of rocks commands manipulate data held in the configuration database. In general, the process of changing configuration is a two-step process:

1. Use rocks commands to change configuration in the database (e.g. `rocks set host`)
2. Rewrite configuration files using `rocks sync config`

It should be noted that step 1 above is usually called several times to update in the database and then step 2 is called to write individual configuration files in the format that the native OS tools understand.



Rocks commands have arguments and parameters. Parameters are of the form "param=<value>" and may appear anywhere. Arguments must appear in the order defined by the command. To get help on any rocks command type "help" for the argument to the command. For example `rocks set host interface ip help`

## 5.2. Boot Order and PXE First

Prior to Rocks 4.3, the BIOS-defined boot order of a compute node *required* that a network boot (known as PXE) come after local hard disk. In particular the boot order in BIOS would be set as

1. CDROM
2. Hard Disk
3. On-board Network Device (PXE)

A user would have to intercept the boot sequence (often by hitting the F12 key on an attached keyboard) to force a network boot. Rocks also provided a small utility on each node (`/boot/kickstart/cluster-kickstart-pxe`) that would manipulate the two-bytes on the local hard disk to force BIOS to bypass booting from the local disk and try the next device on the boot list. When boot order was set as above, the node would pxe boot and therefore re-install.

The logic for this structure was that a frontend did not need to know the state of node (whether it had failed and should be reinstalled or had some other intermediate state). Also it is not required that a frontend by up for a node to reboot itself. Another practical issue arises for PXE booting large clusters. Since the PXE client is in NIC firmware, no assumptions about timeouts, retries or other elements that figure into robustness could be made. Large cluster reinstalls (or reboots) for a kernel the comes over PXE would often result in hung nodes because of the low level of

robustness of TFTP (the underlying protocol used to transfer initial kernel and ramdisk image for nodes booting over the network). For wholesale re-installation of large clusters, PXE does not scale well. For this, Rocks provides the installation kernel and initial ramdisk image on the local hard drive. The command `/boot/kickstart/cluster-kickstart` run on a local node will cause that node to re-install itself by using a local (hard disk) copy of the installation kernel and initial ramdisk.



The above boot order and behaviour continues to be supported in Rocks 4.3. That is, existing rocks clusters can be upgraded without requiring the cluster owner to change any BIOS setting.

### 5.3. Support for PXE First

Rocks 4.3 supports a network device first (or PXE first) BIOS-defined boot order. It is now *recommended* that a network boot (known as PXE) come before local hard disk. In particular the boot order in BIOS should be set as

1. CDROM
2. On-board Network Device (PXE)
3. Hard Disk

The default PXE "action" is to simply pass to the next device down on the BIOS boot list. In the usual case, this is to the local hard disk. Most of the time decision to boot or reinstall is still left to the local node and frontend does not need to know which state the node desires. If booting into re-installation (e.g. the node either did not shut down properly, or `/boot/kickstart/cluster-kickstart` was called locally) that will proceed as expected. However, it is possible to change this action on a per-node basis.

### 5.4. Forcing a Re-install at Next PXE Boot

Starting with Rocks 4.3, the frontend must be configured to tell a node to re-install at the next PXE boot. This action is controllable on a per-node basis. At the end of successful installation, the node requests the frontend to set its pxe boot to `os`. To re-install a node using PXE (e.g. `compute-0-0`), then do the following:

```
# rocks set host pxeboot compute-0-0 action=install
# ssh compute-0-0 "shutdown -r now"
```



If the boot order has not been set to pxe first, you can force a pxe boot with the local keyboard, or by calling `/boot/kickstart/cluster-kickstart-pxe` on the local node.

## 5.5. Inspecting and Changing PXE Behaviour

There are two parts to the Rocks database for modifying PXE behaviour: *pxeboot* and *pxeaction*. The *pxeboot* part determines which logical action should be performed. The base roll ships with three logical actions: "os", "install", and "memtest". The second table in the *pxeaction* table. The associates a logical action with specific tftp configuration. The *pxeaction* table supports a default configuration for an action and it supports a per-node override of the default configuration.



It is possible to have commands affect all nodes. In this case use '%' as the host wildcard. For example `rocks set host pxeboot % action=install` will cause ALL nodes to reinstall at next pxeboot.



For commands that take lists of hosts, it is possible to use an appliance type for the host(s) argument. `rocks list appliance` are the list of valid appliance types. To set the *pxeaction* of all compute appliances to be install, use `rocks set host pxeboot compute action=install`

The following illustrates how to inspect the current action of nodes and then the specifics of each action.

```
[root@vizzy ~]# rocks list host pxeboot
HOST          ACTION
vizzy:        os
compute-0-0:  os
compute-0-1:  os
compute-1-0:  os
compute-1-1:  install
compute-2-0:  os
compute-2-1:  os
```

```
[root@vizzy ~]# rocks list host pxeaction compute-1-1
ACTION        COMMAND      ARGS
install       kernel vmlinuz append ks initrd=initrd.img ramdisk_size=150000
               lang= devfs=nomount pxe kssendmac selinux=0
install headless kernel vmlinuz append ks initrd=initrd.img ramdisk_size=150000
               lang= devfs=nomount pxe kssendmac selinux=0 headless vnc
memtest       kernel memtest -----
os            localboot 0 -----
[root@vizzy ~]#
```

In the above, all nodes are set to pxeboot the "os", except for node compute-1-1. That node will call the pxeboot named "install". In the case the tftp configuration file contain the details arguments of the listed in the install action. The command `rocks list host pxeaction compute-1-1` shows the details of each logical action.



### 5.5.1. Changing a logical PXE action

It is possible to override the details of a logical action on a per-node basis. Suppose that we wanted to make the logical action of "install" for compute-1-1 to be headless and to set a flag `acpi=off`. Then the following will accomplish this using a Rocks add command.

```
[root@vizzy ~]# rocks add host pxeaction compute-1-1 action=install command="kernel vmlinuz" \
args="append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=nomount pxe kssendmac selinux=0 he
```

To inspect that the change is indeed specific to just compute-1-1, then do the following

```
[root@vizzy ~]# rocks list host pxeaction compute-1-1
ACTION          COMMAND          ARGS
install         kernel vmlinuz  append ks initrd=initrd.img ramdisk_size=150000
                                     lang= devfs=nomount pxe kssendmac selinux=0 headless vnc acpi=off
install headless kernel vmlinuz  append ks initrd=initrd.img ramdisk_size=150000
                                     lang= devfs=nomount pxe kssendmac selinux=0 headless vnc
memtest         kernel memtest  -----
os              localboot 0     -----
```

```
[root@vizzy ~]# rocks list host pxeaction compute-1-0
ACTION          COMMAND          ARGS
install         kernel vmlinuz  append ks initrd=initrd.img ramdisk_size=150000
                                     lang= devfs=nomount pxe kssendmac selinux=0
install headless kernel vmlinuz  append ks initrd=initrd.img ramdisk_size=150000
                                     lang= devfs=nomount pxe kssendmac selinux=0 headless vnc
memtest         kernel memtest  -----
os              localboot 0     -----
```

In the above, compute-1-1 has a specific override for its install pxeaction. compute-1-0 still retains the default install action.



Manipulating the pxeaction does NOT update the actual tftp configuration file. You must use `rocks set pxeboot action=<action> hostname` to actually write the specific tftp configuration file



To remove a specific override of a pxeaction for a node use `rocks remove host pxeaction action=<action> hostname`

### 5.5.2. Running Memtest86

It is often useful to run the memory testing tool `memtest86+1` to determine if memory is valid. The straightforward way to accomplish this in Rocks 4.3 is to apply the following procedure (in our example case for host compute-1-1)

```
1. # rocks set host pxeboot compute-1-1 action=memtest
```

2. Boot node compute-1-1 by power cycle or other means.
3. After compute-1-1 has successfully started the diagnostic, reset the pxeboot parameter # rocks set host pxeboot compute-1-1 action=os

## 5.6. Working with and Modifying Network Configuration

The Rocks database holds information that has been discovered about a host and in particular records network interface information including MAC addresses and local device modules. The Rocks command line has several tools to inspect and update entries in the database. Reinstallation of a node will apply the changes to a node. See the following section on Swapping Frontend Ethernet Interfaces.

For the following discussion, a frontend named "jeebs" will be used for illustration. To list the ethernet interfaces do the following:

```
# rocks list host interface jeebs
```

SUBNET	IFACE	MAC	IP	NETMASK	GATEWAY	MODULE	NAME
private	eth0	00:0e:0c:a7:57:d7	10.1.1.1	255.0.0.0	-----	e1000	jeebs
public	eth1	00:19:b9:21:b8:b6	172.19.119.241	255.255.255.0	172.19.119.1	tg3	jeebs.rocksclusters

This describes the two interfaces, eth0 and eth1. Suppose that it is desired to swap these two interfaces. That is we would want to associate the mac address 00:0e:0c:a7:57:d7 with eth1. To do this we must also associate the correct module. The following will change the information only in the database. This uses the `rocks set host interface group` of commands.

```
# rocks set host interface mac jeebs iface=eth1 mac=00:0e:0c:a7:57:d7
# rocks set host interface module jeebs iface=eth1 module=e1000

# rocks set host interface mac jeebs iface=eth0 mac=00:19:b9:21:b8:b6
# rocks set host interface module jeebs iface=eth0 module=tg3
```

Then the updated database configuration is as follows

SUBNET	IFACE	MAC	IP	NETMASK	GATEWAY	MODULE	NAME
private	eth0	00:19:b9:21:b8:b6	10.1.1.1	255.0.0.0	-----	tg3	jeebs
public	eth1	00:0e:0c:a7:57:d7	172.19.119.241	255.255.255.0	172.19.119.1	e1000	jeebs.rocksclusters



After any such database change, always run `rocks sync config`. This will update service configuration files (like `dhcpd`). Reinstalling a node will apply these types of changes to the node.

### 5.6.1. Swapping Interfaces on the Frontend

The previous section described how to swap two interfaces in the database. For compute nodes it is easiest to simply reinstall nodes for the new configuration to be applied properly. For frontends, this is not possible and you should

apply the following procedure after you have updated information in the database. This will recreate the appropriate files.



Before performing this procedure, you must be logged into the frontend's console. Then, you must shutdown the frontend's network by executing:

```
# service network stop

# sed -i -e '/alias eth/d' -e '/^#/d' /etc/modprobe.conf
# dbreport ifcfg modules jeebs >> /etc/modprobe.conf
# dbreport ifcfg eth0 jeebs > /etc/sysconfig/network-scripts/ifcfg-eth0
# dbreport ifcfg eth1 jeebs > /etc/sysconfig/network-scripts/ifcfg-eth1

# shutdown -r now
```

## Notes

1. <http://www.memtest.org>

# Chapter 6. Command Reference

## 6.1. add

### 6.1.1. add appliance

#### rocks add appliance

{appliance} [compute=*bool*] [graph=*string*] [membership=*string*] [node=*string*] [public=*bool*] [short-name=*string*]

Add an appliance specification to the database.

#### arguments

appliance

The appliance name (e.g., 'compute', 'frontend', 'nas').

#### parameters

[compute=*bool*]

True means jobs can be scheduled on these types of appliances. The default is 'yes'.

[graph=*string*]

The directory name of the graph XML files. The default is 'default'.

[membership=*string*]

The full membership name of the appliance. This name will be displayed in the appliances menu by insert-ethers (e.g., 'NAS Appliance'). If not supplied, the membership name is set to the appliance name.

[node=*string*]

The name of the root XML node (e.g., 'compute', 'nas', 'viz-tile'). If not supplied, the node name is set to the appliance name.

[public=*bool*]

True means this appliance will be displayed by 'insert-ethers' in the Appliance menu. The default is 'yes'.

[short-name=*string*]

The basename for the short host name (e.g., 'c', 'f', 'n').

## examples

```
# rocks add appliance nas membership="NAS Appliance" node=nas graph=default compute=no public=yes
```

```
# rocks add appliance tile membership=Tile node=viz-tile graph=default compute=yes public=yes
```

## 6.1.2. add distribution

```
rocks add distribution {distribution}
```

Add a distribution specification to the database.

### arguments

distribution

Name of the new distribution.

## examples

```
# rocks add distribution rocks-dist
```

Adds the distribution named "rocks-dist" into the database.

## 6.1.3. add host

```
rocks add host {host} [cpus=int] [membership=string] [rack=int] [rank=int]
```

Add an new host to the cluster.

### arguments

host

A single host name. If the hostname is of the standard form of `basename-rack-rank` the default values for the membership, rack, and rank parameters are taken from the hostname.

### parameters

[cpus=*int*]

Number of CPUs (cores) in the given host. If not provided the default of 1 CPU is inserted into the database.

[membership=*string*]

Appliance membership name. If not provided and the host name is of the standard form the membership is taken from the basename of the host.

[rack=*int*]

The number of the rack where the machine is located. The convention in Rocks is to start numbering at 0. If not provided and the host name is of the standard form the rack number is taken from the host name.

[rank=*int*]

The position of the machine in the rack. The convention in Rocks is to number from the bottom of the rack to the top starting at 0. If not provided and the host name is of the standard form the rank number is taken from the host name.

## examples

```
# rocks add host compute-0-1
```

Adds the host "compute-0-0" to the database with 1 CPU, a membership name of "compute", a rack number of 0, and rank of 1.

```
# rocks add host frontend rack=0 rank=0 membership=Frontend
```

Adds the host "frontend" to the database with 1 CPU, a membership name of "Frontend", a rack number of 0, and rank of 1.

## related commands

add host interface

### 6.1.4. add host interface

```
rocks add host interface {host} {iface} [gateway=string] [iface=string] [ip=string] [mac=string] [module=string] [name=string] [subnet=string]
```

Adds an interface to a host and sets the associated values

#### arguments

host

Host name of machine

iface

The interface name on the host (e.g., 'eth0', 'eth1')

**parameters**`[gateway=string]`

The gateway to assign to the interface (e.g., '192.168.1.1')

`[iface=string]`

Can be used in place of the iface argument.

`[ip=string]`

The IP address to assign to the interface (e.g., '192.168.1.254')

`[mac=string]`

The MAC address of the interface (e.g., '00:11:22:33:44:55')

`[module=string]`

The device driver name (or module) of the interface (e.g., 'e1000')

`[name=string]`

The name to assign to the interface

`[subnet=string]`

The name of the subnet to assign to the interface (e.g., 'private')

**examples**

```
# rocks add host interface compute-0-0 eth1 ip=192.168.1.2 subnet=private gateway=192.168.1.1 name=fast-0-0
```

```
# rocks add host interface compute-0-0 iface=eth1 ip=192.168.1.2 subnet=private gateway=192.168.1.1
```

```
name=fast-0-0
```

```
    same as above
```

**related commands**

```
set host interface gateway
```

```
set host interface iface
```

```
set host interface ip
```

```
set host interface mac
```

set host interface module

set host interface name

set host interface subnet

## 6.1.5. add host pxeaction

**rocks add host pxeaction** [host...] [action=*string*] [args=*string*] [command=*string*]

Add a pxeaction specification for a host.

### arguments

[host]

List of hosts to add pxeaction definitions. If no hosts are listed, then the global definition for 'action=name' is added.

### parameters

[action=*string*]

Label name for the pxeaction. You can see the pxeaction label names by executing: 'rocks list host pxeaction [host(s)]'.

[args=*string*]

The second line for a pxelinux definition (e.g., append ks initrd=initrd.img ramdisk\_size=150000 lang=devfs=nomount pxe kssendmac selinux=0)

[command=*string*]

The first line for a pxelinux definition (e.g., 'kernel vmlinuz' or 'localboot 0').

### examples

```
# rocks add pxeaction action=os command="localboot 0"
```

Add the global 'os' pxeaction

```
# rocks add pxeaction compute-0-0 action=memtest command="kernel memtest"
```

Add the 'memtest' pxeaction for compute-0-0



## 6.1.6. add network

```
rocks add network {name} {subnet} {netmask} [netmask=string] [subnet=string]
```

Add a network to the database. By default both the "public" and "private" networks are already defined by Rocks.

### arguments

name

Name of the new network.

subnet

The IP network address for the new network.

netmask

The IP network mask for the new network.

### parameters

[netmask=*string*]

Can be used in place of the netmask argument.

[subnet=*string*]

Can be used in place of the subnet argument.

### examples

```
# rocks add network optiputer 192.168.1.0 255.255.255.0
```

Adds the optiputer network address of 192.168.1.0/255.255.255.0.

```
# rocks add network optiputer subnet=192.168.1.0 netmask=255.255.255.0
```

Same as above.

## 6.1.7. add roll

```
rocks add roll [roll...] [clean=bool]
```

Add Roll ISO images to this machine's roll directory. This command copies all files in the ISOs to a directory under /home/install/rolls.

## arguments

[roll]

A list of Roll ISO images to add to /home/install/rolls. If no list is supplied, then if a roll is mounted on /mnt/cdrom, it will be copied into /home/install/rolls.

## parameters

[clean=*bool*]

If set, then remove all files from any existing rolls of the same name, version, and architecture before copying the contents of the Rolls onto the local disk. This parameter should not be set when adding multi-CD Rolls such as the OS Roll, but should be set when adding single Roll CDs such as the Grid Roll.

## examples

```
# rocks add roll clean=1 kernel*iso
```

Adds the Kernel Roll to local Roll directory. Before the Roll is added the old Kernel Roll packages are removed from the Roll directory.

```
# rocks add roll kernel*iso pvfs2*iso ganglia*iso
```

Added the Kernel, PVFS, and Ganglia Rolls to the local Roll directory.

## 6.1.8. add var

### rocks add var

```
{service} {component} {value} [appliance=string] [component=string] [service=string] [value=string]
```

Add variables to the Rocks key/value database. Variables are defined as quad of (Appliance, Service, Component, Value). Within a node XML file, values can be retrieved as `<var name="Service_Component"/>`.

## arguments

service

Defines the service name. e.g., service=Kickstart.

component

Defines the component name. e.g. component=PublicDNS.

value

Defines the value for the variable.

**parameters**`[appliance=string]`

If supplied, restricts to the named appliance. See 'rocks list appliance' for a listing of appliances.

`[component=string]`

Can be used in place of component argument.

`[service=string]`

Can be used in place of service argument.

`[value=string]`

Can be used in place of value argument.

**examples**

```
# rocks add var service=Condor component=Master value=localhost
```

Add the variable name `<var name="Condor_Master"/>` to 'localhost'.

```
# rocks add var Condor Master localhost
```

Same as above.

```
# rocks add var service=Condor component=Master value=localhost appliance=compute
```

Add the variable name `<var name="Condor_Master"/>` to 'localhost' and associate it with only compute appliances.

## 6.2. config

### 6.2.1. config host interface

```
rocks config host interface {host} [iface=string]
```

Output the network configuration file for a host's interface.

**arguments**

host

One host name.

## parameters

[iface=*string*]

Output a configuration file for this host's interface (e.g. 'eth0'). If no 'iface' parameter is supplied, then configuration files for every interface defined for the host will be output (and each file will be delineated by <file> and </file> tags).

## examples

```
# rocks config host interface compute-0-0 iface=eth0
```

Output a network configuration file for compute-0-0's eth0 interface.

## 6.2.2. config host network

**rocks config host network** {host}

Outputs the network configuration file for a host (on RHEL-based machines, this is the contents of the file /etc/sysconfig/network).

## arguments

host

One host name.

## examples

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

Output the network configuration for compute-0-0.

## 6.3. create

### 6.3.1. create mirror

**rocks create mirror** {path} [arch=*string*] [rollname=*string*] [version=*string*]

Create a Roll ISO image from the packages found in the repository located at 'URL'.

## arguments

path

The network location of the repository of packages.

## parameters

[arch=*string*]

Architecture of the mirror. (default = the architecture of of the OS running on this machine).

[rollname=*string*]

The base name for the created Roll. (default = 'updates').

[version=*string*]

The version number of the created Roll. (default = the version of Rocks running on this machine).

## examples

```
# rocks create mirror http://mirrors.kernel.org/centos/4.5/updates/i386/RPMS rollname=updates version=4.5
```

Will mirror all the packages found under the URL <http://mirrors.kernel.org/centos/4.5/updates/i386/RPMS> and will create a Roll ISO image named 'updates-4.5-0.i386.disk1.iso'.

### 6.3.2. create roll

```
rocks create roll {roll...}
```

Create a roll. You may specify either a single XML file to build one Roll or a list of ISO files to build a Meta Roll.

## arguments

roll

Either a list of Roll ISO files or the name of a single Roll XML description file. If a list of Roll ISO files to be merge together into a single Roll. Otherwise the single argument is assumed to be the name of the XML file generated by the top level Makefile in the Roll's source.

## examples

```
# rocks create roll roll-base.xml
```

Creates the Rocks Base Roll from the roll-base.xml description file.

```
# rocks create roll base*iso kernel*iso
```

Create a composite Roll from a list of Roll ISOs.

### 6.3.3. create torrent

```
rocks create torrent {path} [time=string]
```

Create a torrent file for a regular file. This command is heavily used by rocks-dist in order to prepare the RPMS for the Avalanche Installer.

## arguments

path

The pathname of the file or directory requiring torrent files.

## parameters

[time=*string*]

The timestamp to be encoded within the torrent. If none is provided the current time is used.

## examples

```
# rocks create torrent kernel-2.6.9-42.0.2.EL.i686.rpm
```

Generates a torrent file named kernel-2.6.9-42.0.2.EL.i686.rpm.torrent in the current directory.

```
# rocks create torrent rocks-dist/lan/i386/RedHat/RPMS
```

Generates torrent files for every file in the RPMS directory.

## 6.4. disable

### 6.4.1. disable roll

```
rocks disable roll [roll...] [version=string]
```

Disable an available roll. The roll must already be copied on the system using "rocks add roll".

## arguments

[roll]

List of rolls. This should be the roll base name (e.g., base, hpc, kernel). If no rolls are listed, then all the available rolls are disabled.

## parameters

[version=*string*]

The version number of the roll to be disabled. If no version number is supplied, then all versions of a roll will be disabled.

## examples

```
# rocks disable roll kernel
```

Disable the kernel roll

```
# rocks disable roll
```

Disable all the available rolls

## related commands

add roll

create roll

enable roll

list roll

## 6.5. dump

### 6.5.1. dump

#### rocks dump

The top level dump command is used to recursively call all the dump commands in the correct order. This is used to create the restore roll.

## examples

```
$ rocks dump
```

Recursively call all dump commands.

### 6.5.2. dump host

```
rocks dump host [host...]
```

Dump the host 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 compute-0-0
```

Dump host compute-0-0 information.

```
$ rocks dump host compute-0-0 compute-0-1
```

Dump host compute-0-0 and compute-0-1 information.

```
$ rocks dump host
```

Dump all hosts.

## 6.5.3. dump host interface

```
rocks dump host interface [host...]
```

Dump the host interface 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 interface compute-0-0
```

Dump the interfaces for compute-0-0.

```
$ rocks dump host interface compute-0-0 compute-0-1
```

Dump the interfaces for compute-0-0 and compute-0-1.

```
$ rocks dump host interface
```

Dump all interfaces.

## related commands

add host interface



## 6.6. enable

### 6.6.1. enable roll

**rocks enable roll** [roll...]

Enable an available roll. The roll must already be copied on the system using the command "rocks add roll".

#### arguments

[roll]

List of rolls. This should be the roll base name (e.g., base, hpc, kernel). If no rolls are listed, then all the available rolls are enabled.

#### examples

```
# rocks enable roll kernel
```

Enable the kernel roll

```
# rocks enable roll
```

Enable all the available rolls

#### related commands

add roll

create roll

disable roll

list roll

## 6.7. list

### 6.7.1. list appliance

**rocks list appliance** [appliance...]

Lists the appliances defined in the cluster database.

### arguments

[appliance]

Optional list of appliance names.

### examples

```
$ rocks list appliance
```

List all known appliances.

## 6.7.2. list appliance xml

**rocks list appliance xml** [appliance...]

Lists the XML profile for a given appliance type. This is useful for high level debugging but will be missing any host specific variables. It cannot be used to pass into 'rocks list host profile' to create a complete Kickstart/Jumpstart profile.

### arguments

[appliance]

Optional list of appliance names.

### examples

```
$ rocks list appliance xml compute
```

Lists the XML profile for a compute appliance.

```
$ rocks list appliance xml
```

Lists the XML profile for all appliance types.

## 6.7.3. list distribution

**rocks list distribution** [distribution...]

Lists the distributions defined in the cluster database.

## arguments

[distribution]

Optional list of distribution names.

## examples

```
$ rocks list distribution
```

List all known distribution definitions.

## 6.7.4. list help

```
rocks list help [subdir=string]
```

The Help Command print the usage of all the registered Commands.

## parameters

[subdir=*string*]

Relative of Python commands for listing help. This is used internally only.

## examples

```
$ rocks list help
```

List help for all commands

```
$ rocks list help subdir=list/host
```

List help for all commands under list/host

## 6.7.5. list host

```
rocks list host [host...]
```

List the membership, CPU count, physical position info and comment for a list of hosts.

## arguments

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

## examples

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

List info for compute-0-0.

```
$ rocks list host
```

List info for all known hosts.

## 6.7.6. list host appliance

**rocks list host appliance** [host...]

Lists the appliance assignments for hosts. For each host supplied on the command line, this command prints the hostname and appliance assignment for that host.

### arguments

[host]

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

## examples

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

List the appliance assignment for compute-0-0.

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

List the appliance assignments for compute-0-0 and compute-0-1.

## 6.7.7. list host graph

**rocks list host graph** [host...] [arch=*string*] [basedir=*string*]

For each host, output a graphviz script to produce a diagram of the XML configuration graph. If no hosts are specified, a graph for every known host is listed.

### arguments

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

**parameters**[arch=*string*]

Optional. If specified, generate a graph for the specified CPU type. If not specified, then 'arch' defaults to this host's architecture.

[basedir=*string*]

Optional. If specified, the location of the XML node files.

**examples**

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

Generates a graph for compute-0-0

**6.7.8. list host installfile**

```
rocks list host installfile [section=string]
```

Process an XML-based installation file and output an OS-specific installation file (e.g., a kickstart or jumpstart file).

**parameters**[section=*string*]

Which section within the XML installation file to process (e.g., "kickstart", "begin", etc.).

**examples**

```
# rocks list host installfile section="kickstart"
```

Output a RedHat-compliant kickstart file.

**6.7.9. list host interface**

```
rocks list host interface [host...]
```

Lists the interface definitions for hosts. For each host supplied on the command line, this command prints the hostname and interface definitions for that host.

**arguments**

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

## examples

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

List network interface info for compute-0-0.

```
$ rocks list host interface
```

List network interface info for all known hosts.

## 6.7.10. list host membership

**rocks list host membership** [host...]

Lists the membership assignments for hosts. For each host supplied on the command line, this command prints the hostname and membership assignment for that host.

### arguments

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

## examples

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

List the membership assignment for compute-0-0.

```
$ rocks list host membership
```

List the membership assignment for all known hosts.

## 6.7.11. list host partition

**rocks list host partition** [host...]

Lists the partitions for hosts. For each host supplied on the command line, this command prints the hostname and partitions for that host.

### arguments

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

**examples**

```
$ rocks list host partition compute-0-0
    List partition info for compute-0-0.
```

```
$ rocks list host partition
    List partition info for known hosts.
```

**6.7.12. list host profile**

**rocks list host profile** [host...]

Outputs a XML wrapped Kickstart/Jumpstart profile for the given hosts. If not, profiles are listed for all hosts in the cluster. If input is fed from STDIN via a pipe, the argument list is ignored and XML is read from STDIN. This command is used for debugging the Rocks configuration graph.

**arguments**

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

**examples**

```
# rocks list host profile compute-0-0
    Generates a Kickstart/Jumpstart profile for compute-0-0.
```

```
# rocks list host xml compute-0-0 | rocks list host profile
    Does the same thing as above but reads XML from STDIN.
```

**6.7.13. list host pxearction**

**rocks list host pxearction** [host...]

Lists the set of PXE actions for hosts. Each PXE action is a label that points to a command string. The command string is placed into a host-specific pxelinux configuration file. Example labels are 'install' and 'os' which point to command strings used to install and boot hosts respectively.

**arguments**

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

**examples**

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

List the PXE actions available for compute-0-0.

```
$ rocks list host pxearction
```

List the PXE actions available for all known hosts.

**6.7.14. list host pxeboot**

```
rocks list host pxeboot [host...]
```

Lists the current PXE action for hosts. For each host supplied on the command line, this command prints the hostname and PXE action for that host. The PXE action describes what the host will do the next time it is PXE booted.

**arguments**

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

**examples**

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

List the current PXE action for compute-0-0.

```
$ rocks list host pxeboot
```

List the current PXE action for all known hosts.

**6.7.15. list host sitexml**

```
rocks list host sitexml [host...]
```

Lists the site XML file for hosts. For each host supplied on the command line, this command prints the site.xml file for that host which is used for host configuration.

**arguments**

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.



## examples

```
# rocks list host sitexml compute-0-0
```

List the site XML file for compute-0-0.

```
# rocks list host sitexml
```

List the site XML file for all known hosts.

## 6.7.16. list host xml

```
rocks list host xml [host...] [arch=string]
```

Lists the monolithic XML configuration file for hosts. For each host supplied on the command line, this command prints the hostname and XML file configuration for that host. This is the same XML configuration file that is sent back to a host when a host begins its installation procedure.

### arguments

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

### parameters

[arch=*string*]

Optional. If specified, generate a graph for the specified CPU type. If not specified, then 'arch' defaults to this host's architecture.

## examples

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

List the XML configuration file for compute-0-0.

```
$ rocks list host xml
```

List the XML configuration files for all known hosts.

## 6.7.17. list license

```
rocks list license
```

List the Rocks copyright.

## examples

```
$ rocks list license
```

List the Rocks copyright.

## 6.7.18. list membership

```
rocks list membership [membership...]
```

Lists the memberships defined in the cluster database.

### arguments

[membership]

Optional. A list of membership names. If no membership names are supplied, all the known memberships are listed.

## examples

```
$ rocks list membership
```

List all known membership definitions.

## 6.7.19. list network

```
rocks list network [network...]
```

List the defined networks for this system.

### arguments

[network]

Zero, one or more network names. If no network names are supplied, info about all the known networks is listed.

## examples

```
$ rocks list network private
```

List network info for the network named 'private'.

```
$ rocks list network
```

List info for all defined networks.

## 6.7.20. list node xml

### rocks list node xml

```
{node} [addr=string] [arch=string] [basedir=string] [dist=string] [eval=bool] [gen=string] [graph=string] [host=string]
check=bool] [roll=string]
```

Lists the XML configuration information for a host. The graph traversal for the XML output is rooted at the XML node file specified by the 'node' argument. This command executes the first pre-processor pass on the configuration graph, performs all variable substitutions, and runs all eval sections.

### arguments

node

The XML node file that the graph traversal will begin. This should be the basename of the XML file (e.g., 'compute' and not 'compute.xml').

### parameters

[addr=*string*]

Primary address of host. If not supplied, then the loopback IP address is used.

[arch=*string*]

Traverse the graph with the 'arch' parameter set to the supplied value. If not specified, then 'arch' defaults to this host's architecture.

[basedir=*string*]

If specified, the location of the XML node files.

[dist=*string*]

Name of the distribution. If not supplied, then the distribution named 'rocks-dist' is used.

[eval=*bool*]

If set to 'no', then don't execute eval sections. If not supplied, then execute all eval sections.

[gen=*string*]

If set, the use the supplied argument as the program for the 2nd pass generator. If not supplied, then use 'kgen'.

[graph=*string*]

Name of the graph to traverse. If not supplied, then the graph named 'default' is traversed.

[host=*string*]

Primary name of host. If not supplied, then the name of this host is used.

[missing-check=*bool*]

If set to 'no', then disable errors regarding missing nodes. If not supplied, then print messages about missing nodes.

[roll=*string*]

If set, only expand nodes from the named roll. If not supplied, then the all rolls are used.

## examples

```
$ rocks list node xml compute
```

Generate the XML graph starting at the XML node named 'compute.xml'.

## 6.7.21. list roll

```
rocks list roll [roll...]
```

List the status of available rolls.

## arguments

[roll]

List of rolls. This should be the roll base name (e.g., base, hpc, kernel). If no rolls are listed, then status for all the rolls are listed.

## examples

```
$ rocks list roll kernel
```

List the status of the kernel roll

```
$ rocks list roll
```

List the status of all the available rolls

## 6.7.22. list roll command

```
rocks list roll command [roll...]
```

List the commands provided by a roll.

## arguments

[roll]

List of rolls. This should be the roll base names (e.g., base, hpc, kernel). If no rolls are listed, then commands for all the rolls are listed.

## examples

```
$ rocks list roll command base
```

Returns the the list of commands installed by the Rocks base Roll.

### 6.7.23. list var

```
rocks list var [appliance=string] [component=string] [service=string]
```

Lists variables in the Rocks key/value database. Variables are defined as a quad of (Appliance, Service, Component, Value). Within a node XML file, values can be retrieved as `<var name="Service_Component"/>`.

#### parameters

```
[appliance=string]
```

If supplied, restricts listing to this appliance. Using `appliance=global` will list only global values.

```
[component=string]
```

If supplied, restricts listing to this component.

```
[service=string]
```

If supplied, restricts listing to this service.

## examples

```
$ rocks list var
```

List all Rocks variables.

```
$ rocks list var service=Kickstart
```

List all Rocks variables associated with the 'Kickstart' service.

```
$ rocks list var service=Info component=RocksVersion
```

List the Rocks variable for Info\_RocksVersion.

## 6.8. remove

### 6.8.1. remove appliance

```
rocks remove appliance {name}
```

Remove an appliance definition from the system. This can be called with just the appliance or it can be further qualified by supplying the root XML node name and/or the graph XML file name.

## arguments

name

The name of the appliance.

## examples

```
# rocks remove appliance compute
```

Removes the compute appliance from the database.

## 6.8.2. remove distribution

```
rocks remove distribution {distribution}
```

Remove a distribution specification from the database.

## arguments

distribution

Distribution name.

## examples

```
# rocks remove distribution rocks-optiputer
```

Removes the distribution named "rocks-optiputer" from the database.

## 6.8.3. remove host

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

Remove a host from the database. This command will remove all related database rows for each specified host.

## arguments

host

List of hosts to remove from the databavse.

**examples**

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

Remove the compute-0-0 from the database.

**6.8.4. remove host bootflags**

```
rocks remove host bootflags {host...}
```

Remove the kernel boot flags for a list of hosts.

**arguments**

host

List of hosts to remove kernel boot flag definitions. If no hosts are listed, then the global definition is removed.

**examples**

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

Remove the kernel boot flags definition for compute-0-0.

**6.8.5. remove host interface**

```
rocks remove host interface {host} {iface} [iface=string]
```

Remove a network interface definition for a host.

**arguments**

host

One or more named hosts.

iface

Interface that should be removed. This may be a logical interface or the mac address of the interface.

**parameters**

```
[iface=string]
```

Can be used in place of the iface argument.

**examples**

```
# rocks remove host interface compute-0-0 eth1
```

Removes the interface eth1 on host compute-0-0.

```
# rocks remove host interface compute-0-0 compute-0-1 iface=eth1
```

Removes the interface eth1 on hosts compute-0-0 and compute-0-1.

**6.8.6. remove host partition**

```
rocks remove host partition {host...} [partition=string]
```

Remove a partition definitions from a host.

**arguments**

host

A list of one or more host names.

**parameters**

```
[partition=string]
```

A single partition to remove from this host. If no partition is specified, then all partitions from the host are removed.

**examples**

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

Remove all partitions from compute-0-0.

```
# rocks remove host partition compute-0-0 partition=/export
```

Remove only the /export partition from compute-0-0.

**6.8.7. remove host pxeaction**

```
rocks remove host pxeaction {host...} [action=string]
```

Remove a pxeaction specification for a list of hosts.



## arguments

host

List of hosts to remove pxeaction definitions. If no hosts are listed, then the global definition that matches the 'action=name' is removed.

## parameters

[action=*string*]

The label name for the pxeaction. You can see the pxeaction label names by executing: 'rocks list host pxeaction'.

## examples

```
# rocks remove host pxeaction compute-0-0 action=os
```

Remove the 'os' pxeaction for compute-0-0.

## 6.8.8. remove host pxeboot

```
rocks remove host pxeboot {host...}
```

Removes the PXE boot configuration for a host

## arguments

host

One or more named hosts.

## examples

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

Removes the PXE boot configuration for host compute-0-0.

```
# rocks remove host pxeboot compute-0-0 compute-0-1
```

Removes the PXE boot configuration for hosts compute-0-0 and compute-0-1.

## 6.8.9. remove network

```
rocks remove network {network...}
```

Remove network definition from the system. If there are still nodes defined in the database that are assigned to the network name you are trying to remove, the command will not remove the network definition and print a message saying it cannot remove the network.

**arguments**

network

One or more network names.

**examples**

```
# rocks remove network private
```

Remove network info for the network named 'private'.

**6.8.10. remove var**

```
rocks remove var {service} {component} [appliance=string] [component=string] [service=string]
```

Removes variables in the Rocks key/value database. Variables are defined as a quad of (Appliance, Service, Component, Value). Within a node XML file, values can be retrieved as `<var name="Service_Component"/>`.

**arguments**

service

The 'service' of the variable to remove.

component

The 'component' of the variable to remove.

**parameters**

```
[appliance=string]
```

If supplied, remove the Service\_Component variable that is associated with this appliance.

```
[component=string]
```

Can be used in place of component argument.

```
[service=string]
```

Can be used in place of service argument.

**examples**

```
# rocks remove var service=Condor component=Master
```

Remove the variable Condor\_Master from the database.

```
# rocks remove var service=Condor component=Master appliance=compute
```

Remove the variable `Condor_Master` that is associated with the compute appliance.

## 6.9. report

### 6.9.1. report host bootflags

```
rocks report host bootflags [host...]
```

Output the kernel boot flags for a specific host

#### arguments

[host]

Zero, one or more host names. If no host names are supplied, info about all the known hosts is listed.

#### examples

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

Output the kernel boot flags for compute-0-0.

## 6.10. run

### 6.10.1. run host

```
rocks run host [host...] {command} [command=string]
```

Run a command for each specified host.

#### arguments

[host]

Zero, one or more host names. If no host names are supplied, the command is run on all known hosts.

command

The command to run on the list of hosts.

## parameters

[command=*string*]

Can be used in place of the 'command' argument.

## examples

```
$ rocks run host compute-0-0 command="hostname"
```

Run the command 'hostname' on compute-0-0.

```
$ rocks run host compute "ls /tmp"
```

Run the command 'ls /tmp/' on all compute nodes.

# 6.11. set

## 6.11.1. set host bootflags

```
rocks set host bootflags {host...} [flags=string]
```

Set the boot flags for a host. The boot flags will be applied to the configuration file that a host uses to boot the running kernel. For example, if a node uses GRUB as its boot loader, the boot flags will be part of the 'append' line.

## arguments

host

Zero, one or more host names. If no host names are supplied, then the global bootflag will be set.

## parameters

[flags=*string*]

The boot flags to set for the host.

## examples

```
# rocks set host bootflags compute-0-0 flags="mem=1024M"
```

Apply the kernel boot flags "mem=1024M" to compute-0-0.

## 6.11.2. set host comment

```
rocks set host comment {host...} {comment} [comment=string]
```

Set the comment field for a list of hosts.

## arguments

host

One or more host names.

comment

The string to assign to the comment field for each host.

## parameters

[comment=*string*]

Can be used in place of the comment argument.

## examples

```
# rocks set host comment compute-0-0 "Fast Node"
```

Sets the comment field to "Fast Node" for compute-0-0.

```
# rocks set host comment compute-0-0 compute-0-1 "Slow Node"
```

Sets the comment field to "Slow Node" for compute-0-0 and compute-0-1.

```
# rocks set host comment compute-0-0 compute-0-1 comment="Slow Node"
```

Same as above.

### 6.11.3. set host cpus

```
rocks set host cpus {host...} {cpus} [cpus=string]
```

Set the number of CPUs for a list of hosts.

## arguments

host

One or more host names.

cpus

The number of CPUs to assign to each host.

**parameters**`[cpus=string]`

Can be used in place of the cpus argument.

**examples**

```
# rocks set host cpus compute-0-0 2
```

Sets the CPU value to 2 for compute-0-0.

```
# rocks set host cpus compute-0-0 compute-0-1 4
```

Sets the CPU value to 4 for compute-0-0 and compute-0-1.

```
# rocks set host cpus compute-0-0 compute-0-1 cpus=4
```

Same as above.

**6.11.4. set host interface gateway**

```
rocks set host interface gateway {host...} {iface} {gateway} [gateway=string] [iface=string]
```

Sets the gateway address for a logical interface on one or more hosts.

**arguments**

host

One or more named hosts.

iface

Interface that should be updated. This may be a logical interface or the mac address of the interface.

gateway

The gateway address of the interface. Usually of the form nnn.nnn.nnn.nnn where n is a decimal digit. This format is not enforced. Use gateway=NULL to clear.

**parameters**`[gateway=string]`

Can be used in place of the gateway argument.

`[iface=string]`

Can be used in place of the iface argument.

**examples**

```
# rocks set host interface gateway compute-0-0 eth1 192.168.0.1
```

Sets the gateway Address for the eth1 device on host compute-0-0.

```
# rocks set host interface gateway compute-0-0 eth1 ip=192.168.0.1
```

Same as above.

```
# rocks set host interface gateway compute-0-0 iface=eth1 gateway=192.168.0.1
```

Same as above.

```
# rocks set host interface gateway compute-0-0 iface=eth1 gateway=NULL
```

Clear the gateway entry for eth1 on host compute-0-0

**related commands**

add host

**6.11.5. set host interface iface**

```
rocks set host interface iface {host...} {mac} {iface} [iface=string] [mac=string]
```

Sets the logical interface of a mac address for particular hosts.

**arguments**

host

One or more named hosts.

mac

MAC address of the interface whose logical interface will be reassigned

iface

Logical interface.

**parameters**

[iface=*string*]

Can be used in place of the iface argument.

[mac=*string*]

Can be used in place of the mac argument.

**examples**

```
# rocks set host interface iface compute-0-0 00:0e:0c:a7:5d:ff eth1
```

Sets the logical interface of MAC address 00:0e:0c:a7:5d:ff to be eth1

```
# rocks set host interface iface compute-0-0 iface=eth1 mac=00:0e:0c:a7:5d:ff
```

Same as above.

**related commands**

add host

**6.11.6. set host interface ip**

```
rocks set host interface ip {host} {iface} {ip} [iface=string] [ip=string]
```

Sets the IP address for the named interface for one host.

**arguments**

host

Host name.

iface

Interface that should be updated. This may be a logical interface or the mac address of the interface.

ip

The IP address of the interface. Usually of the form nnn.nnn.nnn.nnn where n is a decimal digit. This format is not enforced. Use IP=NULL to clear.

**parameters**

[iface=*string*]

Can be used in place of the iface argument.

[ip=*string*]

Can be used in place of the ip argument.

**examples**

```
# rocks set host interface ip compute-0-0 eth1 192.168.0.10
```

Sets the IP Address for the eth1 device on host compute-0-0.



```
# rocks set host interface ip compute-0-0 iface=eth1 ip=192.168.0.10
```

Same as above.

## related commands

add host

set host interface gateway

set host interface iface

set host interface ip

set host interface module

### 6.11.7. set host interface mac

```
rocks set host interface mac {host} {iface} {mac} [iface=string] [mac=string]
```

Sets the mac address for named interface on host.

#### arguments

host

Host name.

iface

Interface that should be updated. This may be a logical interface or the mac address of the interface.

mac

The mac address of the interface. Usually of the form dd:dd:dd:dd:dd:dd where d is a hex digit. This format is not enforced. Use mac=NULL to clear the mac address.

#### parameters

[iface=*string*]

Can be used in place of the iface argument.

[*mac=string*]

Can be used in place of the mac argument.

## examples

```
# rocks set host interface mac compute-0-0 eth1 00:0e:0c:a7:5d:ff
```

Sets the MAC Address for the eth1 device on host compute-0-0.

```
# rocks set host interface mac compute-0-0 iface=eth1 mac=00:0e:0c:a7:5d:ff
```

Same as above.

```
# rocks set host interface mac compute-0-0 iface=eth1 mac=NULL
```

clears the mac address from the database

## related commands

add host

### 6.11.8. set host interface module

**rocks set host interface module** {host...} {iface} {module} [*iface=string*] [*module=string*]

Sets the device module for a named interface. On Linux this will get translated to an entry in /etc/modprobe.conf.

## arguments

host

One or more hosts.

iface

Interface that should be updated. This may be a logical interface or the MAC address of the interface.

module

The software device module of interface. Use module=NULL to clear.

## parameters

[*iface=string*]

Can be used in place of the iface argument.

[*module=string*]

Can be used in place of the module argument.

## examples

```
# rocks set host interface module compute-0-0 eth1 e1000
```

Sets the device module for eth1 to be e1000 on host compute-0-0.

```
# rocks set host interface gateway compute-0-0 iface=eth1 module=e1000
```

Same as above.

```
# rocks set host interface gateway compute-0-0 iface=eth1 module=NULL
```

Clear the module entry.

## related commands

add host

### 6.11.9. set host interface name

```
rocks set host interface name {host} {iface} {name} [iface=string] [name=string]
```

Sets the logical name of a network interface on a particular host. This is usually a fully qualified domain name.

#### arguments

host

Host name.

iface

Interface that should be updated. This may be a logical interface or the MAC address of the interface.

name

Name of this interface (e.g. hostname.external.net) This is usually of the form, hostname.domain, but is not enforced. Use name=NULL to clear.

#### parameters

[iface=*string*]

Can be used in place of the iface argument.

[name=*string*]

Can be used in place of the name argument.

**examples**

```
# rocks set host interface name compute-0-0 eth1 c0-0.external.net
    Sets the name for the eth1 device on host compute-0-0 to c0-0.external.net

# rocks set host interface name compute-0-0 iface=eth1 name=c0-0.external.net
    Same as above.
```

**related commands**

add host

**6.11.10. set host interface subnet**

```
rocks set host interface subnet {host...} {iface} {subnet} [iface=string] [subnet=string]
```

Sets the subnet for named interface on one of more hosts.

**arguments**

host

One or more named hosts.

iface

Interface that should be updated. This may be a logical interface or the MAC address of the interface.

subnet

The subnet address of the interface. This is a named subnet and must be listable by the command 'rocks list subnet'.

**parameters**

[iface=*string*]

Can be used in place of the iface argument.

[subnet=*string*]

Can be used in place of the subnet argument.

**examples**

```
# rocks set host interface subnet compute-0-0 eth1 public
    Sets eth1 to be on the public subnet.
```

```
# rocks set host interface mac compute-0-0 iface=eth1 subnet=public
```

Same as above.

## related commands

```
add host
```

### 6.11.11. set host membership

```
rocks set host membership {host...} {membership} [membership=string]
```

Set the membership for hosts.

#### arguments

host

One or more host names.

membership

The membership to assign to each host.

#### parameters

```
[membership=string]
```

Can be used in place of the membership argument.

#### examples

```
# rocks set host membership "NAS Appliance" nas-0-0
```

Sets the membership to 'NAS Appliance' for nas-0-0.

```
# rocks set host membership "NAS Appliance" membership=nas-0-0
```

Same as above.

```
# rocks set host membership Compute
```

Sets the membership to 'Compute' for all known hosts.

### 6.11.12. set host pxeboot

```
rocks set host pxeboot {host...} [action=string]
```

Set a pxeaction for a host. This action defines what configuration is sent back to a host the next time it PXE boots.

## arguments

host

One or more host names.

## parameters

[action=*string*]

The label name for the pxeaction. For a list of pxeactions, execute: 'rocks list host pxeaction'. If no action is supplied, then only the configuration file for the list of hosts will be rewritten.

## examples

```
# rocks set host pxeboot compute-0-0 action=os
```

Set the 'os' pxeaction for compute-0-0.

### 6.11.13. set host rack

```
rocks set host rack {host...} {rack} [rack=string]
```

Set the rack number for a list of hosts.

## arguments

host

One or more host names.

rack

The rack number to assign to each host.

## parameters

[rack=*string*]

Can be used in place of rack argument.

## examples

```
# rocks set host rack compute-2-0 2
```

Set the rack number to 2 for compute-2-0.

```
# rocks set host rack compute-0-0 compute-0-1 0
    Set the rack number to 0 for compute-0-0 and compute-0-1.
```

```
# rocks set host rack compute-0-0 compute-0-1 rack=0
    Same as above.
```

### 6.11.14. set host rank

```
rocks set host rank {host...} {rank} [rank=string]
```

Set the rank number for a list of hosts.

#### arguments

host

One or more host names.

rank

The rank number to assign to each host.

#### parameters

```
[rank=string]
```

Can be used in place of rank argument.

#### examples

```
# rocks set host rank compute-0-2 2
    Set the rank number to 2 for compute-0-2.
```

```
# rocks set host rank compute-0-0 compute-1-0 0
    Set the rank number to 0 for compute-0-0 and compute-1-0.
```

```
# rocks set host rank compute-0-0 compute-1-0 rank=0
    Same as above.
```

### 6.11.15. set network netmask

```
rocks set network netmask {network...} {netmask} [netmask=string]
```

Sets the network mask for one or more named networks .

**arguments**

network

One or more named networks that should have the defined netmask.

netmask

Netmask that named networks should have.

**parameters**[netmask=*string*]

Can be used in place of netmask argument.

**examples**

```
# rocks set network netmask optiputer 255.255.255.0
```

Sets the netmask for the "optiputer" network to a class-c address space.

```
# rocks set network netmask optiputer netmask=255.255.255.0
```

Same as above.

```
# rocks set network netmask optiputer cavewave 255.255.0.0
```

Sets the netmask for the "optiputer" and "cavewave" networks to a class-b address space.

**related commands**

add network

set network subnet

**6.11.16. set network subnet**

```
rocks set network subnet {network...} {subnet} [subnet=string]
```

Sets the subnet for one or more named networks.

**arguments**

network

One or more named networks that should have the defined subnet.



subnet

Subnet that named networks should have.

## parameters

[subnet=*string*]

Can be used in place of subnet argument.

## examples

```
# rocks set network subnet optiputer 132.239.51.0
```

Sets the "optiputer" subnet address to 132.239.51.0.

```
# rocks set network subnet optiputer subnet=132.239.51.0
```

Same as above.

```
# rocks set network subnet optiputer cavewave 67.58.32.0
```

Sets both the "optiputer" and "cavewave" subnet addresses to the same value of 67.58.32.0.

## related commands

add network

set network netmask

## 6.11.17. set var

### rocks set var

```
{service} {component} {value} [appliance=string] [component=string] [service=string] [value=string]
```

Set variables in the Rocks key/value database. Variables are defined as quad of (Appliance, Service, Component, Value). Within a node XML file, values can be retrieved as `<var name="Service_Component"/>`.

## arguments

service

Defines the service name. e.g., service=Kickstart.

component

Defines the component name. e.g., component=PublicDNS.

value

Defines the value for the variable.

## parameters

[*appliance=string*]

If supplied, restricts to the named appliance. See 'rocks list appliance' for a listing of appliances.

[*component=string*]

Can be used in place of component argument.

[*service=string*]

Can be used in place of service argument.

[*value=string*]

Can be used in place of value argument.

## examples

```
# rocks set var service=Condor component=Master value=localhost
```

Set the variable name `<var name="Condor_Master"/>` to 'localhost'.

```
# rocks set var service=Condor component=Master value=localhost appliance=compute
```

Set the variable name `<var name="Condor_Master"/>` to 'localhost' and associate it with only compute appliances.

# 6.12. sync

## 6.12.1. sync config

### rocks sync config

For each system configuration file controlled by Rocks, first rebuild the configuration file by extracting data from the database, then restart the relevant services.

## examples

```
# rocks sync config
```

Rebuild all configuration files and restart relevant services.

## 6.12.2. sync dns

### **rocks sync dns**

Rebuild the DNS configuration files, then restart named.

### **examples**

```
# rocks sync dns
```

Rebuild the DNS configuration files, then restart named.

## 6.12.3. sync users

### **rocks sync users**

Update all user-related files (e.g., /etc/passwd, /etc/shadow, etc.) on all known hosts. Also, restart autofs on all known hosts.

### **examples**

```
# rocks sync users
```

Send all user info to all known hosts.

# Appendix A. Frequently Asked Questions

## A.1. Installation

1. Insert-ethers never sees new compute nodes. I also don't see any DHCP messages from compute nodes on the frontend. What is wrong?

Try bypassing the network switch connecting your nodes to the frontend. The switch may be configured to squash broadcast messages from unknown IP addresses, which drops DHCP messages from nodes. To verify your switch is indeed the problem:

1. Connect an ethernet cable between a single compute node and the frontend's "eth0" interface.
2. Install the compute node normally (Install Compute Nodes). You should see the DHCP messages from the node at the frontend.

2. While trying to install a compute node, and when I plug a monitor into the compute node, I see the error message 'Error opening kickstart file /tmp/ks.cfg. No such file or directory' or I see a screen on the compute node asking me to select a language. What went wrong?

A compute node kickstart requires the following services to be running on the frontend:

1. dhcpd
2. httpd
3. mysqld
4. autofs

To check if httpd and mysqld are running:

```
# ps auwx | grep httpd
# ps auwx | grep mysqld
```

If either one is not running, restart them with:

```
# /etc/rc.d/init.d/httpd restart
```

and/or

```
# /etc/rc.d/init.d/mysqld restart
```

The autofs service is called 'automount'. To check if it is running:

```
# ps auwx | grep automount
```

If it isn't, restart it:

```
# /etc/rc.d/init.d/autofs restart
```

Finally, to test if the Rocks installation infrastructure is working:

```
# rocks list host profile compute-0-0
```

This should return a kickstart file.

And to see if there are any errors associated with constructing kickstart files on the frontend:

```
# rocks list host profile compute-0-0 > /dev/null
```

**3.** I successfully installed all the Rolls, but during the last stage after the machine reboots, the system hangs with the error: *GRUB Loading Stage2....* What went wrong?

This is an intermittent problem we've seen in the lab as well. The installation is fine, except that the grub installation program, for an unknown reason, did not run correctly.

Here is a workaround:

- Put the Rocks Boot Roll CD in the frontend and boot the frontend.

- At the boot prompt, type:

```
frontend rescue
```

- A screen will appear, click the *Continue* button.

- When you see the shell prompt, execute:

```
# chroot /mnt/sysimage
```

- Run the grub installation program:

```
# /sbin/grub-install `awk -F= '/^#boot/ { print $2 }' /boot/grub/grub.conf`
```

This should output something similar to:

```
Installation finished. No error reported.
This is the contents of the device map /boot/grub/device.map.
Check if this is correct or not. If any of the lines is incorrect,
fix it and re-run the script `grub-install`.
```

```
# this device map was generated by anaconda
(fd0)      /dev/fd0
(hd0)      /dev/hda
```

- Exit the chroot environment:

```
# exit
```

- Reboot the frontend.
- Take the CD out of the drive and the frontend should come up cleanly.

**4.** When I try to install a compute node, the error message on the compute node says, "Can't mount /tmp. Please press OK to restart". What should I do?

Most likely, this situation arises due to the size of the disk drive on the compute node. The installation procedure for Rocks formats the disk on the compute node if Rocks has never been installed on the compute node before.

The fix requires changing the way Rocks partitions disk drives. See Partitioning for details.

5. My compute nodes don't have a CD drive and my network cards don't PXE boot, but my compute nodes do have a floppy drive. How can I install the compute nodes?

You will create a boot floppy that emulates the PXE protocol. This is accomplished by going to the web site:

ROM-o-matic.net<sup>1</sup>

Then click on the version number under the *Latest Production Release* (as of this writing, this is version 5.4.3).

Select your device driver in item 1. Keep the default setting in item 2 (Floppy bootable ROM Image). Then click "Get ROM" in item 4.

We suggest using `dd` to copy the downloaded floppy image to the floppy media. For example:

```
# dd if=eb-5.4.0-pcnet32.zdisk of=/dev/fd0
```

Then run `insert-ethers` on your frontend and boot your compute node with the floppy.

## A.2. Configuration

1. How do I remove a compute node from the cluster?

On your frontend end, execute:

```
# rocks remove host "[your compute node name]"
```

For example, if the compute node's name is `compute-0-1`, you'd execute:

```
# rocks remove host compute-0-1
# rocks sync config
```

The compute node has been removed from the cluster.

2. Why doesn't startx work on the frontend machine?

Before you can run `startx` you need to configure XFree86 for your video card. This is done just like on standard Red Hat machines using the `system-config-display` program. If you do not know anything about your video card just select "4MB" of video RAM and 16 bit color 800x600. This video mode should work on any modern VGA card.

3. I can't install compute nodes and I have a Dell Powerconnect 5224 network switch, what can I do?

Here's how to configure your Dell Powerconnect 5224:

You need to set the `edge port` flag for all ports (in some Dell switches is labeled as *fast link*).

First, you'll need to set up an IP address on the switch:

- Plug in the serial cable that came with the switch.

- Connect to the switch over the serial cable.

The username/password is: admin/admin.

- Assign the switch an IP address:

```
# config
# interface vlan 1
# ip address 10.1.2.3 255.0.0.0
```

- Now you should be able to access the switch via the ethernet.

- Plug an ethernet cable into the switch and to your laptop.

- Configure the ip address on your laptop to be:

```
IP: 10.20.30.40
netmask: 255.0.0.0
```

- Point your web browser on your laptop to 10.1.2.3

- Username/password is: admin/admin.

- Set the *edge port* flag for all ports. This is found under the menu item: *System->Spanning Tree->Port Settings*.

- Save the configuration.

This is accomplished by going to *System->Switch->Configuration* and typing 'rocks.cfg' in the last field 'Copy Running Config to File'. In the field above it, you should see 'rocks.cfg' as the 'File Name' in the 'Start-Up Configuration File'.

#### 4. How do I export a new directory from the frontend to all the compute nodes that is accessible under /home?

Execute this procedure:

- Add the directory you want to export to the file `/etc/exports`.

For example, if you want to export the directory `/export/disk1`, add the following to `/etc/exports`:

```
/export/disk1 10.0.0.0/255.0.0.0(rw)
```



This exports the directory only to nodes that are on the internal network (in the above example, the internal network is configured to be 10.0.0.0)

- Restart NFS:

```
# /etc/rc.d/init.d/nfs restart
```

- Add an entry to `/etc/auto.home`.

For example, say you want `/export/disk1` on the frontend machine (named *frontend-0*) to be mounted as `/home/scratch` on each compute node.

Add the following entry to `/etc/auto.home`:

```
scratch frontend-0:/export/disk1
```

- Inform 411 of the change:

```
# make -C /var/411
```

Now when you login to any compute node and change your directory to `/home/scratch`, it will be automounted.

### 5. How do I disable the feature that reinstalls compute nodes after a hard reboot?

When compute nodes experience a *hard* reboot (e.g., when the compute node is reset by pushing the power button or after a power failure), they will reformat the root file system and reinstall their base operating environment.

To disable this feature:

- Login to the frontend
- Create a file that will override the default:

```
# cd /home/install
# cp rocks-dist/lan/arch/build/nodes/auto-kickstart.xml \
site-profiles/5.0/nodes/replace-auto-kickstart.xml
```

Where *arch* is "i386" or "x86\_64".

- Edit the file `site-profiles/5.0/nodes/replace-auto-kickstart.xml`
- Remove the line:

```
<package>rocks-boot-auto</package>
```

- Rebuild the distribution:

```
# cd /home/install
# rocks-dist dist
```

- Reinstall all your compute nodes



An alternative to reinstalling all your compute nodes is to login to each compute node and execute:

```
# /etc/rc.d/init.d/rocks-grub stop
# /sbin/chkconfig --del rocks-grub
```

## A.3. System Administration

### 1. How do I use user accounts from an external NIS server on my cluster?

While there is no certain method to do this correctly, if necessary we recommend you use "ypcat" to periodically gather external NIS user accounts on the frontend, and let the default 411 system distribute the information inside the cluster.



The following cron script will collect NIS information from your external network onto the frontend. The login files created here will be automatically distributed to cluster nodes via 411. This code courtesy of Chris Dwan at the University of Minnesota.

```
(in /etc/cron.hourly/get-NIS on frontend)

#!/bin/sh
ypcat -k auto.master > /etc/auto.master
ypcat -k auto.home > /etc/auto.home
ypcat -k auto.net > /etc/auto.net
ypcat -k auto.web > /etc/auto.web

ypcat passwd > /etc/passwd.nis
cat /etc/passwd.local /etc/passwd.nis > /etc/passwd.combined
cp /etc/passwd.combined /etc/passwd

ypcat group > /etc/group.nis
cat /etc/group.local /etc/group.nis > /etc/group.combined
cp /etc/group.combined /etc/group
```



There is no way to insure that UIDs GIDs from NIS will not conflict with those already present in the cluster. You must always be careful that such collisions do not occur, as unpredictable and undefined behavior will result.

## Notes

1. <http://www.rom-o-matic.net/>

# Appendix B. Release Notes

## B.1. Release 4.3 - changes from 4.2.1

### B.1.1. New Features

- Rocks Command Line

Initial release of the Rocks command line which facilitates non-SQL administrative access to the database. All Rocks commands have a regular structure of "rocks <verb> <component>". For example, to list all hosts that have been discovered by the frontend, execute: "rocks list host".

All rocks commands can be listed by executing: rocks. Also, help is included with each command. For example, for help on the command "rocks add host", execute: "rocks add host help".

For an overview of the Rocks command line, see Introduction to the Rocks Command Line<sup>1</sup>. The reference for all Rocks commands can be found here<sup>2</sup>.

- PXE First

Hosts can now be configured in BIOS with a boot order of CD, PXE, Hard Disk (previous releases of Rocks required: CD, Hard Disk, PXE). In combination with the Rocks command line, node-specific installation parameters are easily supported. For details on PXE First, see Boot Order and PXE First<sup>3</sup>.

Note: The boot order of (CD, HD, PXE) continues to be supported in Rocks 4.3. That is, existing Rocks clusters can be upgraded without requiring the cluster owner to change any BIOS settings.

### B.1.2. Enhancements

OS: Based on CentOS release 4/update 5 and all updates as of July 4, 2007.

Base: Anaconda installer updated to v10.1.1.63.

Base: Performance improvement when building torrent files for the Avalanche Installer.

Base: Database indirects. More flexibility with Rocks variables.

Grid: Globus updated to gt4.0.4 with web services.

Condor: updated to v6.8.5.

PVFS2: updated to v2.6.3.

Java: updated to v1.5.0\_10.

Ganglia: updated to v3.0.4.

HPC: Now using OpenMPI and PVM from RedHat distribution.

### B.1.3. Bug Fixes

Base: Install now supports machines which have more than 26 disk drives.

Base: 411 clients now atomically update files.

Condor: Max heap size properly set for java programs on small and large memory machines.

Condor: All logging written to `/var/opt/condor`.

## B.2. Release 3.2.0 - changes from 3.1.0

New Feature - Added the Condor Roll. This brings the distributed high-throughput features from the Condor project to Rocks clusters.

New Feature - Added the Area51 Roll. This roll contains security tools and services to check the integrity of the files and operating system on your cluster.

New Feature - Ganglia RSS news event service.

Enhancement - Improved network handling for compute nodes: any interface may be used for the cluster private network, not simply the default "eth0".

Enhancement - Better support for cross-architecture clusters containing x86 and x86\_64 machines.

Enhancement - GM device driver now builds and loads on compute nodes that have a custom kernel (e.g., a kernel from kernel.org).

Enhancement - Software RAID for custom compute node partitioning is supported.

Enhancement - Added variables for root and swap partition. If you only want to change the size of root and/or swap, you only have to reassign two XML variables.

Enhancement - The default root partition size has been increased to 6 GB (up from 4 GB).

Enhancement - SGE ganglia monitor added. The state of all SGE jobs can be tracked from the frontend's web page.

Enhancement - PXE support extended to support floppy-based Etherboot and ia64.

Enhancement - EKV uses ssh instead of telnet for security.

Enhancement - New Myrinet MPICH version 1.2.5..12.

Enhancement, Java Roll -- Updated JDK to version 1.4.2\_04

Enhancement - Latest software updates recompiled for three architectures from RHEL source rpms.

Enhancement - Automatic MySQL Cluster database backup.

Enhancement - MAC addresses are included for each node in the "Cluster Labels" output.

Enhancement - Frontend rescue mode on the Rocks Base CD enabled. By typing "frontend rescue" at the boot prompt will give you a shell in which you can examine the state of the frontend.

Bug Fix - 411 hardened. More reliable notification of changed files. Correct Makefile encrypts login files on frontend first-boot.

Bug Fix - Multiple CD drives are supported for bringing up a frontend. If you have more than one CD drive connected to your frontend, the installer will now correctly identify which CD you are using.

Bug Fix - Ganglia metrics are now saved on frontend reboot. After a reboot, all Ganglia history will be restored from the previous boot.

Bug Fix - PVFS compiled with `-mcmmodel=kernel` on Opteron.

Bug Fix - XML escape characters (e.g., `&`, `<`, `>`) are supported in the installation screens (e.g., the Cluster Information screen and the Root Password screen).

Bug Fix, Intel Roll - All the Intel compiler libraries are now copied to the compute nodes.

## **B.3. Release 3.2.0 - changes from 3.1.0**

New Feature - Added the Condor Roll. This brings the distributed high-throughput features from the Condor project to Rocks clusters.

New Feature - Added the Area51 Roll. This roll contains security tools and services to check the integrity of the files and operating system on your cluster.

New Feature - Ganglia RSS news event service.

Enhancement - Improved network handling for compute nodes: any interface may be used for the cluster private network, not simply the default "eth0".

Enhancement - Better support for cross-architecture clusters containing x86 and x86\_64 machines.

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Bug Fix - PVFS compiled with `-mcmmodel=kernel` on Opteron.

Bug Fix - XML escape characters (e.g., `&`, `<`, `>`) are supported in the installation screens (e.g., the Cluster Information screen and the Root Password screen).

Bug Fix, Intel Roll - All the Intel compiler libraries are now copied to the compute nodes.

## B.4. Release 3.1.0 - changes from 3.0.0

Base Linux packages compiled from publicly available RedHat Enterprise Linux 3 Source (Advanced Workstation) for all architectures.

Switched to Sun Grid Engine 5.3 as the default batch scheduling system.

More Rolls: NMI/Globus Release 4, Java, Condor, Intel compiler rolls available.

New Architectures: Opteron (x86\_64) receives first-class functionality.

Enhancement - New MPICH version 1.2.5.2. More efficient MPD parallel job-launcher handling. MPICH2 included by default as well.

Enhancement - Using latest Myrinet mpich-gm 2.0.8 for all architectures.

Enhancement - Updated SSH version 3.7.1 with no login delay.

Enhancement - 411 Secure Information Service used by default, replacing NIS.

Enhancement - Greceptor replaces Gschedule to support mpdring, 411, cluster-top and others. Achieves an order of magnitude better performance than its predecessor.

## B.5. Release 3.0.0 - changes from 2.3.2

Based on RedHat 7.3 for x86 and RedHat Advanced Workstation 2.1 for ia64 (all packages recompiled from publicly available source).

Enhancement - Includes RedHat updated RPMS (and recompiled SRPMs for ia64), as of September 3 2003.

Enhancement - Includes kernel version 2.4.20-20.7 for x86 and version 2.4.18e.37 for ia64. Installation environment includes all drivers from the above kernel packages.

Enhancement - New full-featured DNS server and structured ".local" naming conventions within cluster.

Enhancement - Linpack (`xhpl`) works out of the box for Pentium IV and Athlon.

Enhancement - Added remove node feature to `insert-ethers`.

Enhancement - New layout of all MPICH transports. See `/opt/mpich` on the frontend for the new directory structure.

Enhancement - Add support for 'Rolls'. An x86 Rocks frontend install now requires two CDs: the Rocks Base CD and the HPC Roll. An ia64 frontend still requires only one DVD.

- Enhancement - Added 'Grid' Roll. This roll includes all packages from NMI R3.1, which includes Globus, the Simple Certificate Authority, and other packages.
- Enhancement - High-Performance, fault-tolerant MPD job launcher made available. Automatic MPD ring creation and healing via KAgreement-mpd protocol. (Currently in beta phase for this release)
- Enhancement - New 411 Secure Information Service to replace NIS. (Currently in beta phase for this release)
- Enhancement - Latest Ganglia version 2.5.4 including better webfrontend speed and streamlined appearance, and more efficient network and disk metric handling.
- Enhancement - New PhpSysInfo page on compute nodes, available along with /proc link on Ganglia host view page.
- Enhancement - Ganglia command line tool has new --clustersize and --alive=host options.
- Enhancement - Kickstart graph now viewable from frontend web page.
- Enhancement - For kickstart graph files, new <file> tags made available, with owner="root.root" and perms="ga+r" attributes. Beta phase of RCS-based tracking of all config file changes made for post-section repeatability.
- Enhancement - Kickstart graph ordering is explicit. Previously the evaluation order of individual nodes depended on graph weights. Node dependencies can now be explicitly specified using <order> tags in the graph files.
- Bug Fix - UNIX manual pages correctly shown (we extend /etc/man.conf)
- Bug Fix - NTP now synchronizes all compute node clocks with the frontend.
- Bug Fix - add-extra-nic now supports multiple NICs per compute node.
- Bug Fix - Ganglia RRD metric histories are archived on physical disk and restored on startup.
- Bug Fix - Includes NCSA's OpenPBS scalability patches. Can now launch PBS jobs that require more than 64 processors.
- Bug Fix - USB keyboard works on all ia64 Tiger boxes

## B.6. Release 2.3.2 - changes from 2.3.1

- Bug fix - Memory leaks in the broadcastSSH gmetric python module are fixed.
- Bug fix - Gmetad will not crash when long ganglia metric names are introduced in the cluster.
- Bug Fix - Building MPICH-GM package correctly for AMD Athlon processors.
- Bug Fix - Added PBS directories: /opt/OpenPBS/sched\_priv, /opt/OpenPBS/sched\_logs, /opt/OpenPBS/undelivered.
- Bug Fix - Added userdel that correctly updates the NIS database.
- Enhancement - The Rocks-specific Ganglia metrics are much more efficient with a new Python C extension module that publishes ganglia metrics. The PBS job-queue monitor particularly benefits from this new module.
- Enhancement - Updated rocks-boot package to contain all the modules from the latest kernel-BOOT package.
- Enhancement - The Ganglia monitor-core and webfrontend packages have been updated to the latest version 2.5.3.
- Enhancement - The frontend is now a fully configured Rocks cluster build host. By checking out all the Rocks source code on a 2.3.2 frontend, one can build all the source code simply by executing `make rpm` in the directory `.../rocks/src/`.

Enhancement - Updated SGE packages from v5.3p2-4 to v5.3p3-1.

Enhancement - Added Rocks version number to `/home/install/contrib` directory structure.

## B.7. Release 2.3.1 - changes from 2.3

Bug fix - Now all the installation device drivers from Red Hat's device disks are included (e.g., Broadcom's Ethernet adapters). In Rocks 2.3, only the device drivers found on Red Hat's installation boot floppy were included.

Bug fix - User-specified NIS domains are now supported (in Rocks 2.3, only 'rocks' NIS domain was supported).

Bug fix - User-specified compute node disk partitioning is now supported.

Bug fix - Sun Grid Engine `commd` port errors during post installation and Sun Grid Engine warnings during `insert-ethers` were fixed.

Bug fix - Building for Pentium II/III and Athlon added to ATLAS RPM. (on a side note, ATLAS is now built against gcc version 3.2).

Enhancement - PVFS upgraded to version 1.5.6.

Enhancement - More detail has been added to the PBS queue monitoring web page (e.g., can view jobs for only one user and can view nodes for one job). Additionally, the monitoring code now more efficient and it has been hardened due to direct experiences on a 300-node Rocks cluster.

Enhancement - The `bssh` service has been moved from a standalone service to a task managed by the Ganglia `gschedule` service.

Enhancement - The ethernet-based MPICH package has been updated to version 1.2.5.

Enhancement - The Myrinet-based MPICH package has been updated to version 1.2.5.9.

Enhancement - OpenPBS version 2.3.16 has replaced PBS. Additionally, the *big memory* patch has been applied. Also, the license for OpenPBS requires registration for those that use OpenPBS, so if you use OpenPBS to manage your computational resources, please register at <http://www.OpenPBS.org>.

Enhancement - The `maui` package has been updated to version 3.2.5.

Enhancement - Updated Myricom's GM to version 1.6.3.

New Feature - Added a link of the main web page of the frontend that allows one to make sheets of labels with the names of all the compute nodes.

New Feature - An alternative version of `gcc` is now installed (version 3.2 is installed in `/opt/gcc32/...`).

## B.8. Release 2.2.1 - changes from 2.2

Bug fix - `pvfs` and `gm` modules don't build because the kernel source and kernel binary RPMs were of a different version.

Bug fix - the partitioning on compute nodes only partitioned the first drive. Now all drives on compute nodes are partitioned with a single partition. The default partitioning is: 4 GB root partition, then `/state/partition1` is the remainder of the first drive. The second drive, if present, will have one partition labeled `"/state/partition2"`. The third drive, if present, will have one partition labeled `"/state/partition3"`, etc.

Bug fix - the Rocks CD didn't support as many hardware devices as the RedHat CD. All the hardware modules found on the RedHat CD have been added to the Rocks CD (including many, many more).

## **B.9. Release 2.2 - changes from 2.1.2**

Based on RedHat 7.2.

Upgraded Ganglia (provided by Matt Massie of UC Berkeley) to 2.1.1.

Incorporated PVFS RPMs that were graciously provided to us from Najib Ninaba and Laurence Liew who work at Scalable Systems Pte Ltd in Singapore.

insert-ethers looks to see if a Rocks distribution exists. If it doesn't, insert-ethers rebuilds it.

Upgraded MPICH-GM to version 1.2.1..7b.

Added the "stream" memory bandwidth benchmark.

Added functionality to rocks-dist so distributions can be rebuilt without having to mirror the entire distribution.

Implemented a "greedy" partitioning scheme on compute nodes. The default partitioning is: 4 GB root partition, then /state/partition1 is the remainder of the first drive. The second drive, if present, will have one partition labeled "/state/partition2". The third drive, if present, will have one partition labeled "/state/partition3", etc.

Bug fix - added a "watchdog" timer to kickstart. This reboots a kickstarting node if it can't find a kickstart file. This problem was reported by folks trying to kickstart multiple nodes at the same time.

Bug fix - increased the polling intervals for maui so it won't time out when asking PBS about node status on larger clusters.

Bug fix - makedhcp now adds the full pathname to pxelinux.0 when it builds dhcpd.conf.

Bug fix - create a device node for /dev/cdrom.

Bug fix - /var/log/messages is now appropriately rotated.

## **B.10. Release 2.1.2 - changes from 2.1.1**

Many network and storage drivers have been added to the installation CD. For example, SMC 83c170 EPIC/100 (epic100.o), RTL8139 SMC EZ Card Fast Ethernet (8139too.o) and the Promise SuperTrak Driver (pti\_st.o) have all been included (as well as about 100 more).

The cluster configuration web form has been simplified.

The initial kickstart file that is generated from the web form is now streamed directly back to the user (rather than displaying the kickstart file, and then asking the user to save the file). This should finally kill the "I saved my kickstart file on Windows" problem.

An option to manually partition a frontend disk has been added to the cluster configuration web form.

The recursive directory /home/install/install/install/... has been eliminated.

Ganglia's axon is now started before pbs-server, as the pbs-server initialization script asks ganglia for the number of processor in each node when it creates one of it's configuration files.

The latest "stable" release of Myricom's GM (1.5) and MPICH-GM (1.2.1..7) packages.



High-Performance Linpack is now precompiled for Myrinet and Ethernet.

## B.11. Release 2.1.1 - changes from 2.1

The main change in this release is the use of an XML-based *kickstart graph* to actively manage kickstart files.

Includes support for IA-64 compute nodes. See the Installing IA-64 Compute Nodes HOWTO<sup>4</sup> for detailed information.

A full X server is now installed on frontend machines.

Added PXE support for kickstarting compute nodes.

All compute nodes now install ATLAS and high-performance Linpack -- some slick software from the Innovative Computing Laboratory<sup>5</sup> at the University of Tennessee.

Modified to the PBS server initialization script to dynamically determine the number of CPUs in compute nodes by querying *ganglia*.

Created a *rocks-pylib* package that contains all the common code used by Rocks command line utilities that access the MySQL database, thus giving all the tools the same basic functionality and common user-specified flags.

Patched Red Hat's installation tool (*anaconda*) so the default behavior is to get kickstart files with HTTP (Red Hat's default is NFS). This frees the installation procedure of requiring NFS for *any* of its functions.

Rewrite of *insert-ethers* to give it the look and feel of a standard Red Hat installation tool.

Now using Red Hat's *pump* instead of *dhclient* for the DHCP client.

Properly create the default PBS configuration file (*/usr/apps/pbs/pbs.default*) so PBS is now operational "out of the box".

Fixed the annoying, but harmless, message "`socket.error: (101, 'Network is unreachable')`" that was seen on frontend boots.

Fixed the annoying, but harmless, message "`user 0 unknown`" that was seen on a compute node's first boot after kickstarting.

Fixed the 444 permissions problem on */usr/man* and moved all the Rocks man pages into the new home for Linux man pages (*/usr/share/man*).

## B.12. Release 2.1 - changes from 2.0.1

The main change in this release is that thanks to RedHat 7.1, we now use the Linux 2.4 kernel.

Based on RedHat 7.1, instead of 7.0.

Linux 2.4.x kernel, instead of 2.2.x.

Cluster-dist has been replaced with Rocks-dist. Command line arguments are very similar, with the *explode* command being removed and replaced with the *--copy* flag. The new Rocks-dist creates smaller distributions, fixes the problem of expensive mirror updating, and simplifies CD building. Also, it no longer deletes the distribution before rebuilding, this means the build directory (where kickstart files reside) is persistent across distribution builds.

Frontend is now a stratum 10 NTP server, so compute nodes will clock sync to the frontend even when the frontend cannot reach an external time source.

Usher daemon now correctly daemonizes, since we patch the GM code to allow processes to fork.

Symbolic links for Ekv and piece-pipe RPMs removed from the build directory, and "@Control@" section added to kickstart files.

Pbs\_mom\_config.h generated in the kickstart build directory.

Added pre-defined types to the models table in the SQL database. Also, removed dead tables from database, and made column order more human friendly.

Add SQL parsing to cluster-[pskillfork] scripts.

Removed cluster-config-compute, and cluster-config-frontend from the "%post" section in the kickstart file. The cluster-config rpm is now build and installed on the fly on each compute-node.

Bumped lilo timeout to 5 seconds.

Added FORCE\_UNIPROCESSOR macro test to force sick SMP machines to kickstart as uniprocessor nodes.

Major revision of insert-ethers. Can now be used to replace nodes, and start at arbitrary ranks and basenames.

Minor maui and pbs bug fixes.

Added gm-mpich SHMEM support to mpi-launch.

## B.13. Release 2.0.1 - changes from 2.0

Changed to new directory structure according to RedHat. Existing users will have to delete their mirror of www.rocksclusters.org and re-mirror to pickup the current RedHat directory naming scheme. NOTE: you need the new cluster-dist from www.rocksclusters.org to create a new mirror!

Added support to kickstart laptops (still working on this)

Frontend can now have either a DHCP or static address for the external network. For DHCP the DNS information provided from the external DHCP server is inserted into the Rocks Database and propagated to compute nodes.

Increased default DHCP lease time

Replaced Linux's useradd with create-account.

Force glibc-common RPM to be installed. RedHat 7.0 doesn't install this due to errors in the RPM database.

NIS database gets rebuilt on the frontend once an hour.

Create directories on frontend/compute nodes before putting down SSL and SSH keys. Fixed permission on directories.

Ssh-agent now forwards through nodes

Ssh doesn't use privileged port (makes firewalls happy)

cluster-kickstart set real and effect UID to root so all members of the install group can run shoot-node. Previously only root could do this.

Fixed reinstalls on IDE and SCSI hosts (only IDA host worked before, thanks to a RedHat 7.0 change)

Fixed bssh bug

## **Notes**

1. <http://www.rocksclusters.org/roll-documentation/base/4.3/commandline.html>
2. <http://www.rocksclusters.org/roll-documentation/base/4.3/c229.html>
3. <http://www.rocksclusters.org/roll-documentation/base/4.3/boot-order.html>
4. [../howto/ia64.php](http://www.rocksclusters.org/roll-documentation/howto/ia64.php)
5. <http://icl.cs.utk.edu/>

# Appendix C. Kickstart Nodes Reference

## C.1. Rocks Base Nodes

### C.1.1. 411

The packages and other common elements of the 411 Secure Information Service.

*Parent Nodes:*

- base

### C.1.2. 411-client

Sets up the 411 Secure Information Service for clients. The 411 service will automatically configure itself when a file is published. Also puts all current 411 files from the frontend into the kickstart file for services that cannot tolerate a single 411 failure. Note that 411 can never guarantee full absolute success at any single time. It only offers consistency over the long term.

*Parent Nodes:*

- client

### C.1.3. 411-server

Sets up the 411 Secure Information Service for Master nodes. Creates the RSA public and private keys for the cluster, and configures Apache for 411.

*Parent Nodes:*

- server

### C.1.4. apache

Apache HTTP Server

*Parent Nodes:*

- base

- cluster-db

### **C.1.5. autofs**

AutoFS for automounting home directories over NFS or the loopback device.

*Parent Nodes:*

- autofs-client
- autofs-server

### **C.1.6. autofs-client**

AutoFS Client

*Parent Nodes:*

- client

*Children Nodes:*

- autofs

### **C.1.7. autofs-server**

AutoFS server

*Parent Nodes:*

- server

*Children Nodes:*

- autofs

## C.1.8. base

Base class for all Rocks nodes. This should include compute nodes, frontend nodes, standalone laptops, computer labs, graphics nodes, nfs servers To achieve this level of flexibility this base class should have edges only to those classes that implement the core of Rocks.

*Parent Nodes:*

- client
- server

*Children Nodes:*

- 411
- apache
- c-development
- disk-stamp
- elilo
- fstab
- grub
- installclass
- ip-diag
- keyboard
- logrotate
- node
- node-thin
- rpc
- scripting
- ssh
- ssl

## C.1.9. c-development

Minimalist C development support. This is everything you need to compile the kernel.

*Parent Nodes:*

- base

## C.1.10. cdr

CDR Tools (burnings, iso, ripping, mp3 encoding)

*Parent Nodes:*

- devel

## C.1.11. central

A Rocks Cluster Central server. Can kickstart other servers over the network.

*Parent Nodes:*

- server

## C.1.12. client

The 'client node' in the graph. This file is used as a connection point for other XML configuration nodes.

*Children Nodes:*

- 411-client
- autofs-client
- base
- installclass-client
- ntp-client
- ssh-client
- syslog-client

## C.1.13. cluster-db

Rocks Cluster Database

*Parent Nodes:*

- server

*Children Nodes:*

- apache

### **C.1.14. cluster-db-data**

Populate cluster database with initial data

*Parent Nodes:*

- server

### **C.1.15. cluster-db-structure**

Cluster Database SQL table structure. This used to be generated from a dump of the structure on Meteor. Now we just edit this directly.

*Parent Nodes:*

- server

### **C.1.16. devel**

The 'devel node' in the graph. This file is used as a connection point for other XML configuration nodes.

*Parent Nodes:*

- server

*Children Nodes:*

- cdr
- docbook
- emacs
- fortran-development



## C.1.17. dhcp-server

Setup the DHCP server for the cluster

*Parent Nodes:*

- server

## C.1.18. disk-stamp

Take a root partition, and make it ours! This is the key to determining, on reinstalls, if we should save partitions (because the stamp is there) or blow away all the partitions on the disk (because the stamp isn't there).

*Parent Nodes:*

- base

## C.1.19. dns-server

Configures a DNS nameserver for the cluster on the frontend. Both forward and reversed zones are defined using the database.

*Parent Nodes:*

- server

## C.1.20. docbook

DOC Book support (needed to build rolls)

*Parent Nodes:*

- devel

## C.1.21. elilo

IA-64 Bootloader support

*Parent Nodes:*

- base

## C.1.22. emacs

Emacs OS

*Parent Nodes:*

- devel

## C.1.23. fortran-development

Fortran

*Parent Nodes:*

- devel

## C.1.24. fstab

Examine the disks on the box we're installing and see if there are existing, non-root partitions which we should preserve.

*Parent Nodes:*

- base

## C.1.25. grub

IA-32 Boot loader support

*Parent Nodes:*

- base

## C.1.26. install

Do everything needed to kickstart compute nodes or, generally speaking, everything needed to kickstart any node from this machine.

*Parent Nodes:*

- server

## **C.1.27. installclass**

The base installclass files. This graph node must precede any other installclass graph nodes.

*Parent Nodes:*

- base

## **C.1.28. installclass-client**

The client installclass files.

*Parent Nodes:*

- client

## **C.1.29. installclass-server**

The server installclass files.

*Parent Nodes:*

- server

## **C.1.30. ip-diag**

TCP/IP Network diagnostic tools.

*Parent Nodes:*

- base

### **C.1.31. keyboard**

Support USB keyboard for ia64

*Parent Nodes:*

- base

### **C.1.32. logrotate**

Append rules to logrotate to prune files in /var/log

*Parent Nodes:*

- base

### **C.1.33. media-server**

Root for the kickstart file on the CD/DVD.

*Children Nodes:*

- server

### **C.1.34. node**

A node is a machine in the cluster. Node's are on a private network and get DHCP/NIS state from the frontend.

*Parent Nodes:*

- base

### **C.1.35. node-thin**

Turn off a bunch of packages we think we can live without. They take up too much room on the CD. For DVD based systems this is not required Be the ugly american. the only reason why we do this is because we want to be able to fit a rocks-enabled solution onto a single cdrom and the packages below don't directly help people to run parallel applications

*Parent Nodes:*

- base

### **C.1.36. ntp**

Network Time Protocol

*Parent Nodes:*

- ntp-client
- ntp-server

### **C.1.37. ntp-client**

Network Time Protocol

*Parent Nodes:*

- client

*Children Nodes:*

- ntp

### **C.1.38. ntp-server**

Network Time Protocol

*Parent Nodes:*

- server

*Children Nodes:*

- ntp

## **C.1.39. perl-development**

Perl support

*Parent Nodes:*

- scripting

## **C.1.40. python-development**

Python support

*Parent Nodes:*

- scripting

## **C.1.41. rocks-dist**

Distribution building with rocks-dist

*Parent Nodes:*

- server

## **C.1.42. rpc**

RPC support

*Parent Nodes:*

- base

## **C.1.43. scripting**

*Parent Nodes:*

- base

*Children Nodes:*

- perl-development
- python-development
- tcl-development

## C.1.44. server

The 'server node' in the graph. This file is used as a connection point for other XML configuration nodes.

*Parent Nodes:*

- media-server
- server-wan

*Children Nodes:*

- 411-server
- autofs-server
- base
- central
- cluster-db
- cluster-db-data
- cluster-db-structure
- devel
- dhcp-server
- dns-server
- install
- installclass-server
- ntp-server
- rocks-dist
- syslog-server
- x11-thin

## C.1.45. server-wan

A Rocks Cluster machine that has been kickstarted over the wide area network. Used by the central server to construct a minimal kickstart file.

*Children Nodes:*

- server

## C.1.46. ssh

Enable SSH

*Parent Nodes:*

- base

## C.1.47. ssh-client

SSH Config for compute nodes and other non-frontend appliances. We are using one key pair among all SSH servers in the cluster. This implies we do not care about Man-in-the-Middle attacks. We have subverted the protection for these attacks for several releases (broadcastSSH). This logic should not be in the ssh.xml node so the frontend will generate its own keypair.

*Parent Nodes:*

- client

## C.1.48. ssl

Open SSL support

*Parent Nodes:*

- base

## C.1.49. syslog

Setup Syslog

*Parent Nodes:*



- syslog-client
- syslog-server

### **C.1.50. syslog-client**

Setup Syslog for client machine to forward messages

*Parent Nodes:*

- client

*Children Nodes:*

- syslog

### **C.1.51. syslog-server**

Setup Syslog for server to accept forwarded messages

*Parent Nodes:*

- server

*Children Nodes:*

- syslog

### **C.1.52. tcl-development**

Tcl support

*Parent Nodes:*

- scripting

### **C.1.53. x11**

X11 Desktop applications.

*Parent Nodes:*

- x11-thin

### **C.1.54. x11-thin**

Trimmed down version of X11 for when we don't need sound all all that other GUI nonsense. I just want to run netscape man.

*Parent Nodes:*

- server

*Children Nodes:*

- x11

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www.rocksclusters.org  
version 5.0 (V)

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```
<one line to give the program's name and a brief idea of what it does.>  
Copyright (C) 19yy <name of author>
```

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```
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Gnomovision comes with ABSOLUTELY NO WARRANTY; for details type `show w'.
This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

The hypothetical commands `show w' and `show c' should show the appropriate parts of the General Public License. Of course, the commands you use may be called something other than `show w' and `show c'; they could even be mouse-clicks or menu items--whatever suits your program.

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```
Yoyodyne, Inc., hereby disclaims all copyright interest in the
program `Gnomovision' (a program to direct compilers to make passes
at assemblers) written by James Hacker.
```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
```

That's all there is to it!

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```

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For example, on rare occasions, there may be a special need to encourage the widest possible use of a certain library, so that it becomes a de-facto standard. To achieve this, non-free programs must be allowed to use the library. A more frequent case is that a free library does the same job as widely used non-free libraries. In this case, there is little to gain by limiting the free library to free software only, so we use the Lesser General Public License.

In other cases, permission to use a particular library in non-free programs enables a greater number of people to use a large body of free software. For example, permission to use the GNU C Library in non-free programs enables many more people to use the whole GNU operating system, as well as its variant, the GNU/Linux operating system.

Although the Lesser General Public License is Less protective of the users' freedom, it does ensure that the user of a program that is linked with the Library has the freedom and the wherewithal to run that program using a modified version of the Library.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, whereas the latter must be combined with the library in order to run.

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0. This License Agreement applies to any software library or other program which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Lesser General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a



portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the

application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not

compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that

uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (1) uses at run time a copy of the library already present on the user's computer system, rather than copying library functions into the executable, and (2) will operate properly with a modified version of the library, if the user installs one, as long as the modified version is interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

e) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the materials to be distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

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If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

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END OF TERMS AND CONDITIONS

#### How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

```
<one line to give the library's name and a brief idea of what it does.>  
Copyright (C) <year> <name of author>
```

```
This library is free software; you can redistribute it and/or  
modify it under the terms of the GNU Lesser General Public  
License as published by the Free Software Foundation; either  
version 2.1 of the License, or (at your option) any later version.
```

```
This library is distributed in the hope that it will be useful,  
but WITHOUT ANY WARRANTY; without even the implied warranty of  
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU  
Lesser General Public License for more details.
```

```
You should have received a copy of the GNU Lesser General Public  
License along with this library; if not, write to the Free Software  
Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
```

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your school, if any, to sign a "copyright disclaimer" for the library, if necessary. Here is a sample; alter the names:

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the  
library 'Frob' (a library for tweaking knobs) written by James Random Hacker.
```

```
<signature of Ty Coon>, 1 April 1990  
Ty Coon, President of Vice
```

That's all there is to it!

## E.6. GNU Library General Public License v2

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Version 2, June 1991

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[This is the first released version of the library GPL. It is  
numbered 2 because it goes with version 2 of the ordinary GPL.]

### Preamble

The licenses for most software are designed to take away your  
freedom to share and change it. By contrast, the GNU General Public  
Licenses are intended to guarantee your freedom to share and change  
free software--to make sure the software is free for all its users.

This license, the Library General Public License, applies to some  
specially designated Free Software Foundation software, and to any  
other libraries whose authors decide to use it. You can use it for  
your libraries, too.

When we speak of free software, we are referring to freedom, not  
price. Our General Public Licenses are designed to make sure that you  
have the freedom to distribute copies of free software (and charge for  
this service if you wish), that you receive source code or can get it  
if you want it, that you can change the software or use pieces of it  
in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid  
anyone to deny you these rights or to ask you to surrender the rights.  
These restrictions translate to certain responsibilities for you if  
you distribute copies of the library, or if you modify it.

For example, if you distribute copies of the library, whether gratis  
or for a fee, you must give the recipients all the rights that we gave  
you. You must make sure that they, too, receive or can get the source  
code. If you link a program with the library, you must provide  
complete object files to the recipients so that they can relink them  
with the library, after making changes to the library and recompiling  
it. And you must show them these terms so they know their rights.

Our method of protecting your rights has two steps: (1) copyright  
the library, and (2) offer you this license which gives you legal  
permission to copy, distribute and/or modify the library.



Also, for each distributor's protection, we want to make certain that everyone understands that there is no warranty for this free library. If the library is modified by someone else and passed on, we want its recipients to know that what they have is not the original version, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that companies distributing free software will individually obtain patent licenses, thus in effect transforming the program into proprietary software. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License, which was designed for utility programs. This license, the GNU Library General Public License, applies to certain designated libraries. This license is quite different from the ordinary one; be sure to read it in full, and don't assume that anything in it is the same as in the ordinary license.

The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary

General Public License rather than by this special one.

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0. This License Agreement applies to any software library which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Library General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

In addition, mere aggregation of another work not based on the Library with the Library (or with a work based on the Library) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or

link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)
- b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.
- c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.
- d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

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-- Paul F. Dubois, Jan. 13, 2000.

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## F.17. perl

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1. <http://cvs.rocksclusters.org>