Base Roll: Users Guide

Version 5.1 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	5.1
Maintained By	Rocks Group
Architecture	i386, x86_64
Compatible with Rocks™	5.1

Table 1-2. Roll Compatibility

Roll	Requires [a]	Optional [b]	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	
xen		X	

Roll	Requires [a]	Optional [b]	Conflicts
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:** 30 GB
- **Memory Capacity:** 1 GB
- **Ethernet:** 2 physical ports (e.g., "eth0" and "eth1")
- **BIOS Boot Order:** CD, Hard Disk

Compute Node

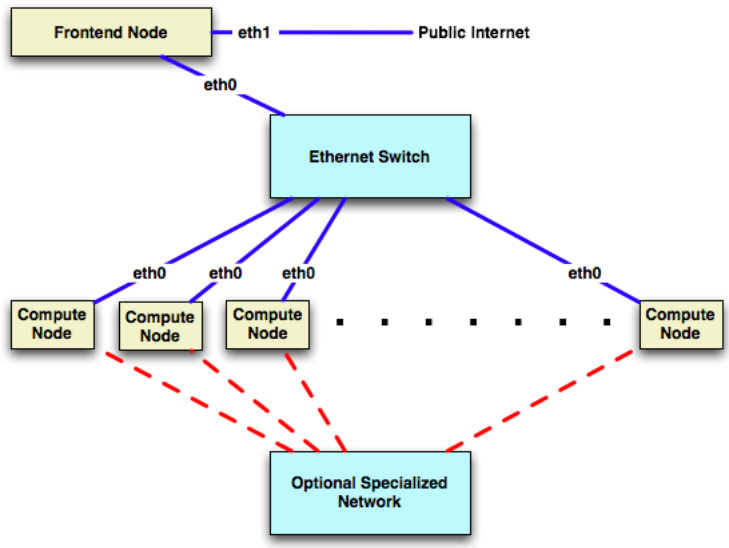
- **Disk Capacity:** 30 GB
- **Memory Capacity:** 1 GB
- **Ethernet:** 1 physical port (e.g., "eth0")
- **BIOS Boot Order:** PXE (Network Boot), CD, Hard Disk

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[1] *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

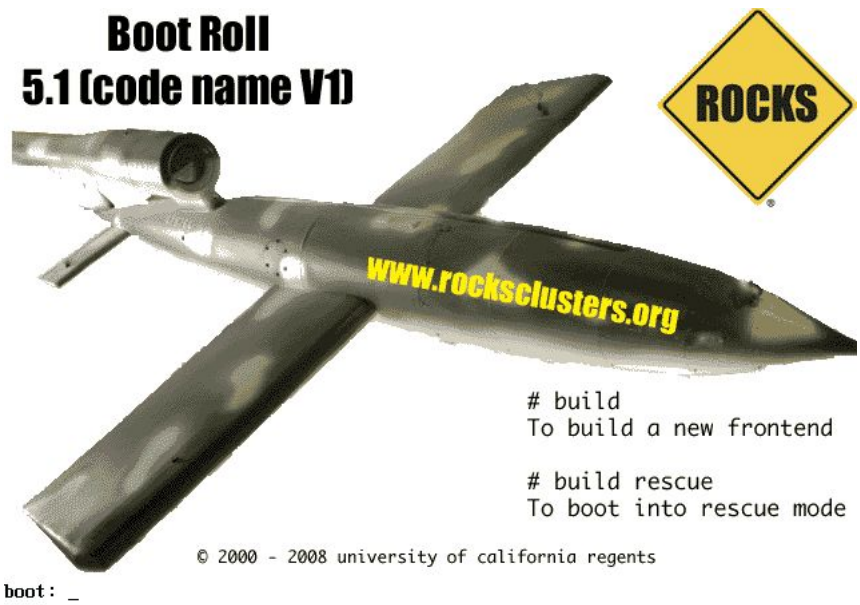
The Core Meta Roll CD can be substituted for the individual Base and Web-Server Rolls.

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 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:



When you see the screen above, type:

```
build
```

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).

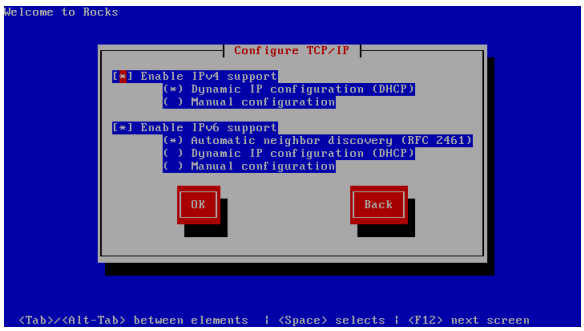
If the installation fails, very often you will see a screen that complains of a missing `/tmp/ks.cfg` kickstart file. To get more information about the failure, access the kickstart and system log by pressing `Ctrl-Alt-F3` and `Ctrl-Alt-F4` respectively.

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

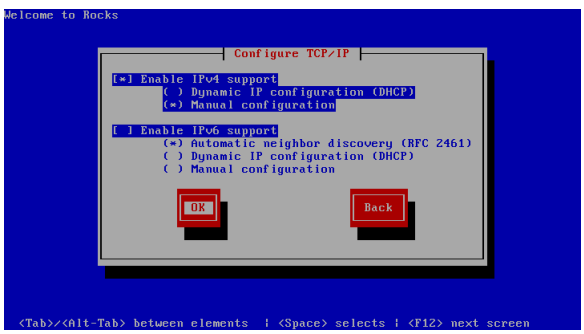
3.

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

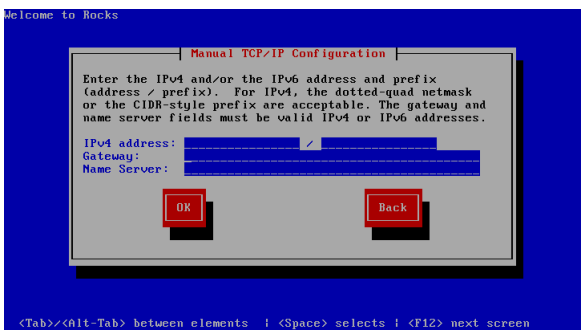
If you see the screen below:



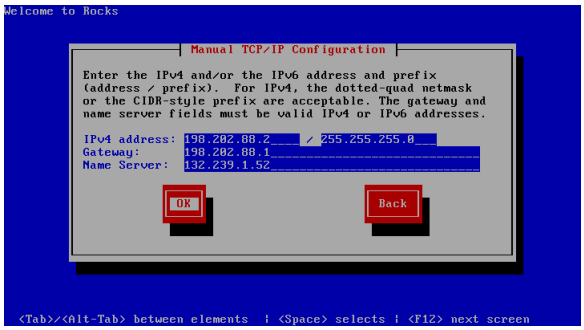
You'll want to: 1) enable IPv4 support, 2) select manual configuration for the IPv4 support (no DHCP) and, 3) disable IPv6 support. The screen should look like:



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

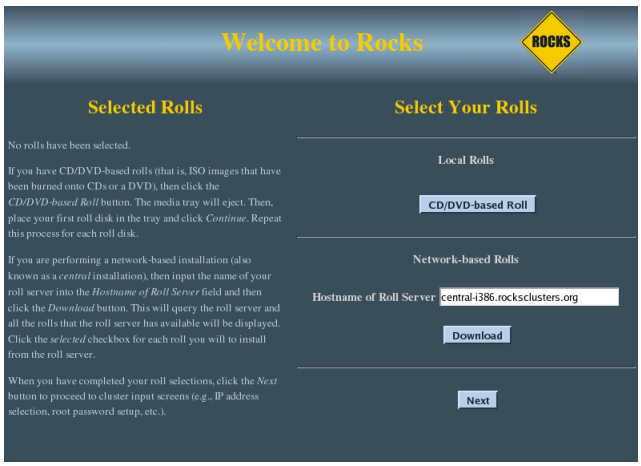


In this screen, enter the *public* IP configuration. Here's an example of the public IP info we entered for one our frontends:



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

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

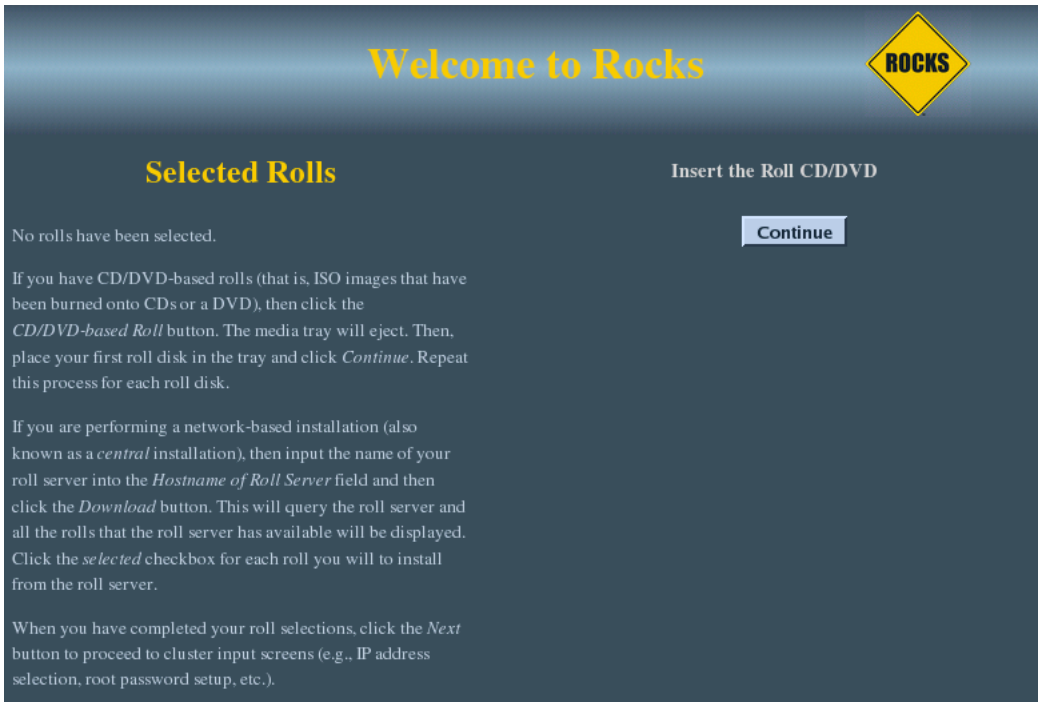


From this screen, you'll select your rolls.

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.

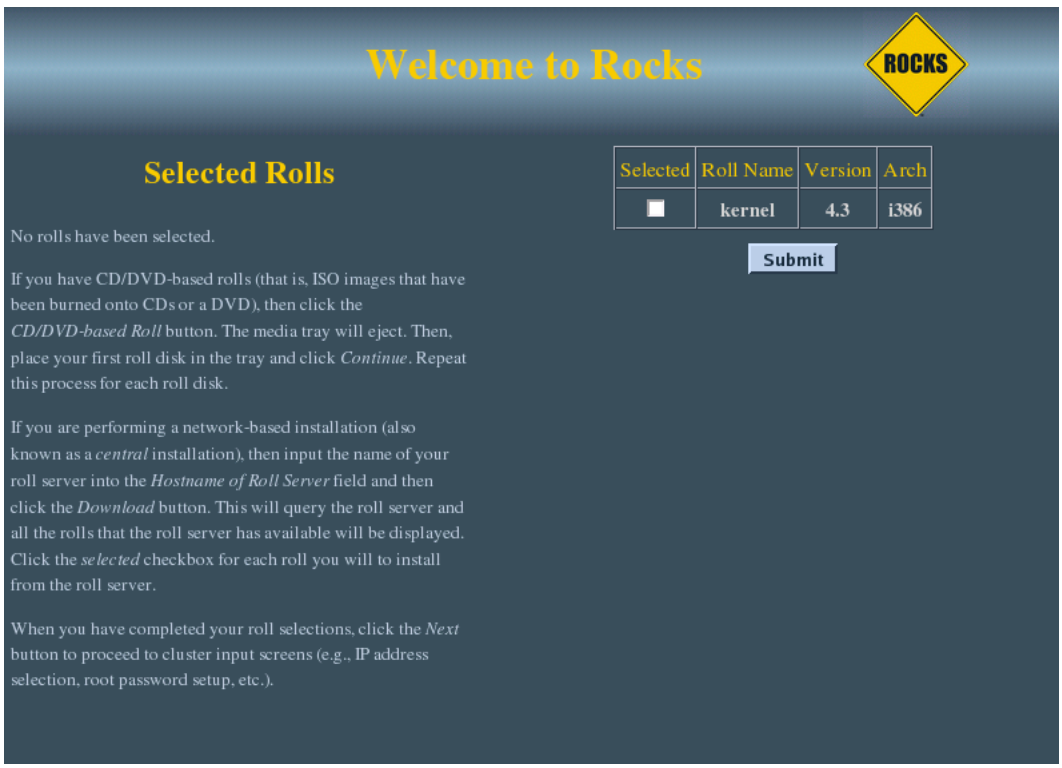
5. The CD will eject and you will see this screen:



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).

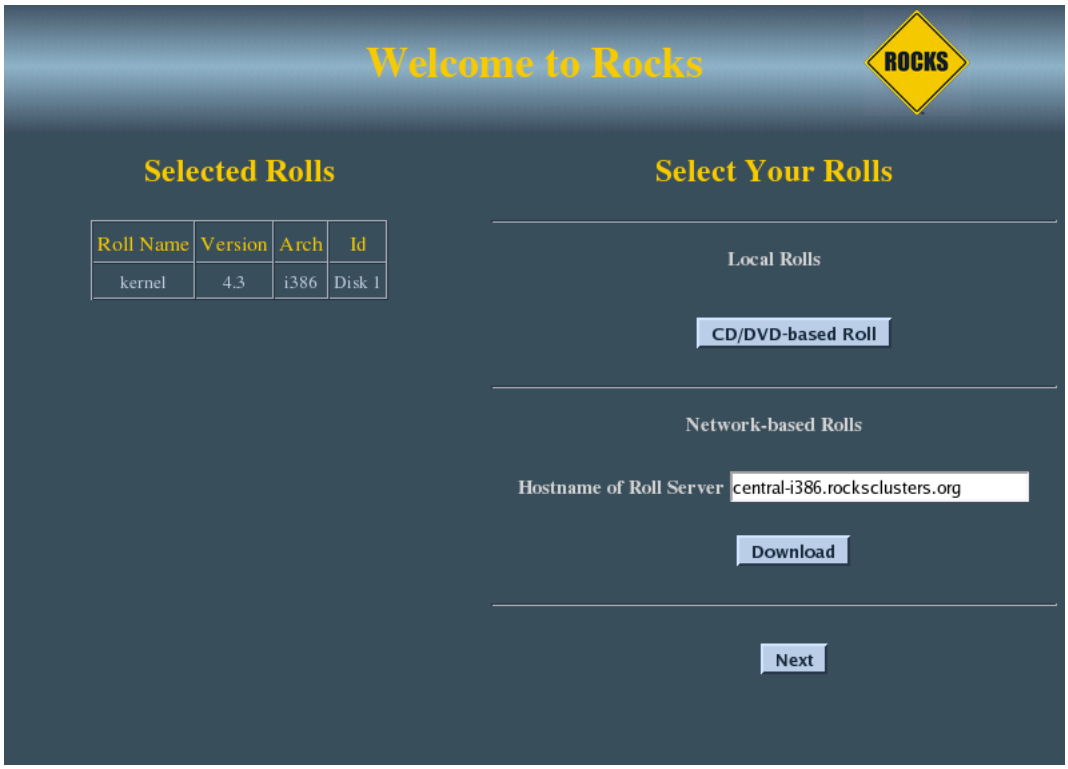
Click the 'Continue' button.

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



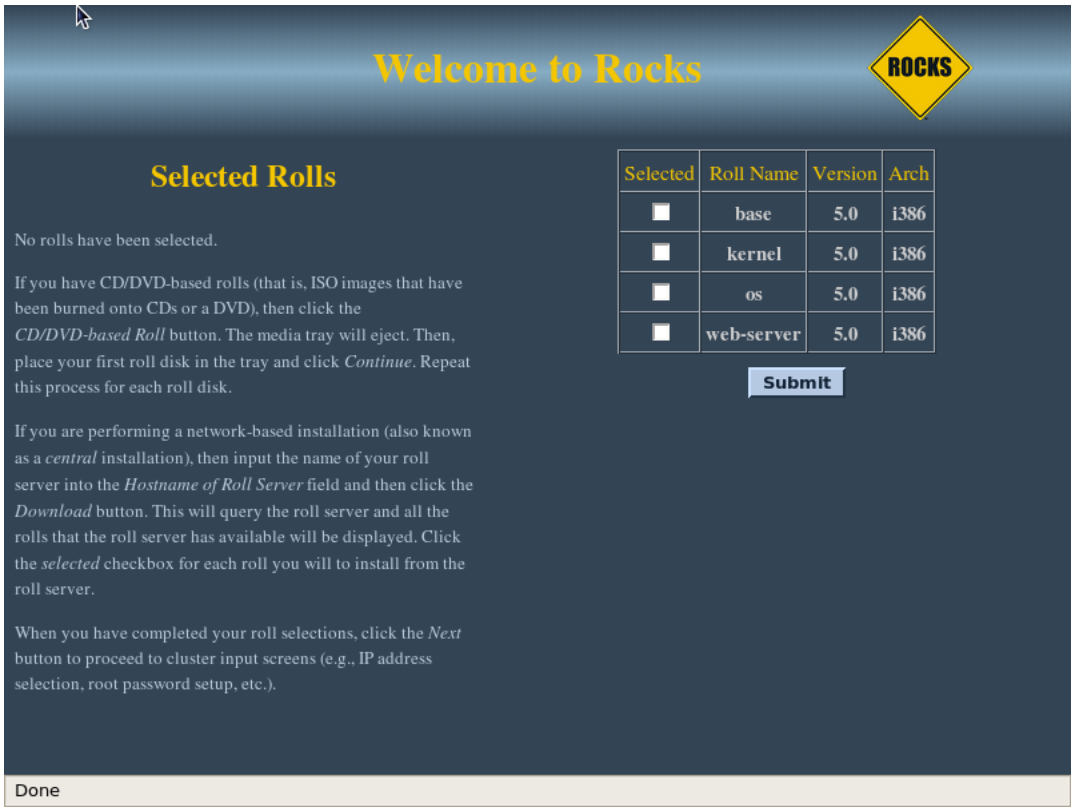
Select the Kernel/Boot Roll by checking the 'Selected' box and clicking the 'Submit' button.

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



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:



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

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

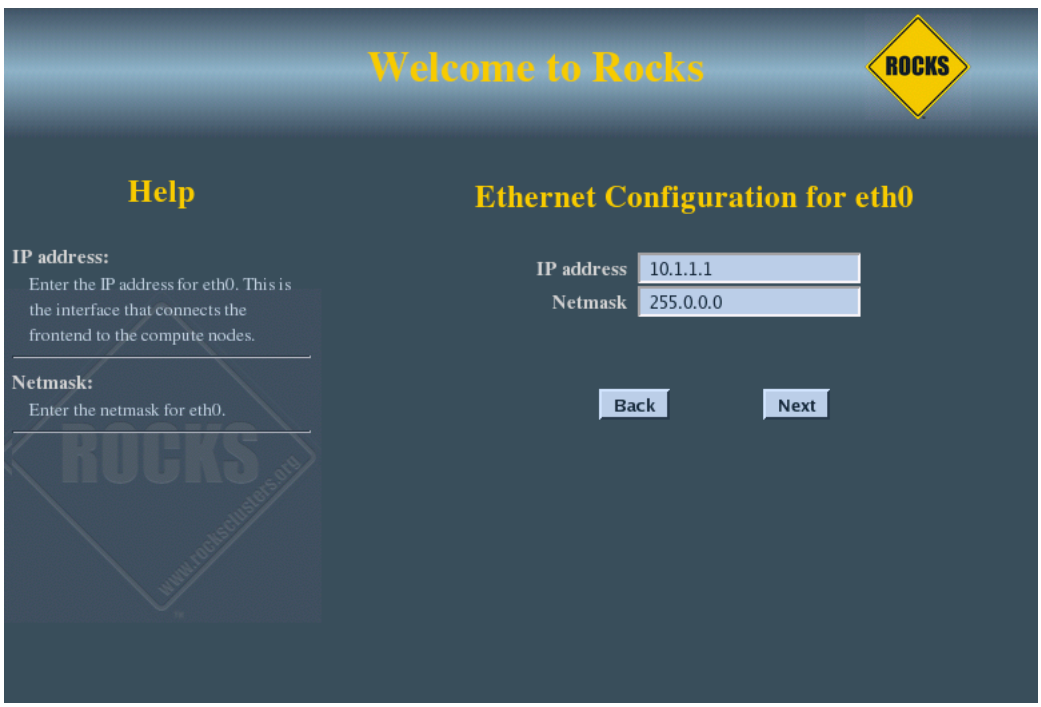
The one important field in this screen is the *Fully-Qualified Host Name* (all other fields are optional).

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.

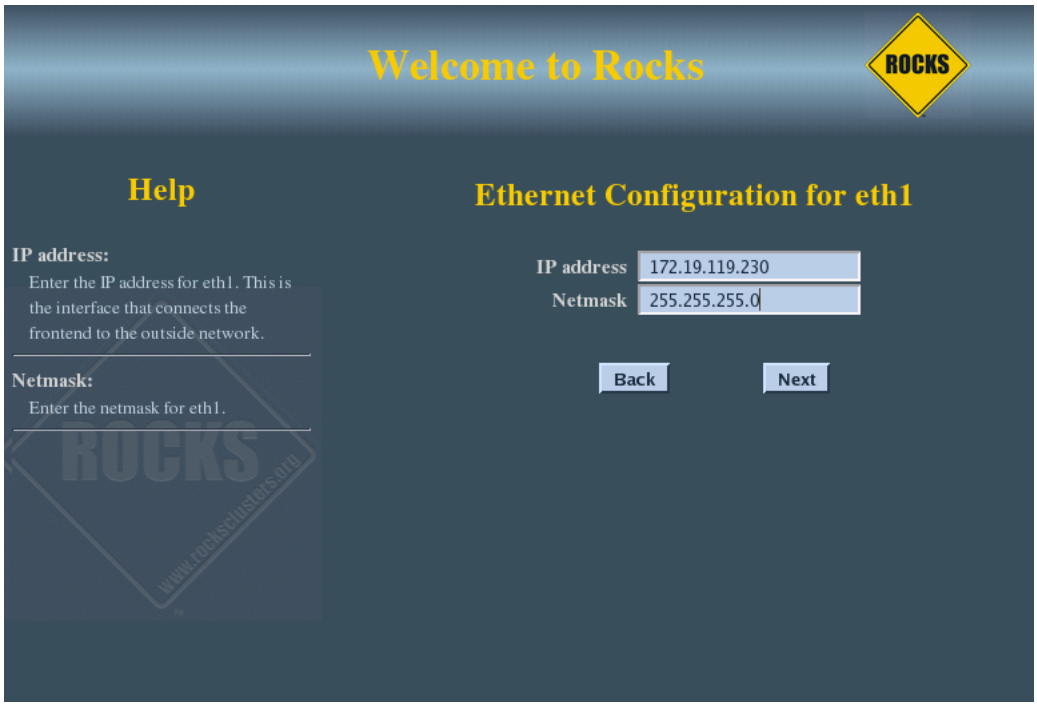
Fill out the form, then click the 'Next' button.

10. 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.



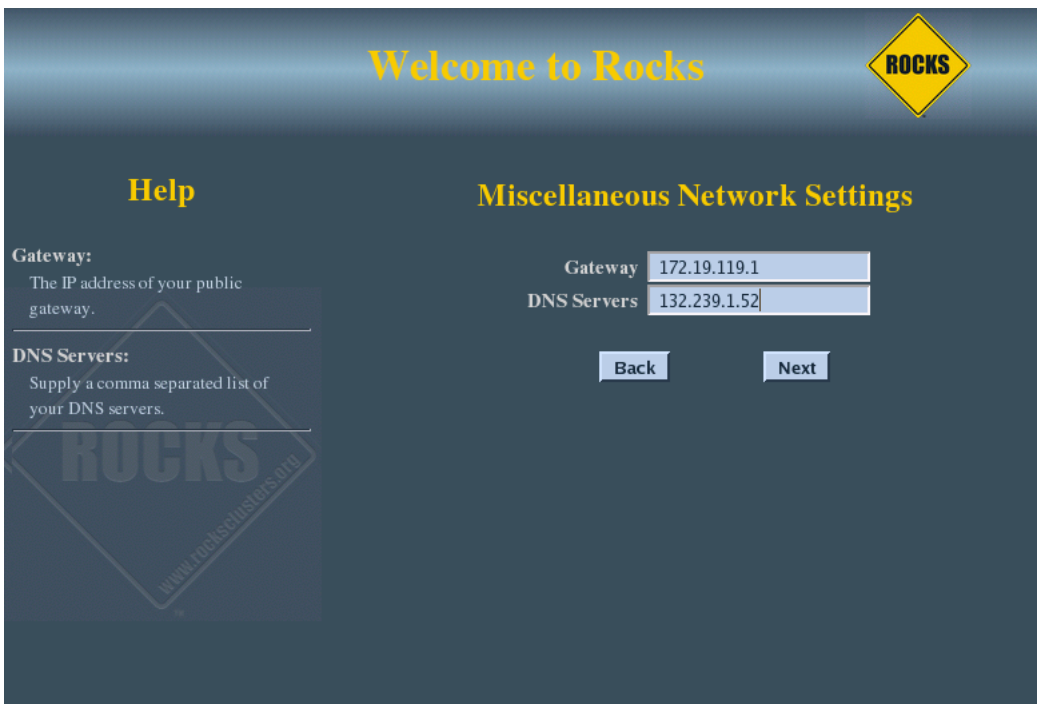
It is recommended that you accept the defaults (by clicking the 'Next' button). But for those who have unique circumstances that requires different values for the internal ethernet connection, we have exposed the network configuration parameters.

11. 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).

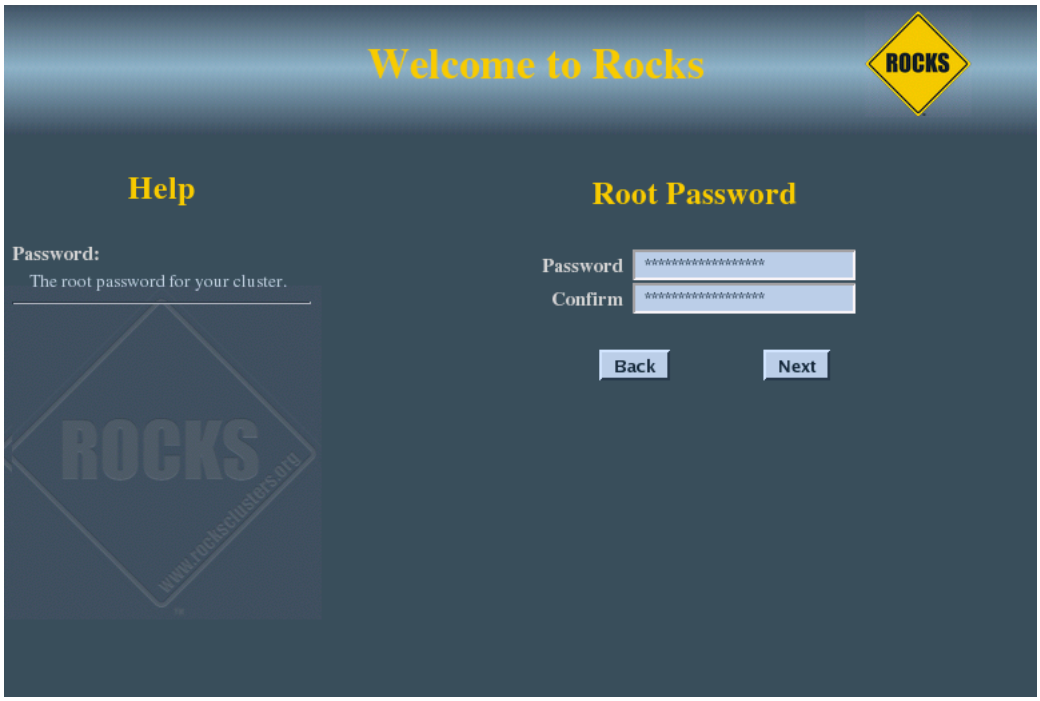


The above window is an example of how we configured the external network on one of our frontend machines.

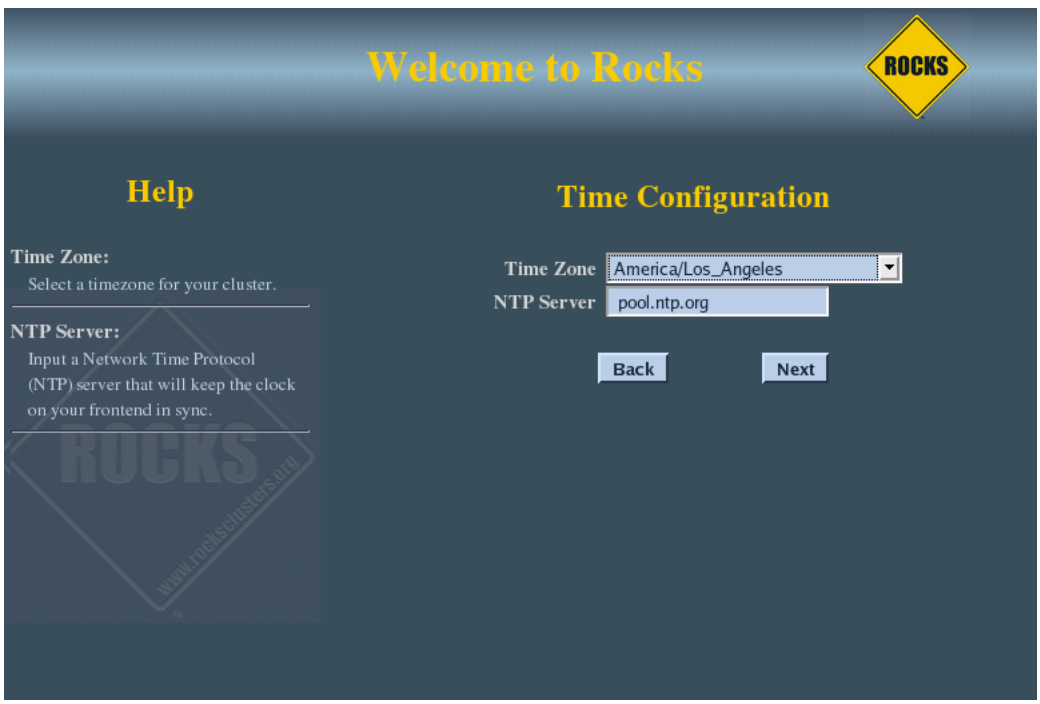
12. Configure the the *Gateway* and *DNS* entries:



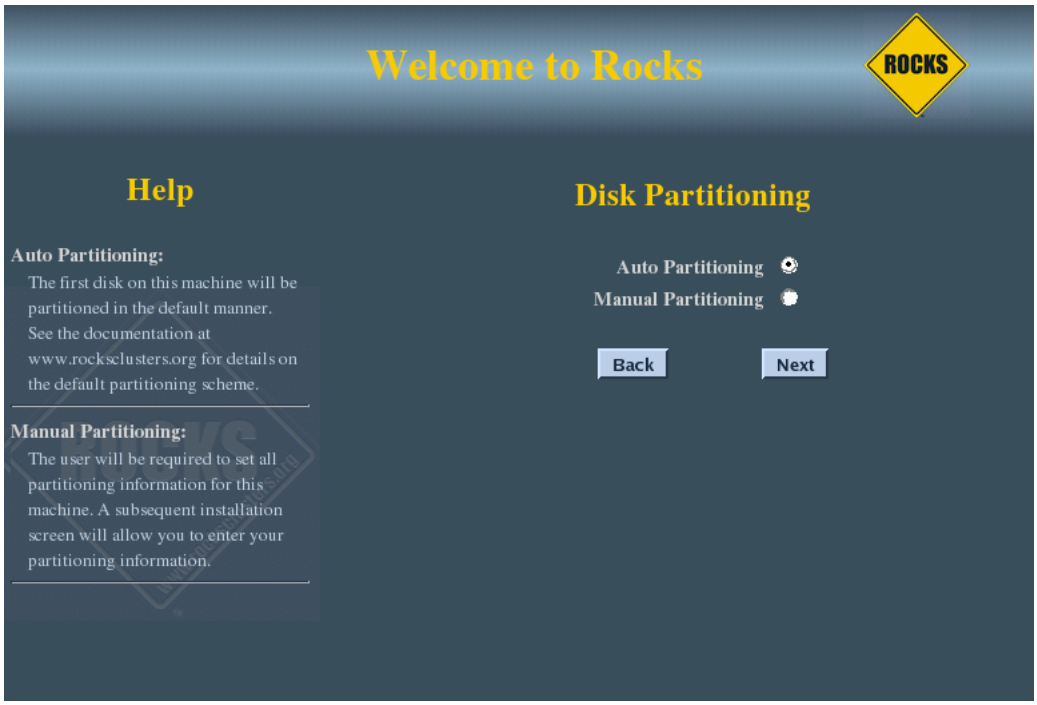
13. Input the root password:



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
/	16 GB
/var	4 GB
swap	1 GB
/export (symbolically linked to /state/partition1)	*remainder of root disk*

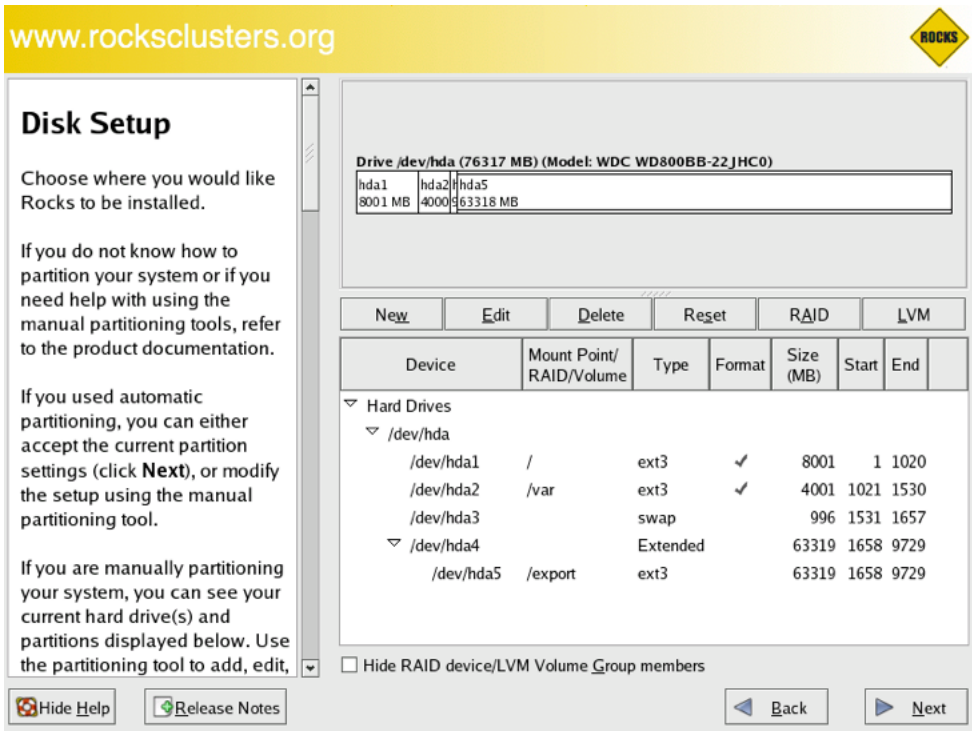
When you use automatic partitioning, the installer will repartition and reformat the *first hard drive* that the installer discovers. All previous data on this drive will be erased. All other drives will be left untouched.

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:



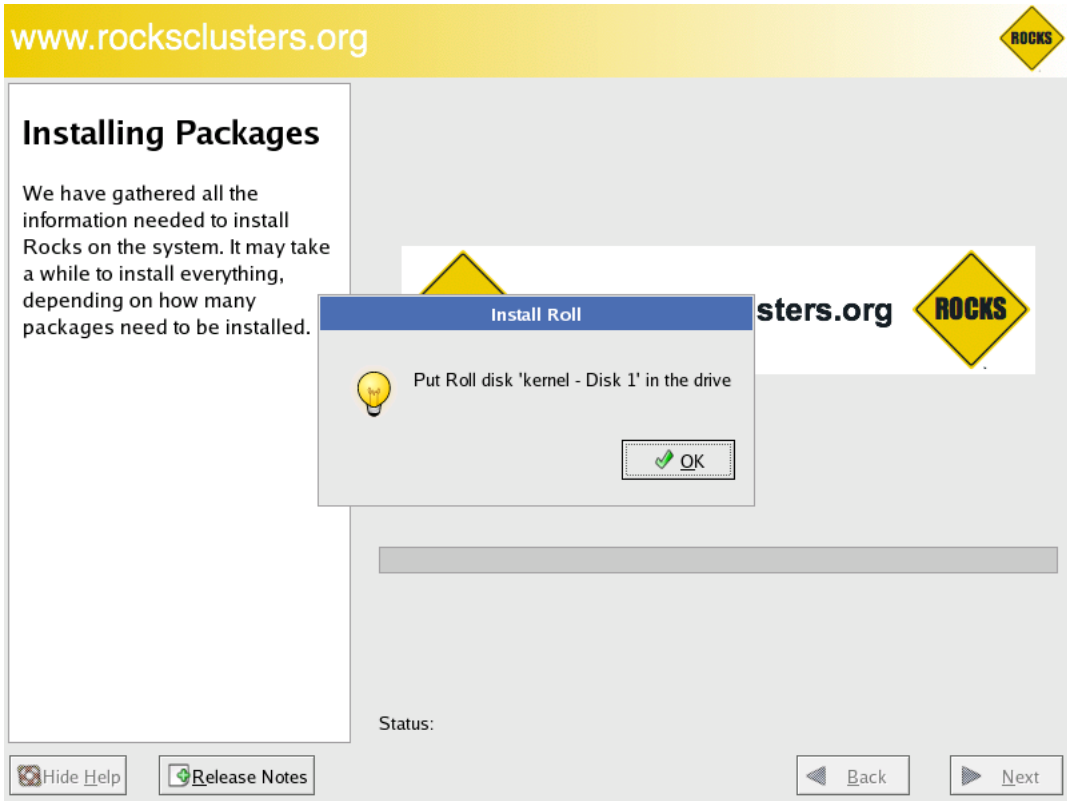
Above is an example of creating a '/', '/var', swap and '/export' partitions.

If you select manual partitioning, you must specify at least 16 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.



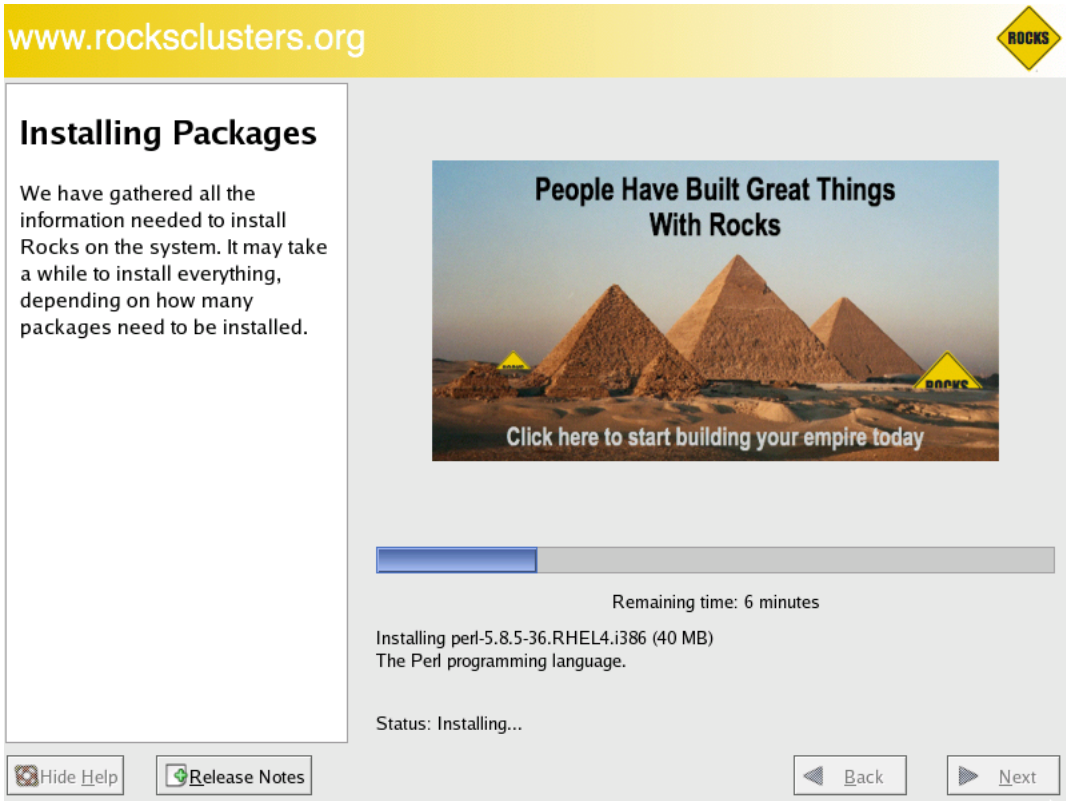
In the example screen above, insert the Kernel/Boot Roll into the CD tray and click 'OK'.

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:



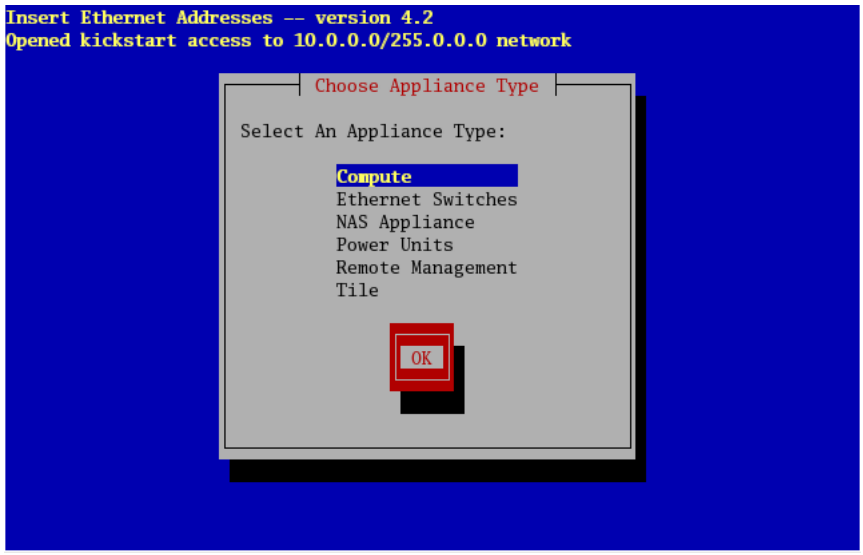
19. Finally, the boot loader will be installed and post configuration scripts will be run in the background. When they complete, the frontend will reboot.

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.

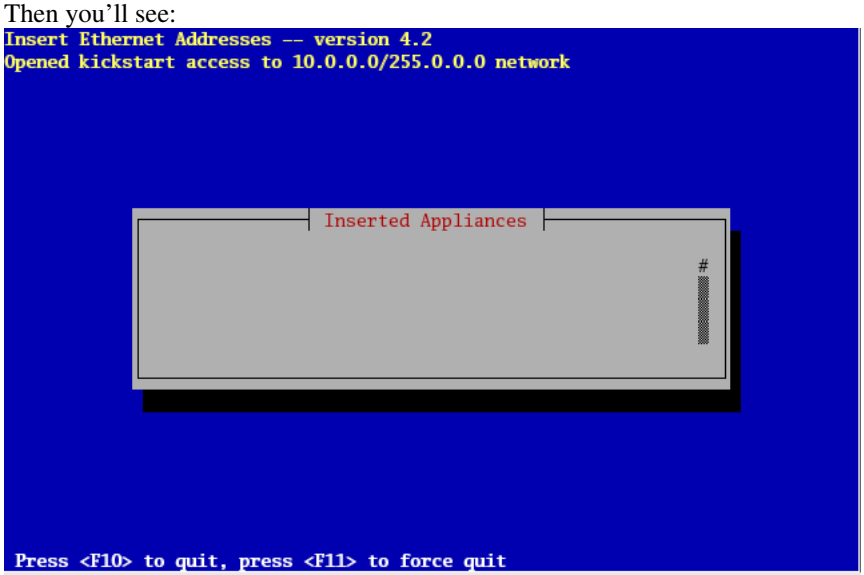
When `insert-ethers` captures the DHCP request for the managed switch, it will configure it as an ethernet switch and store that information in the MySQL database on the frontend.

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.

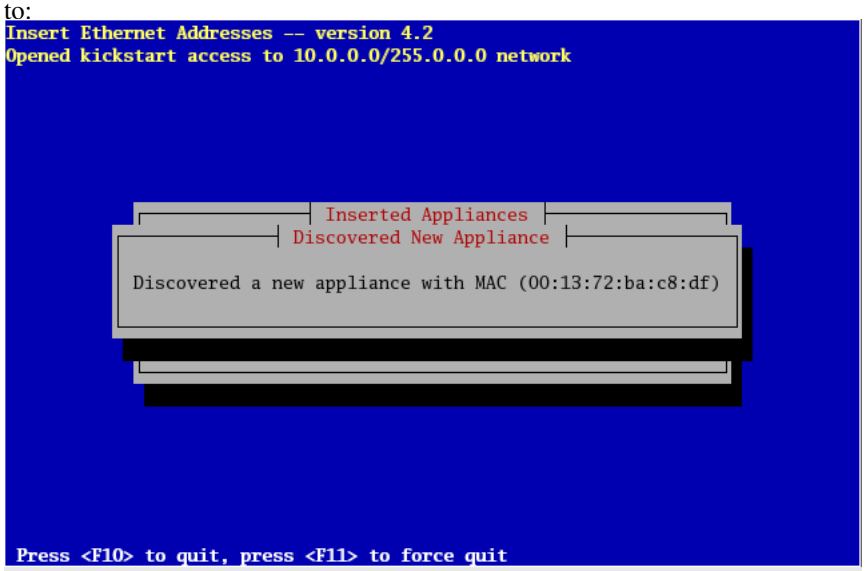
4. Power up the first compute node.

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.

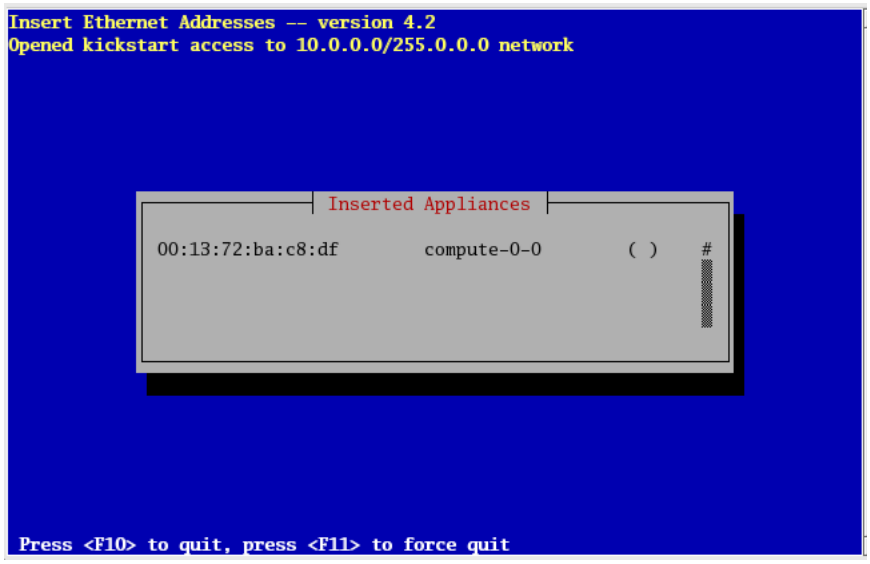
If you don't have a CD drive in your compute nodes and if the network adapters in your compute nodes don't support PXE, see Using a Floppy to PXE boot.

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



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:



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.

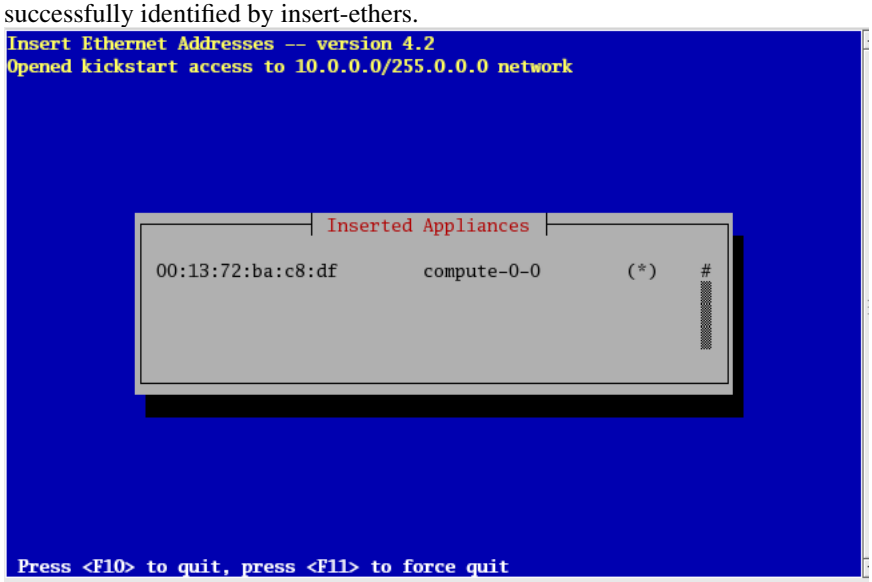


Figure: The compute node has successfully requested a kickstart file from the frontend. If there are no more compute nodes, you may now quit insert-ethers. Kickstart files are retrieved via HTTPS. If there was an error during the transmission, the error code will be visible instead of "*".

6. 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
   ```

7. After you've installed all the compute nodes in a cabinet, quit `insert-ethers` by hitting the 'F8' key.

8. 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.

Let's 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 += /share/apps/myscript.sh /share/apps/myscript2.py
```

This will add the shell script `/share/apps/myscript.sh`, and the python script `/share/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/rocks/install/site-profiles` are saved and restored. So, any user modifications that are added via the XML node method will be preserved.

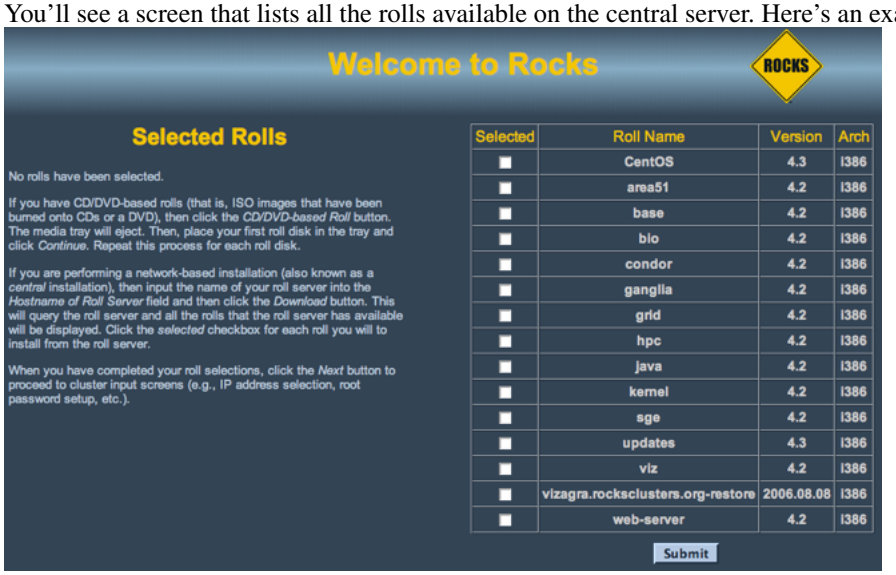
The networking info for all node interfaces (e.g., the frontend, compute nodes, NAS appliances, etc.) are saved and restored. This is accomplished via the 'rocks dump' command.

2.5. Installing a Frontend over the Network

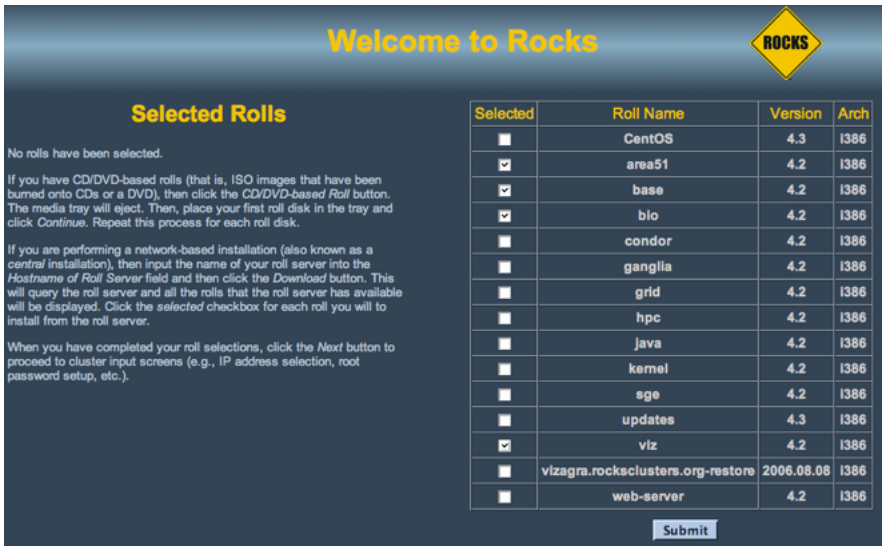
This section describes installing a Rocks frontend from a "Central" server over the wide area network, a process called WAN kickstart. The client frontend will retrieve Rocks Rolls and configuration over the Internet, and use these to install itself.

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:

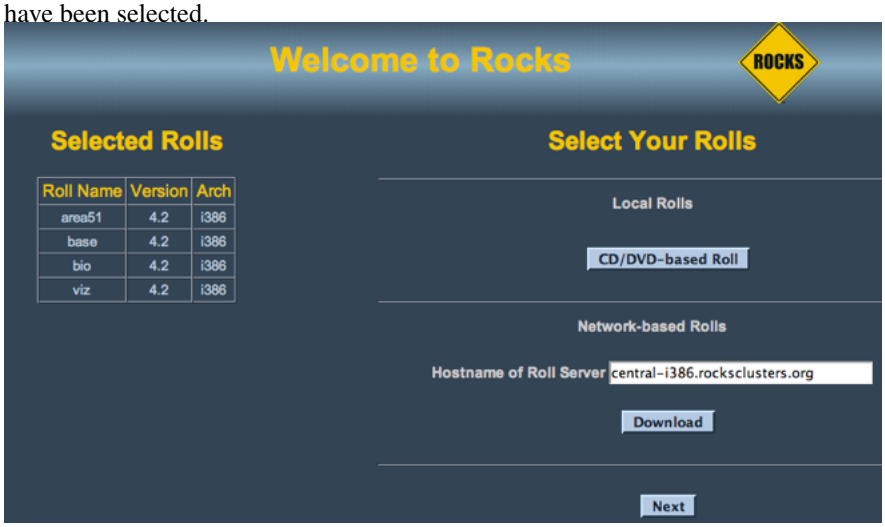


3. Now, select the rolls from the central server. To select a roll, click the checkbox next to roll. For example, this screen shows the *area51*, *base*, *bio* and *viz* rolls selected:



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.



5. To select more rolls from another server, go to step 1 and enter a different FQDN.
6. 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.
7. 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.
8. 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 permenantly 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.

1. 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. Defining and Modifying Networks and Network Interfaces

3.1. Networks, Subnets, VLANs and Interfaces

Rocks uses a SQL database to hold information about nodes including network device information. In version 5.1 support was added for VLAN tagged interfaces to enable construction of virtual clusters and other more complicated network scenarios. There are a large number of commands that allow manipulation of subnet definitions, physical interfaces, and logical VLAN interfaces.

The basic model of operation is for an administrator to use a series of commands to add and set/change networking definitions in the database and then either re-install a node or reconfigure/restart the network configuration by calling `rocks sync config <host>`

3.2. Named Networks/Subnets

Rocks clusters are required to have two subnets defined: "public" and "private", but a cluster owner can define more subnets. The commmand `rocks list network` lists the defined networks

```
[root@rocks ~]# rocks list network
NETWORK    SUBNET       NETMASK
private:   172.16.254.0 255.255.255.0
public:    132.239.8.0  255.255.255.0
optiputer: 67.58.32.0   255.255.224.0
```

In the screen above, the additional network called "optiputer" is defined with netmask 255.255.224.0(/19). To add a network called "fast" as 192.168.1.0 and netmask 255.255.255.0(/24) do the following

```
[root@rocks ~]# rocks add network fast subnet=192.168.1.0 netmask=255.255.255.0
[root@rocks ~]# rocks list network
NETWORK    SUBNET       NETMASK
private:   172.16.254.0 255.255.255.0
public:    132.239.8.0  255.255.255.0
optiputer: 67.58.32.0   255.255.224.0
fast:      192.168.1.0  255.255.255.0
```

The subnet and netmask of an existing network can be changed using `rocks set network subnet` and `rocks set network netmask` commands.

3.3. Host Interfaces

There are three types of interfaces that a cluster owner may need to be concerned about: physical, logical, and VLAN (virtual LAN) bridges. Linux (and other OSes like Solaris) support logical interfaces that share a particular physical network port. The following shows physical network devices and associations of those devices to a named network (or subnet, used interchangably in this discussion). In figures, the /<nn> notation is standard method of specify the number of bits in the netmask. Examples include: /24=255.255.255.0 (Class C subnet), /16=255.255.0.0 (Class B subnet), /8=255.0.0.0 (Class A subnet) and /25=255.255.255.128

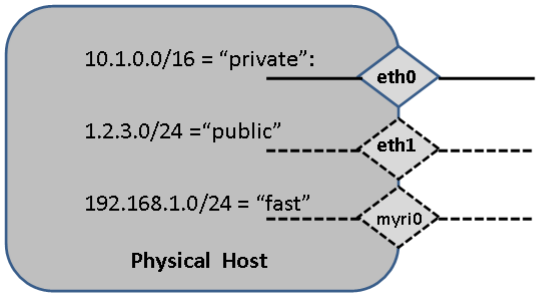


FIGURE: Hosts can have any number of physical networking devices. Every Rocks Node must eth0 defined (the private network). Frontends also must have eth1 (the public network). Other devices could be myri0 (for Myrinet) or ib0 (for Infiniband).

Adding a new network interface to a host can be done from the command line. For example, to add an interface named "myri0" with IP address 192.168.1.10 on logical subnet "fast", then

```
[root@rocks ~]# rocks add host interface compute-0-0-1 iface=myri0 subnet=fast ip=192.168.1.10
[root@rocks ~]# rocks list host interface compute-0-0-1
SUBNET  IFACE MAC               IP             NETMASK       GATEWAY MODULE NAME          VLANID
private eth0  00:16:3e:00:00:11 172.16.254.192 255.255.255.0 ------- xennet compute-0-0-1 ------
fast    myri0 ----------------- 192.168.1.10   255.255.255.0 ------- ------ ------------- ------
```

You can also set other fields for a host interface when field is one of [mac, ip, gateway, module, name, vlanid] the command `rocks set host interface <field> <host> iface=<iface> value`. So set the name of host of compute-0-0-1 on myri0 interface execute the command

```
[root@rocks ~]# rocks set host interface name compute-0-0-1 iface=myri0 compute-myri-0-0-1
[root@rocks ~]# rocks list host interface compute-0-0-1
SUBNET  IFACE MAC               IP             NETMASK       GATEWAY MODULE NAME               VLANI
private eth0  00:16:3e:00:00:11 172.16.254.192 255.255.255.0 ------- xennet compute-0-0-1      -----
fast    myri0 ----------------- 192.168.1.10   255.255.255.0 ------- ------ compute-myri-0-0-1 -----
```

3.4. Virtual LANs (VLANs) and Logical VLAN Bridges

Linux supports VLAN tagging on virtual interfaces (i.e. IEEE 802.1Q). For example, if a host has physical interface eth0 (untagged), then the kernel can send and receive a tagged packets if a properly defined interface named

eth0.<vlanid> has been created and properly configured. Tagging allows the same physical network to be partitioned into many different networks. A key feature of VLAN tagging is that a broadcast packet (e.g. a DHCPDISCOVER Packet) only broadcasts on the tagged VLAN in which is was initially sent.

Rocks supports two types of VLAN interfaces - the first is an explicit device name like eth0.10 that is defined on a particular physical interface. The second is a logical device name of the form "vlan*". In rocks, the physical VLAN device can also have an IP address associated with it, however a logical VLAN device cannot. We use the logical VLAN to construct bridges suitable that are suitable for virtual machines.

1. Explicit VLAN Devices of the form <interface>.<vlanid> can have IP addresses assigned
2. Rocks-Specific: Logical VLAN Devices of the form "vlan*" CANNOT have IP address assigned

3.4.1. Physical VLAN Devices

Physical VLAN devices are interfaces associated with a specific physical interfaces. While eth0 is used as and example, any physical IP interface can have a VLAN associated with it.

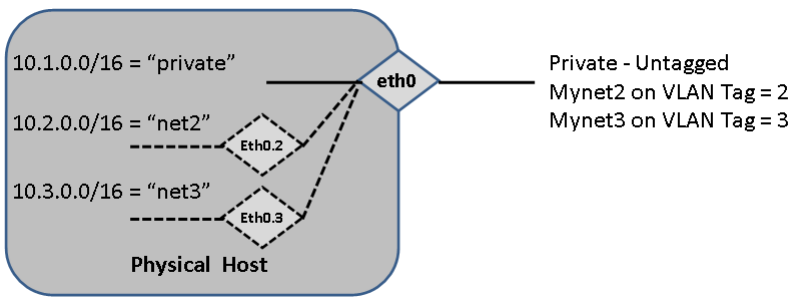


FIGURE: Physical VLAN device called eth0.2. This device may be assigned an IP and a network name (e.g. "net") that is unrelated to the network name of the physical device (eth0). All packets sent on this interface will be tagged with VLANID=2. Multiple Physical VLAN devices can be defined.

Use the following example to add a physical VLAN device, Assign a tag, and an IP address

```
[root@rocks ~]# rocks add host interface compute-0-0-1 iface=eth0.2 subnet=net2 ip=10.2.1.10
[root@rocks ~]# rocks set host interface vlan compute-0-0-1 iface=eth0.2 vlanid=2
[root@rocks ~]# rocks list host interface compute-0-0-1
SUBNET  IFACE  MAC               IP             NETMASK       GATEWAY MODULE NAME          VLANID
private eth0   00:16:3e:00:00:11 172.16.254.192 255.255.255.0 ------- xennet compute-0-0-1 ------
net2    eth0.2 ----------------- 10.2.1.10      255.255.255.0 ------- ------ ------------- 2
```

3.4.2. Logical VLAN Devices

The second kind of VLAN interface that Rocks supports is a what we term as Logical VLAN device. The Virtual VLAN gives the ability of having a raw interface with no IP address assigned that is generally used as a bridge for

virtual machine guests. Virtual VLAN devices have their subnet=<subnet of physical>

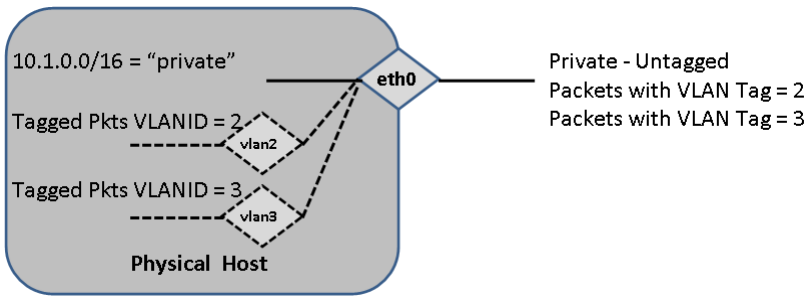


FIGURE: Virtual VLAN devices called vlan2 and vlan3. These types of devices may be NOT have an IP address (This is a Rocks-specific construction).

```
[root@rocks ~]# rocks add host interface compute-0-0-1 vlan2
[root@rocks ~]# rocks add host interface compute-0-0-1 vlan3
[root@rocks ~]# rocks set host interface vlan compute-0-0-1 vlan2 2
[root@rocks ~]# rocks set host interface vlan compute-0-0-1 vlan3 3
[root@rocks ~]# rocks list host interface compute-0-0-1
SUBNET  IFACE MAC               IP             NETMASK       GATEWAY MODULE NAME          VLANID
private eth0  00:16:3e:00:00:11 172.16.254.192 255.255.255.0 ------- xennet compute-0-0-1 ------
------- vlan2 ----------------- -------------- ------------- ------- ------ ------------- 2
------- vlan3 ----------------- -------------- ------------- ------- ------ ------------- 3
```

At this stage, the vlan interfaces are not currently associated with any physical network device. Linux will not configure these devices on the node without the association. We overload the meaning of subnet in this case to mean: "associate the logical vlan device with the physical device that is in subnet ’x’". As an example, we can associate both vlan2 and vlan3 to be tagged packet interfaces on the the subnet named private.

```
[root@tranquil ~]# rocks set host interface subnet compute-0-0-1 vlan2 subnet=private
[root@tranquil ~]# rocks set host interface subnet compute-0-0-1 vlan3 subnet=private
[root@tranquil ~]# rocks list host interface compute-0-0-1
SUBNET  IFACE MAC               IP             NETMASK       GATEWAY MODULE NAME          VLANID
private eth0  00:16:3e:00:00:11 172.16.254.192 255.255.255.0 ------- xennet compute-0-0-1 ------
private vlan2 ----------------- -------------- ------------- ------- ------ ------------- 2
private vlan3 ----------------- -------------- ------------- ------- ------ ------------- 3
```

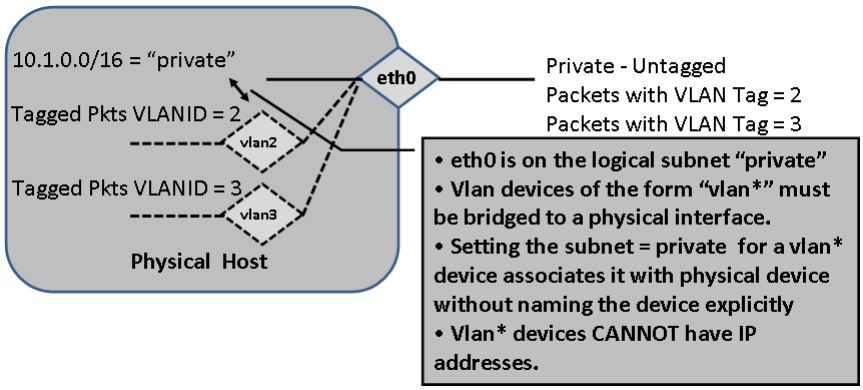


FIGURE: Virtual VLAN devices called vlan2 and vlan3 are associated with the physical device that is desigated as subnet private. Notice, that no netmask is associated with the vlan2 and vlan3 devices. These are raw, tagged packet interfaces and are of most use for bridges when hosting VMs.

3.5. Network Bridging for Virtual Machines

Rocks support of Virtual Machines requires the proper setup of networking bridges. Rocks supports multiple network adapters for Virtual Machines, In this section, we describe the various kinds of bridging scenarios for virtual machines and how to set them up. For these examples, the physical machine will be called vm-container-0-0,

3.5.1. VM Network Bridging to Physical Devices

When a VM is bridged to the physical device, it must be assigned in the same subnet as the physical device with a compatible IP address

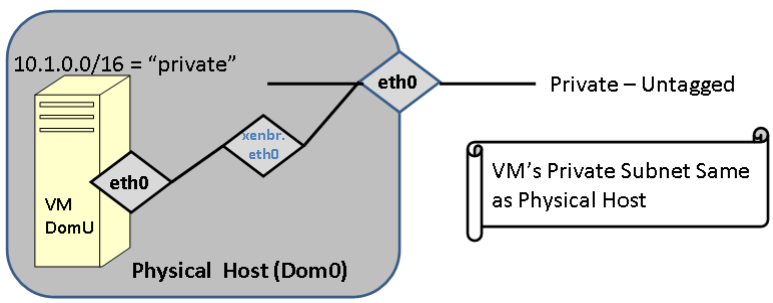


FIGURE: The Virtual machine is bridged to eth0. In this case eth0 of the VM is in the same subnet (with a compatible IP) address. The VM and the Container will be able to ping each other. This was the only configuration supported in Rocks 5.0

Use the following example shows this most basic of bridging scenarios. The guest (compute-0-0-1) and the container (vm-container-0-0) are in the same IP subnet ans will be able to ping each other.

```
[root@tranquil images]# rocks list host interface vm-container-0-0 compute-0-0-1
HOST              SUBNET    IFACE    MAC               IP             NETMASK       GATEWAY MODULE N
```

```
compute-0-0-1:    private   eth0     00:16:3e:00:00:11 172.16.254.192 255.255.255.0 ------- xennet c
vm-container-0-0: private   eth0     00:09:6b:89:39:68 172.16.254.238 255.255.255.0 ------- e1000  v
```

3.5.2. Logical VLAN Devices

In this scenario, The guest (hosted-vm-0-0-2) and the host (vm-container-0-0) are not in the same logical network.

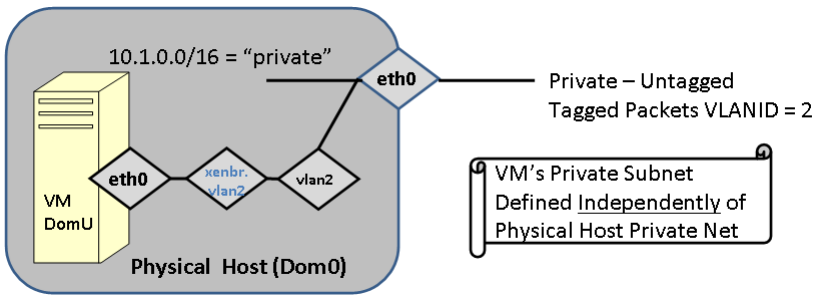


FIGURE: Guest VM is bridged through a logical VLAN devices.

```
[root@rocks ~]# rocks list host interface vm-container-0-0 hosted-vm-0-0-0
HOST               SUBNET  IFACE MAC               IP              NETMASK   GATEWAY MODULE NAME
hosted-vm-0-0-0:  ------- eth0  00:16:3e:00:00:05 -------------- ---------- ------ ------ hosted-vm-
vm-container-0-0: private eth0  00:0e:0c:5d:7e:5e 10.255.255.254 255.0.0.0 ------- e1000  vm-contain
vm-container-0-0: private vlan2 ----------------- -------------- ---------- ------- ------ ----------
```

In the above configuration, Logical VLAN device vlan2 (with tag=2) will be on the physical network eth0 on vm-container-0-0. The hosted-vm-0-0 (a Rocks "appliance" that simply holds a generic VM guest) will have have its interface on VLANID=2. The physical machine must have a Logical vlan device with the same tag.

Below we, give a more complicated configuration and walk through exactly what is bridged where.

```
[root@rocks ~]# rocks list host interface vm-container-0-0
SUBNET  IFACE   MAC               IP             NETMASK       GATEWAY MODULE NAME             VLANI
private eth0    00:0e:0c:5d:7e:5e 10.255.255.254 255.0.0.0     ------- e1000  vm-container-0-0 -----
net10   eth1    00:10:18:31:74:84 192.168.1.10   255.255.255.0 ------- tg3    vm-net10-0-0     -----
net10   vlan100 ----------------- -------------- ------------- ------- ------ ---------------- 100
private vlan2   ----------------- -------------- ------------- ------- ------ ---------------- 2

[root@rocks ~]# rocks list host interface hosted-vm-0-0-0
SUBNET IFACE MAC               IP NETMASK GATEWAY MODULE NAME            VLANID
------ eth0  00:16:3e:00:00:05 -- ------- ------- ------ hosted-vm-0-0-0 2
------ eth1  00:16:3e:00:00:80 -- ------- ------- ------ --------------- 100
```

In the above scenario, if hosted-vm-0-0-0 (Xen guest, DomU) were to be booted on physical host vm-container-0-0 (Dom0), The packets from the guest on eth0 will be tagged with VLANID=2, and eth1 with VLANID=100. The host machine, must have Logical VLAN interfaces called "vlan*.". To make the proper bridge configuration, Rocks will match the VLANIDs of the guest interfaces to the VLANIDs on the host. On the host, logical interface vlan2 is labeled as being on the private network (eth0) and logical vlan100 is labeled as being on the net10 network (eth1). on

3.5.3. Networking for Virtual Clusters

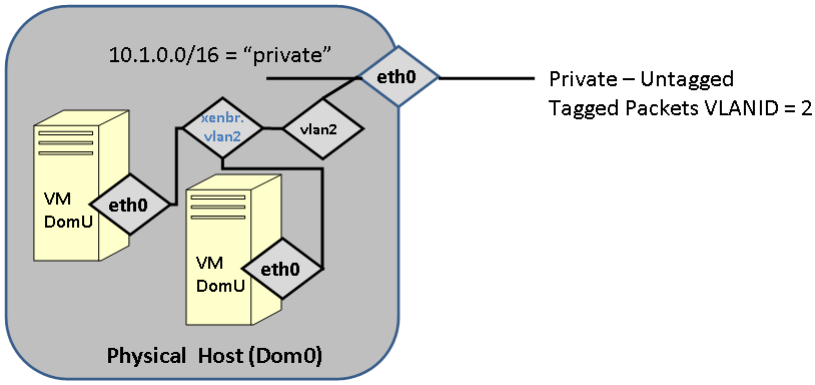


FIGURE: Multiple VMS communicating on a Logical VLAN interface.

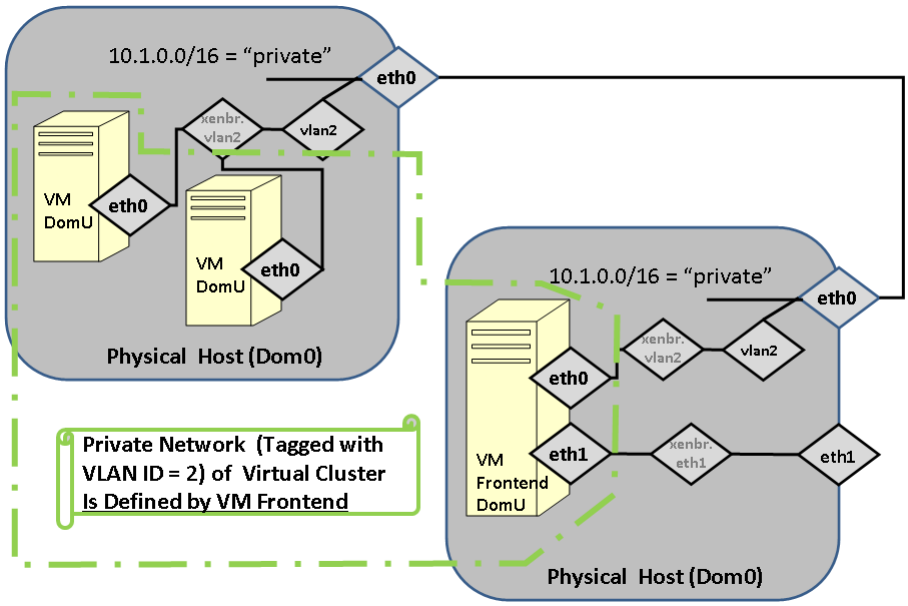


FIGURE: Fully Virtualized cluster, including a virtual frontend.

3.6. Networking Configuration Examples

In this section, we describe some common networking configurations and how to use Rocks commands to set up various networking scenarios

3.6.1. Adding a public IP address the second ethernet adapter on a compute node

Often, owners want the second ethernet adapter to be on the public network and for the default routing to be in the

public network. Assuming that the public network is 1.2.3.0/255.255.255.0 and the default gateway for that network is 1.2.3.1, the following set of commands define the second interface of a compute to have address 1.2.3.25 with name mypublic.myuniversity.edu, update all required configruation files on the frontend, update all required configuration files on the node compute-0-0 and restart the network on compute-0-0.

```
rocks set host interface ip  compute-0-0 iface=eth1 ip=1.2.3.25
rocks set host interface gateway  compute-0-0 iface=eth1 ip=1.2.3.1
rocks set host interface name  compute-0-0 iface=eth1 name=mypublic.myuniversity.edu
rocks sync config
rocks sync network compute-0-0
```

3.6.2. Adding an IP network for local message passing.

Often, users will want to use the second ethernet device for a messaging passing. In this example, we illustrate creating a named subnet work and then scripting IP assignment for a rack of 32 nodes with IP range of 192.168.1.10 ... 192.168.1.41.

```
rocks add network fast subnet=192.168.1.0 netmask=255.255.255.0
IP=10
NNODES=32
NODE=0
while [ $NODE -lt $NNODES ]; then \
 rocks set host interface ip  compute-0-$NODE iface=eth1 ip=192.168.1.$IP; \
 rocks set host interface subnet  compute-0-$NODE iface=eth1 subnet=fast; \
 rocks set host interface name  compute-0-$NODE iface=eth1 name=compute-fast-0-$NODE; \
 let IP++; \
 let NODE++; \
done
rocks sync config
rocks sync network compute
```

The above will add the named subnet called "fast", assign IP addresses sequentially, name the eth1 interface on each node, rewrite DNS configuration (sync config) and finally rewrite and then restart the network configuration on each compute appliance. This additional network configuration is persistent across re-installation of nodes.

Chapter 4. Customizing your Rocks Installation

4.1. Adding Packages to Compute Nodes

Put the package you want to add in:

`/export/rocks/install/contrib/5.1/`*`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 /export/rocks/install/site-profiles/5.1/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 */export/rocks/install/rocks-dist/...*

```
# cd /export/rocks/install
# rocks create distro
```

Now, reinstall your compute nodes.

4.1.1. 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 /export/rocks/install
# rocks create distro
```

Now, reinstall your compute nodes.

4.2. Customizing Configuration of Compute Nodes

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

```
# cd /export/rocks/install/site-profiles/5.1/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 /export/rocks/install
# rocks create distro
```

Then, reinstall your compute nodes.

4.3. 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 `/share/apps`.

```
# cd /share/apps
```

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

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

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

4.4. 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.

4.5. Compute Node Disk Partitioning

4.5.1. Default Disk Partitioning

The default root partition is 16 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 4-1. Compute Node -- Default Root Disk Partition

Partition Name	Size
/	16 GB
swap	1 GB
/var	4 GB
/state/partition1	*remainder of root disk*

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

4.5.2. 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.

4.5.2.1. Single Disk Example

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

```
# cd /export/rocks/install/site-profiles/5.1/nodes/
# cp skeleton.xml replace-partition.xml
```

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

```
<main>
 <!-- kickstart 'main' commands go here -->
</main>

<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 16 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[1].

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

Then apply this configuration to the distribution by executing:

```
# cd /export/rocks/install
# rocks create distro
```

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 `/share/apps/nukeit.sh` and then execute:

```
# ssh compute-0-0 'sh /share/apps/nukeit.sh'
```

Then, reinstall the node:

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

4.5.2.2. 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 /export/rocks/install
# rocks create distro
```

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 `/share/apps/nukeit.sh` and then execute:

```
# ssh compute-0-0 'sh /share/apps/nukeit.sh'
```

Then, reinstall the node:

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

4.5.2.3. 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()

</pre>
```

4.5.3. 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 4-2. A Compute Node with 3 SCSI Drives

Device Name	Mountpoint	Size
/dev/sda1	/	16 GB
/dev/sda2	swap	1 GB
/dev/sda3	/var	4 GB
/dev/sda4	/state/partition1	*remainder of root disk*
/dev/sdb1	/state/partition2	*size of disk*
/dev/sdc1	/state/partition3	*size of disk*

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

```
# cd /export/rocks/install/site-profiles/5.1/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 /export/rocks/install
# rocks create distro
```

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 `/share/apps/nukeit.sh` and then execute:

```
# ssh compute-0-0 'sh /share/apps/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 /export/rocks/install/site-profiles/5.1/nodes/replace-partition.xml
```

Then apply this update to the distribution by executing:

```
# cd /export/rocks/install
# rocks create distro
```

4.5.4. 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 /export/rocks/install/site-profiles/5.1/nodes/
# cp skeleton.xml replace-partition.xml
```

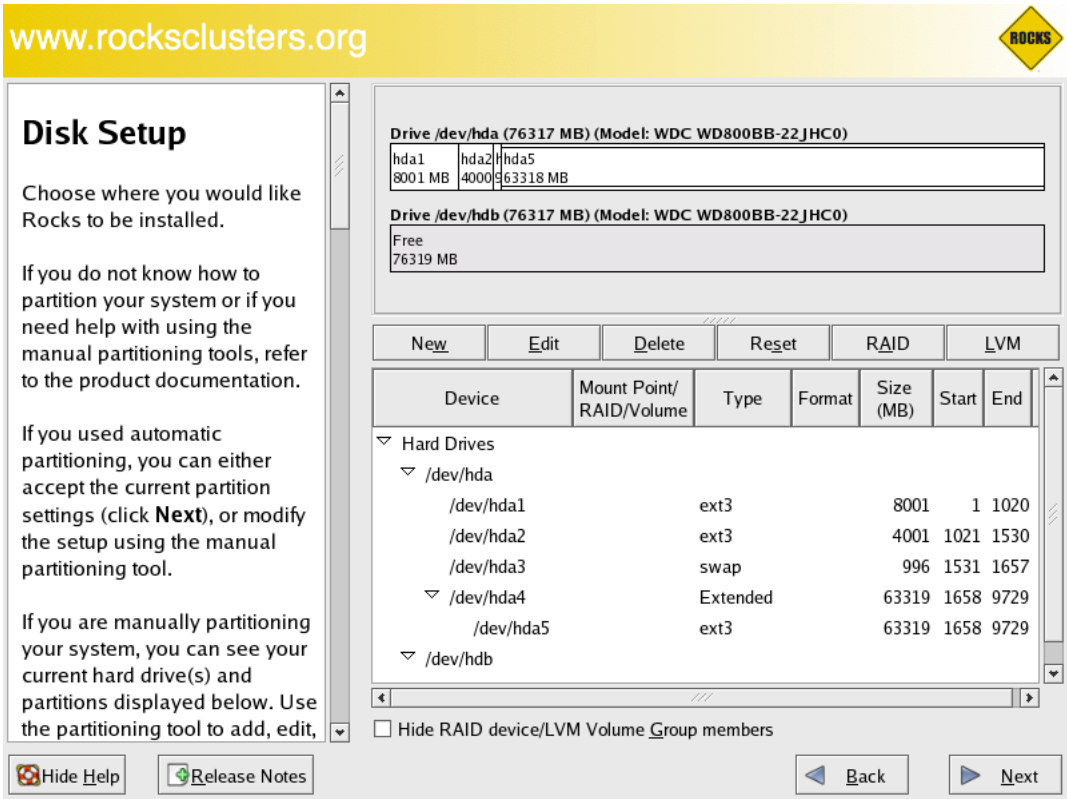
Inside `replace-partition.xml`, add the following section:

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

Then apply this configuration to the distribution by executing:

```
# cd /export/rocks/install
# rocks create distro
```

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
```

4.6. Creating a Custom Kernel RPM

4.6.1. 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 that 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 /export/rocks/install/contrib/5.1/<arch>/RPMS/
  ```

  Where *<arch>* is i386 or x86_64.

- Rebuild the distribution:

```
# cd /export/rocks/install
# rocks create distro
```

- 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.

4.7. 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 implicatations. 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 /export/rocks/install/rocks-dist/arch/build/graphs/default/base-rsh.xml \
 /export/rocks/install/site-profiles/5.1/graphs/default/
```

Where *arch* is your architecture ("i386" or "x86_64").

Now edit `/export/rocks/install/site-profiles/5.1/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 /export/rocks/install
# rocks create distro
```

Then, reinstall your compute nodes.

4.8. 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[2].

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 `/export/rocks/install/site-profiles/5.1/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 `/export/rocks/install/site-profiles/5.1/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 /export/rocks/install
# rocks create distro
```

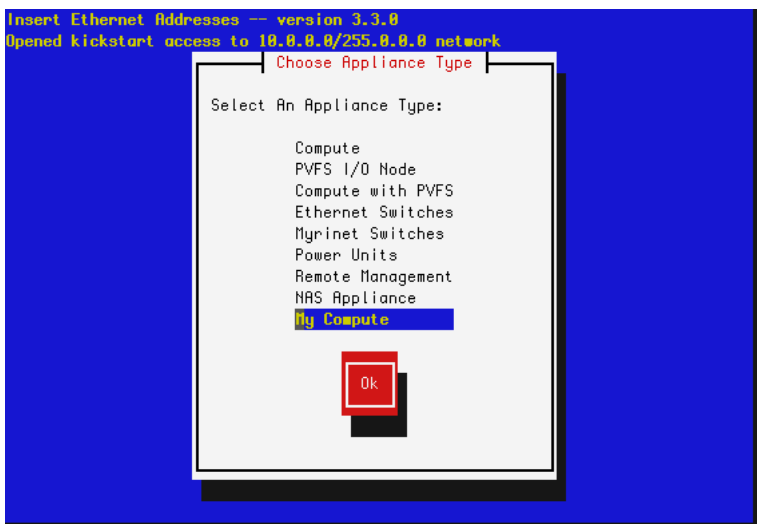
Now we need to add an entry into the Rocks MySQL database. This is accomplished with the rocks command line:

```
# /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).

4.9. 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[3] which is maintained by Jon Masters at Red Hat.

1. Set up a build environment:

   ```
   # cd /export
   # hg clone http://fyp.rocksclusters.org/hg/rocks-5.1
   ```

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

   ```
   # cd /export/rocks-5.1/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-5.1/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-5.1/rocks/src/roll/kernel/RPMS/x86_64/rocks-boot* \
 /export/rocks/install/contrib/5.1/x86_64/RPMS/
```


If you are building on an i386 system, change the above x86_64 references to i386.

10. Rebuild the distro:

```
# cd /export/rocks/install
# rocks create distro
```

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

```
# cd /export/rocks/install
# rpm -Uvh --force rocks-dist/x86_64/RedHat/RPMS/rocks-boot-5*.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.

4.9.1. 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-5.1/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*.

4.10. 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-network-prefix.local
```

Where *local-network-prefix* for a default rocks is *10*. That is, the above file name would be:

```
/var/named/reverse.rocks.domain.10.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
2. http://www.rocksclusters.org/rocks-documentation/reference-guide/5.1/
3. http://dup.et.redhat.com/ddiskit/

Chapter 5. Community Resources

5.1. Access to Rocks Source Code

The source code for Rocks is available from a public read-only Mercurial[1] repository. As of Rocks 5.0 Mercurial (hg) is installed on your frontend machine, for older version of Rocks (or non-Rocks platforms) you will need to install the Mercurial package yourself. Binary packages for Mercurial are available here[2].

Mercurial is a distributed source control system. A very good explanation on how this differs from CVS is available on the Mercurial site[3]. Fundamentally, distributed source control turns your checked out source code from a read-only copy into a repository and then grants read-write access to others based on your checked out repository. In the context of Rocks this means individual Roll developers can independently control who has access to their code.

To check out the current source code you will first need to clone master Rocks read-only repository as follows. This operation will take several minutes (if not hours) and unlike a CVS checkout it may appear to hang, be patient.

```
$ hg clone http://fyp.rocksclusters.org/hg/rocks-5.1
destination directory: rocks-5.1
real URL is http://fyp.rocksclusters.org/hg/rocks-5.1/
requesting all changes
adding changesets
adding manifests
adding file changes
added 1 changesets with 2815 changes to 2815 files
2815 files updated, 0 files merged, 0 files removed, 0 files unresolved
```

5.2. All Past Rocks Releases

All past Rocks releases can be found at `ftp.rocksclusters.org:/pub/rocks`.

5.3. Email Discussion List

The primary mode for support for Rocks is through our email discussion list.

Click here[4] to subscribe.

The archives[5] hold messages from the Rocks discussion list dating back to June 2002.

5.4. Office Hours

Another mode in which to get support for Rocks is through "Office Hours". The idea is to have a set time in which members of the Rocks community can have a one-on-one live conversation with a Rocks developer.

Office Hours is held every Tuesday from 11:30 AM to 12:30 PM Pacific Time. If that time slot is inconvienient for you, send a note to officehours@rocksclusters.org and we'll try to set up an appointment.

The prerequisite for Office Hours is you must be able to make an audio or video conference call with Skype. Video conference calls are preferred, but not required.

To speak to a Rocks developer during Office Hours, just make a Skype call to the user name "rocksclusters".

5.5. Rocks License

```
BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY,
WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE
OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN
IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.
```

5.5.1. 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).

Notes

1. http://www.selenic.com/mercurial/wiki/
2. http://www.selenic.com/mercurial/wiki/index.cgi/BinaryPackages
3. http://www.selenic.com/mercurial/wiki/index.cgi/CvsConcepts
4. https://lists.sdsc.edu/mailman/listinfo/npaci-rocks-discussion
5. https://lists.sdsc.edu/pipermail/npaci-rocks-discussion/

Chapter 6. Administration Examples

6.1. 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 confiuration 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`

6.2. 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 commmand `/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.

6.3. 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.

6.4. 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.

6.5. 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.

6.5.1. 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`

6.5.2. 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`

6.6. 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 illustation. 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 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

```
# rocks list host interface jeebs
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.

6.6.1. 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 7. Advanced Tasks

7.1. Flashing BIOS on Compute Nodes Using PXE

This procedure describes how to flash BIOS on a client node (e.g., compute node or viz tile node) by using the Rocks command line and PXE.

- First, you must add the BIOS flashing files (e.g., a DOS-based flash utility, .bin file or an autoexec.bat) to the directory `/opt/pxeflash/addon`.

  As an example, to flash a Dell Dimension E521 desktop, we executed:

  ```
  # cd /opt/pxeflash/addon
  # wget http://ftp.us.dell.com/bios/DME521-010111.EXE
  ```

- To add the BIOS flashing file to a bootable floppy image, execute:

  ```
  # cd /opt/pxeflash
  # make build
  ```

  This will incorporate all files in the `/opt/pxeflash/addon` directory into a floppy image named `pxeflash-FDSTD.288`.

- Now copy the floppy image into `/tftpboot/pxelinux/pxeflash`, by executing:

  ```
  # make install
  ```

- Set a client node to PXE boot your flash image:

  ```
  # rocks set host pxeboot <hostname> action=pxeflash
  ```

- PXE boot the client node. After the client boots, it will display a DOS prompt.
- Before flashing the client node, on the frontend, reset the PXE action so the client boots the OS from local disk:

  ```
  # rocks set host pxeboot <hostname> action=os
  ```

- On the client, execute the BIOS flash program.

  In our example, we executed the program `DME521-010111.EXE`.

- When the flash process completes, reboot the client node.

Important Acknowledgement: We are grateful for the contribution of Jeremy Lawrence for describing the basic approach in his Rocks discussion list posting https://lists.sdsc.edu/pipermail/npaci-rocks-discussion/2005-June/012092.html.

7.2. Frontend Central Server

A Central Server is a Rocks Frontend node that can kickstart other frontends and provide rolls over the network, in a process called WAN kickstart. All Rocks frontends have the ability to act as central servers.

The standard Rocks distribution (located under /export/rocks/install) contains a distro suitable for WAN kickstart. The only steps you must take is to open "www" and "https" access on your frontend for the purpose of RPM package transfer. See Enable WWW access.

Ensure that the hostname on central is fully qualified. Specifically, the "PublicHostname" value in the `app_globals` table of the database must be correct and reachable from the outside world.

7.2.1. Adding Rolls to Serve from a Central

You may wish to serve rolls from your central server that you have not installed during installation. All frontends will serve the rolls they were built with to client frontends, but often it is advantageous to serve other rolls as well.

First, you must download the Roll ISO image to your central. Then, execute:

```
# rocks add roll <rollname>*.iso
```

7.3. Cross Kickstarting

Rocks supports heterogeneous clusters that contain nodes of different hardware architectures with a process called cross-kickstarting. To support an architecture different than its own, a frontend needs to expand its local distribution with additional packages. This section describes how to install distributions for other architectures on your frontend.

Start with a frontend node, as described by Install Frontend, or Upgrade Frontend. Follow the instructions below for every desired architecture.

For this example, we assume the frontend is an x86 (32-bit) and the compute nodes are x86_64 CPUs (64-bit).

1. Retrieve the required Rocks rolls for x86_64 (and optional rolls as desired)

   For each roll, add it to the frontend's roll repository:

   ```
   # rocks add roll <roll-name>.iso
   ```

2. Rebuild your distribution for the new architecture with the following flags.

   ```
   # cd /export/rocks/install
   # rocks create distro
   # rocks create distro arch=x86_64
   ```

   The above assumes your frontend is running the i386 version of Rocks. If your frontend is running the x86_64 version of Rocks and you want to support i386-based nodes with the frontend, you'll execute:

   ```
   # cd /export/rocks/install
   # rocks create distro
   # rocks create distro arch=i386
   ```

Now your frontend is prepared to cross-kickstart compute nodes and other cluster appliances of different architectures.


Rocks does not currently support PXE cross-kickstart installs; you must boot non-native compute nodes from a native-architecture Rocks CD that contains the Kernel Roll. In the above example you must install a x86_64 compute node from an x86_64 boot media instead of PXE.

7.4. Adding Kernel Boot Parameters

There are two scenarios in which you need to add extra kernel boot parameters: 1) during installation, and 2) during normal boot. For both scenarios, will use the example of adding the kernel boot parameter: "ucsd=rocks".

7.4.1. Adding Kernel Boot Parameters to the Installation Kernel

The boot *action* of a node is controlled by the Rocks command line. For example, the following lists what the nodes will do on their next PXE boot:

```
# rocks list host pxeboot
HOST         ACTION
olympic:     ------
compute-0-0: os
```

We see that `compute-0-0` will boot the "os", that is, it will boot off its local disk. Another common action is "install" which means the node will boot the installation kernel and install itself on the node's next PXE boot.

To list all the possible boot actions for a compute node, execute:

```
# rocks list host pxeaction compute-0-0
ACTION           COMMAND               ARGS
install          kernel vmlinuz        append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=n
install headless kernel vmlinuz        append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=n
memtest          kernel memtest        ------------------------------------------------------------
os               localboot 0           ------------------------------------------------------------
pxeflash         kernel memdisk bigraw append initrd=pxeflash.img keeppxe
rescue           kernel vmlinuz        append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=n
```

To change a node's boot action to "install", execute:

```
# rocks set host pxeboot compute-0-0 action="install"
```

Then we see that correct boot action has been applied:

```
# rocks list host pxeboot
HOST         ACTION
olympic:     -------
compute-0-0: install
```

Now to add or change the kernel boot parameters for the installing kernel, we'll need to add or modify an action. We'll create a new action called "install ucsd" and add our boot flag "ucsd=rocks" to the end of the kernel boot parameters:

```
# rocks add host pxeaction action="install ucsd" command="kernel vmlinuz \
```

```
  args="append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=nomount \
  pxe kssendmac selinux=0 noipv6 ucsd=rocks"
```

We now see that "install ucsd" is an available action:

```
# rocks list host pxeaction compute-0-0
ACTION           COMMAND               ARGS
install          kernel vmlinuz        append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=n
install headless kernel vmlinuz        append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=n
install ucsd     kernel vmlinuz        append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=n
memtest          kernel memtest        ------------------------------------------------------------
os               localboot 0           ------------------------------------------------------------
pxeflash         kernel memdisk bigraw append initrd=pxeflash.img keeppxe
rescue           kernel vmlinuz        append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=n
```

We can add an action to only one node by including the node name in the "rocks add host pxeaction" command line. For example, here's how to apply the "install ucsd" action only to compute-0-0:

```
# rocks add host pxeaction compute-0-0 action="install ucsd" \
  command="kernel vmlinuz \
  args="append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=nomount \
  pxe kssendmac selinux=0 noipv6 ucsd=rocks"
```

Also, you can override a global action by simply replacing the "args". For example, here's how to override the global "install" action:

```
# rocks add host pxeaction compute-0-0 action="install" \
  command="kernel vmlinuz \
  args="append ks initrd=initrd.img ramdisk_size=150000 lang= devfs=nomount \
  pxe kssendmac selinux=0 noipv6 ucsd=rocks"
```

7.4.2. Adding Kernel Boot Parameters to the Running Kernel

To get the current parameters that will be appended to the default kernel boot parameters, execute:

```
# rocks report host bootflags
rocks-168: dom0_mem=1024M
compute-0-0: dom0_mem=1024M
```

Then, to add our boot flag of "ucsd=rocks", execute:

```
# rocks set host bootflags compute-0-0 flags="dom0_mem=1024M ucsd=rocks"
```

To check to make sure the flag has been added to the database, execute:

```
# rocks report host bootflags
rocks-168: dom0_mem=1024M
compute-0-0: dom0_mem=1024M ucsd=rocks
```

To apply the flags to the running kernel, you'll need to reinstall the compute nodes. For example, you'll need to reinstall compute-0-0 in order to apply "ucsd=rocks" to its kernel boot parameters. After compute-0-0 is reinstalled, you can check that the new kernel boot parameters have been applied by logging into compute-0-0 and executing:

```
# cat /proc/cmdline
ro root=LABEL=/ dom0_mem=1024M ucsd=rocks
```

Chapter 8. Command Reference

8.1. add

8.1.1. add appliance

rocks add appliance {appliance} [compute=*bool*] [graph=*string*] [membership=*string*] [node=*string*] [os=*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.

[os=*string*]

The OS that the appliance type can support. Some appliances can support both linux and solaris, where as others can support only one of the two. Acceptable values are 'linux' or 'sunos'. Defaults to 'linux'

[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

8.1.2. 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.

8.1.3. add host

rocks add host {host} [cpus=*int*] [membership=*string*] [os=*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.

[os=*string*]

The operating system name. The default is: linux.

[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

8.1.4. add host alias

rocks add host alias {host} {name} [name=*string*]

Adds an alias to a host

arguments

host

Host name of machine

name

The alias name for the host.

parameters

[name=*string*]

Can be used in place of the name argument.

examples

rocks add host alias compute-0-0 c-0-0

Adds the alias 'c-0-0' to the host 'compute-0-0'.

rocks add host alias compute-0-0 name=c-0-0

Same as above.

8.1.5. add host interface

rocks add host interface {host} {iface} [gateway=*string*] [iface=*string*] [ip=*string*] [mac=*string*] [module=*string*] [name=*string*] [subnet=*string*] [vlan=*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')

[vlan=*string*]

The VLAN ID to assign the interface

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

8.1.6. 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 host pxeaction action=os command="localboot 0"

Add the global 'os' pxeaction

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

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

8.1.7. 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.

8.1.8. 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 /export/rocks/install/rolls.

arguments

[roll]

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

related commands

create roll

disable roll

enable roll

list roll

remove roll

8.1.9. 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.

8.2. create

8.2.1. create distro

rocks create distro [arch=*string*] [dist=*string*] [rolls=*string*] [root=*string*] [version=*string*]

Create a Rocks distribution. This distribution is used to install Rocks nodes.

parameters

[arch=*string*]

The architecture of the distribution. The default is the native architecture of the machine.

[dist=*string*]

The directory name of the distribution. The default is: "rocks-dist".

[rolls=*string*]

A list of rolls that should be included in the distribution. This must be a list separated by spaces of the form: rollname,version. For example: rolls="CentOS,5.0 kernel,5.0". The default is to include all the enabled rolls for the native architecture. To get a list of enabled rolls, execute: "rocks list roll".

[root=*string*]

The path prefix location of the rolls. The default is: /export/rocks/install.

[version=*string*]

The version of the distribution. The default is the native version of the machine.

examples

rocks create distro

Create a distribution in the current directory.

8.2.2. 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'.

8.2.3. create package

rocks create package {directory} [prefix=*string*] [release=*string*] [version=*string*]

Create a RedHat or Solaris package from a given directory. The package will install files in either the same location as the given directory, or a combination of the directory basename and the provided prefix.

arguments

directory

The source directory of the files used to create the OS-specific package.

parameters

[prefix=*string*]

The prefix pathname prepended to the base name of the source directory.

[release=*string*]

Release number of the created package (default is '1')

[version=*string*]

Version number of the created package (default is '1.0')

examples

rocks create package /opt/stream stream

Create a package named stream in the current directory using the contents of the /opt/stream directory. The resulting package will install its files at /opt/stream.

rocks create package /opt/stream localstream prefix=/usr/local

Create a package named localstream in the current directory using the contents of the /opt/stream directory. The resulting package will install its files at /usr/local/stream.

8.2.4. 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.

related commands

add roll

disable roll

enable roll

list roll

remove roll

8.2.5. 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.

8.3. disable

8.3.1. disable roll

rocks disable roll {roll...} [arch=*string*] [version=*string*]

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

arguments

roll

List of rolls to disable. This should be the roll base name (e.g., base, hpc, kernel).

parameters

[arch=*string*]

The architecture to disable this roll for. If no architecture is supplied, then the roll will be disabled for all architectures.

[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 ganglia version=5.0 arch=i386

Disable version 5.0 the Ganglia roll for i386 nodes

related commands

add roll

create roll

enable roll

list roll

remove roll

8.4. dump

8.4.1. 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.

8.4.2. dump appliance

rocks dump appliance [appliance...]

Outputs info (as rocks commands) about the appliances defined in the cluster database.

arguments

[appliance]

Optional list of appliance names. If no appliance names are supplied, then info about all appliances is output.

examples

$ rocks dump appliance

Dump all known appliances.

8.4.3. 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.

8.4.4. 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

8.4.5. dump network

rocks dump network [network...]

Dump the network information as rocks commands.

arguments

[network]

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

examples

$ rocks dump network

Dump all network info.

$ rocks dump network public

Dump network info the 'public' network.

8.5. enable

8.5.1. enable roll

rocks enable roll {roll...} [arch=*string*] [version=*string*]

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

arguments

roll

List of rolls to enable. This should be the roll base name (e.g., base, hpc, kernel).

parameters

[arch=*string*]

The architecture to enable this roll for. If no architecture is supplied, then the roll will be enabled for all architectures.

[version=*string*]

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

examples

rocks enable roll kernel

Enable the kernel roll

rocks enable roll ganglia version=5.0 arch=i386

Enable version 5.0 the Ganglia roll for i386 nodes

related commands

add roll

create roll

disable roll

list roll

remove roll

8.6. help

8.6.1. help

rocks help {command}

List help for the command line client. With no arguments it lists all the commands available. Otherwise it will list the subset of command with the specified string (see examples).

arguments

command

The substring matched against all commands.

examples

$ rocks help

Alias for 'rocks list help'

$ rocks help viz

Lists all the commands with the string 'viz' in the name.

$ rocks help list host

Lists all the commands with the string 'list host' in the name.

8.7. list

8.7.1. 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.

8.7.2. 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.

8.7.3. 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.

8.7.4. 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

8.7.5. 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.

8.7.6. list host alias

rocks list host alias [host...]

Lists the aliases for a host.

arguments

[host]

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

examples

$ rocks list host alias compute-0-0

List the aliases for compute-0-0.

$ rocks list host membership

List the aliases for all known hosts.

8.7.7. 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.

8.7.8. 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

8.7.9. 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.

8.7.10. 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.

8.7.11. 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.

8.7.12. 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.

8.7.13. 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.

8.7.14. list host pxeaction

rocks list host pxeaction [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 pxeaction compute-0-0

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

$ rocks list host pxeaction

List the PXE actions available for all known hosts.

8.7.15. 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.

8.7.16. 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.

8.7.17. 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 it's 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.

8.7.18. list license

rocks list license

List the Rocks copyright.

examples

$ rocks list license

List the Rocks copyright.

8.7.19. 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.

8.7.20. 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.

8.7.21. 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'.

8.7.22. 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

related commands

add roll

create roll

disable roll

enable roll

remove roll

8.7.23. 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.

8.7.24. 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.

8.8. remove

8.8.1. 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.

8.8.2. 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.

8.8.3. 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.

8.8.4. remove host alias

rocks remove host alias {host} {name} [name=*string*]

Remove an alias for a host.

arguments

host

One hosts.

name

The alias name that should be removed.

parameters

[name=*string*]

Can be used in place of the name argument.

examples

rocks remove host alias compute-0-0 c-0-0

Removes the alias c-0-0 for host compute-0-0.

rocks remove host alias compute-0-0 name=c-0-0

Same as above.

8.8.5. 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.

8.8.6. 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.

8.8.7. 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.

8.8.8. 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.

8.8.9. 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.

8.8.10. 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'.

8.8.11. remove roll

rocks remove roll {roll...} [arch=*string*] [version=*string*]

Remove a roll from both the database and filesystem.

arguments

roll

List of rolls. This should be the roll base name (e.g., base, hpc, kernel).

parameters

[arch=*string*]

The architecture of the roll to be removed. If no architecture is supplied, then all architectures will be removed.

[version=*string*]

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

examples

rocks remove roll kernel

Remove all versions and architectures of the kernel roll

rocks remove roll ganglia version=5.0 arch=i386

Remove version 5.0 of the Ganglia roll for i386 nodes

related commands

add roll

create roll

disable roll

enable roll

list roll

8.8.12. 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.

8.9. report

8.9.1. report distro

rocks report distro

Output the path prefix for the location of the Rocks distribution.

examples

$ rocks report distro

Output the current path prefix to the distribution.

8.9.2. 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.

8.9.3. report host dhcpd

rocks report host dhcpd {host}

Output the DHCP server configuration file for a specific host.

arguments

host

Create a DHCP server configuration for the machine named 'host'. If no host name is supplied, then generate a DHCP configuration file for this host.

examples

$ rocks report host dhcpd frontend-0-0

Output the DHCP server configuration file for frontend-0-0.

8.9.4. report host interface

rocks report 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 report host interface compute-0-0 iface=eth0

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

8.9.5. report host network

rocks report 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 report host network compute-0-0

Output the network configuration for compute-0-0.

8.9.6. report script

rocks report script

Take STDIN XML input and create a shell script that can be executed on a host.

examples

$ rocks report host interface compute-0-0 | rocks report script

Take the network interface XML output from 'rocks report host interface' and create a shell script.

8.9.7. report version

rocks report version

Output the version of Rocks.

examples

$ rocks report version

Output the current Rocks version.

8.10. run

8.10.1. 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.

8.11. set

8.11.1. set host bootflags

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

Set the boot flags for a host. The boot flags will 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 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.

8.11.2. 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.

8.11.3. 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.

8.11.4. 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

8.11.5. 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

8.11.6. 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

8.11.7. 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

8.11.8. 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

8.11.9. 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

8.11.10. 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

8.11.11. set host interface vlan

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

Sets the VLAN ID for an 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.

vlanid

The VLAN ID that should be updated. This must be an integer and the pair 'subnet/vlanid' must be defined in the VLANs table.

parameters

[iface=*string*]

Can be used in place of the iface argument.

[vlanid=*string*]

Can be used in place of the vlanid argument.

examples

rocks set host interface vlan compute-0-0-0 eth0 2

Sets compute-0-0-0's private interface to VLAN ID 2.

rocks set host interface vlan compute-0-0-0 subnet=eth0 vlanid=2

Same as above.

related commands

add host

8.11.12. 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.

8.11.13. 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.

8.11.14. 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.

8.11.15. 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.

8.11.16. 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

8.11.17. 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

8.11.18. 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.

8.12. sync

8.12.1. 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.

8.12.2. 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.

8.12.3. sync host network

rocks sync host network

Reconfigure and restart the network for the named hosts.

examples

rocks sync host network compute-0-0

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

8.12.4. 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 swich 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[1]

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.zdsk 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 /export/rocks/install
  # cp rocks-dist/arch/build/nodes/auto-kickstart.xml \
  site-profiles/5.1/nodes/replace-auto-kickstart.xml
  ```

  Where *arch* is "i386" or "x86_64".
- Edit the file `site-profiles/5.1/nodes/replace-auto-kickstart.xml`
- Remove the line:

  ```
  <package>rocks-boot-auto<package>
  ```
- Rebuild the distribution:

  ```
  # cd /export/rocks/install
  # rocks create distro
  ```
- 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 unpredicatble 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 commmand line, see Introduction to the Rocks Command Line[1]. The reference for all Rocks commands can be found here[2].

- 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[3].

  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 -mcmodel=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.

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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 efficent 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[4] 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[5] 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 utilties 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-[ps|kill|fork] 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
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 guarentee full absolute success at any single time. It only offers consistancy 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 enconding)

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 preceed 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 Protocl

Parent Nodes:

- client

Children Nodes:

- ntp

C.1.38. ntp-server

Network Time Protocl

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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Figure D-1. Rocks™ logo

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    with or without modifications, to be licensed at no charge to all
    third parties under the terms of this General Public License (except
    that you may choose to grant warranty protection to some or all
    third parties, at your option).

    c) If the modified program normally reads commands interactively when
    run, you must cause it, when started running for such interactive use
    in the simplest and most usual way, to print or display an
    announcement including an appropriate copyright notice and a notice
    that there is no warranty (or else, saying that you provide a
    warranty) and that users may redistribute the program under these
    conditions, and telling the user how to view a copy of this General
    Public License.

    d) 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.

Mere aggregation of another independent work with the Program (or its
derivative) on a volume of a storage or distribution medium does not bring
the other work under the scope of these terms.
```

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c) accompany it with the information you received as to where the corresponding source code may be obtained. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form alone.)

Source code for a work means the preferred form of the work for making modifications to it. For an executable file, complete source code means all the source code for all modules it contains; but, as a special exception, it need not include source code for modules which are standard libraries that accompany the operating system on which the executable file runs, or for standard header files or definitions files that accompany that operating system.

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END OF TERMS AND CONDITIONS

Appendix: How to Apply These Terms to Your New Programs

If you develop a new program, and you want it to be of the greatest possible use to humanity, the best way to achieve this is to make it free software which everyone can redistribute and change under these terms.

To do so, attach the following notices to the program. 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 program's name and a brief idea of what it does.>
Copyright (C) 19yy  <name of author>
```

```
    This program is free software; you can redistribute it and/or modify
    it under the terms of the GNU General Public License as published by
    the Free Software Foundation; either version 1, or (at your option)
    any later version.

    This program is distributed in the hope that it will be useful,
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    You should have received a copy of the GNU General Public License
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    Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307, USA.

Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this
when it starts in an interactive mode:

    Gnomovision version 69, Copyright (C) 19xx name of author
    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.

You should also get your employer (if you work as a programmer) or your
school, if any, to sign a "copyright disclaimer" for the program, if
necessary.  Here a sample; alter the names:

  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!
```

E.4. GNU General Public License v2

```
      GNU GENERAL PUBLIC LICENSE
         Version 2, June 1991
```

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b) You must cause any work that you distribute or publish, that in whole or in part contains or is derived from the Program or any part thereof, to be licensed as a whole at no charge to all third parties under the terms of this License.

c) If the modified program normally reads commands interactively when run, you must cause it, when started running for such interactive use in the most ordinary way, to print or display an announcement including an appropriate copyright notice and a notice that there is no warranty (or else, saying that you provide a warranty) and that users may redistribute the program under

these conditions, and telling the user how to view a copy of this License. (Exception: if the Program itself is interactive but does not normally print such an announcement, your work based on the Program is not required to print an announcement.)

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In addition, mere aggregation of another work not based on the Program with the Program (or with a work based on the Program) on a volume of a storage or distribution medium does not bring the other work under the scope of this License.

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b) Accompany it with a written offer, valid for at least three years, to give any third party, for a charge no more than your cost of physically performing source distribution, a complete machine-readable copy of the corresponding source code, to be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange; or,

c) Accompany it with the information you received as to the offer to distribute corresponding source code. (This alternative is allowed only for noncommercial distribution and only if you received the program in object code or executable form with such an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for making modifications to it. For an executable work, 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 executable. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary

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To do so, attach the following notices to the program. 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 program's name and a brief idea of what it does.>
> Copyright (C) <year> <name of author>
>
> This program is free software; you can redistribute it and/or modify
> it under the terms of the GNU General Public License as published by
> the Free Software Foundation; either version 2 of the License, or
> (at your option) any later version.
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> This program is distributed in the hope that it will be useful,
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Also add information on how to contact you by electronic and paper mail.

If the program is interactive, make it output a short notice like this when it starts in an interactive mode:

> Gnomovision version 69, Copyright (C) year name of author
> 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.

You should also get your employer (if you work as a programmer) or your
school, if any, to sign a "copyright disclaimer" for the program, if
necessary.  Here is a sample; alter the names:

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  <signature of Ty Coon>, 1 April 1989
  Ty Coon, President of Vice

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consider it more useful to permit linking proprietary applications with the
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```

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```
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         Version 2.1, February 1999

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can use it too, but we suggest you first think carefully about whether
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strategy to use in any particular case, based on the explanations below.
```

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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.

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(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.)

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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.

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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.

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>
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>
> <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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[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

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with the library, after making changes to the library and recompiling
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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

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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.

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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.

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  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.

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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.

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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.

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F.11. libxml2

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