

CUDA Roll: Users Guide



Version 4.3 Edition



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Table of Contents

Preface	i
1. Requirements and Compatibility	1
1.1. Rocks Version.....	1
1.2. Hardware	1
1.3. Compatibility.....	1
2. Installing the CUDA Roll	2
2.1. Installation on a New System.....	2
2.2. Adding the Roll to an Existing Installation	6
2.3. Optional installation of the driver on the Frontend	9
3. Using the CUDA Roll	10
3.1. Summary of Installed Components	10
3.2. Testing the Installation	10
A. Rocks Copyright	12
B. Third Party Copyrights and Licenses	14
B.1. NVIDIA CUDA License	14
B.2. NVIDIA Driver License	16

List of Figures

2-1. Adding a roll.....	2
2-2. Loading the roll	2
2-3. List of available rolls	3
2-4. Selecting the CUDA Roll	4
2-5. CUDA Roll selected for installation.....	5

Preface

The purpose of the NVIDIA® CUDA™ Roll is to install and configure the device driver and full toolchain necessary to run and develop CUDA programs on a Rocks™ cluster. As of this release, this includes: CUDA Toolkit Version 1.0, CUDA SDK Version 1.0, and the NVIDIA Display Driver Version 100.14.

Please visit NVIDIA's site¹ to learn more about CUDA.

Notes

1. <http://developer.nvidia.com/object/cuda.html>

Chapter 1. Requirements and Compatibility

1.1. Rocks Version

The CUDA Roll is for use with Rocks version 4.3 ("Mars Hill"). At this time only the x86_64 architecture has been tested.

1.2. Hardware

Using CUDA requires CUDA capable devices be installed in the compute nodes. CUDA capable devices include the cards in the NVIDIA G8x series and beyond.

1.3. Compatibility

Compatibility has been verified with the following optional Rolls:

- area51
- ganglia
- grid
- java
- sge

Other Rolls may work but have not been tested.



At this time the CUDA Roll is **not** compatible with the viz roll due to the different ways in which they install the device driver in the nvidia-driver rpm. We hope to have a common driver rpm in a future release.

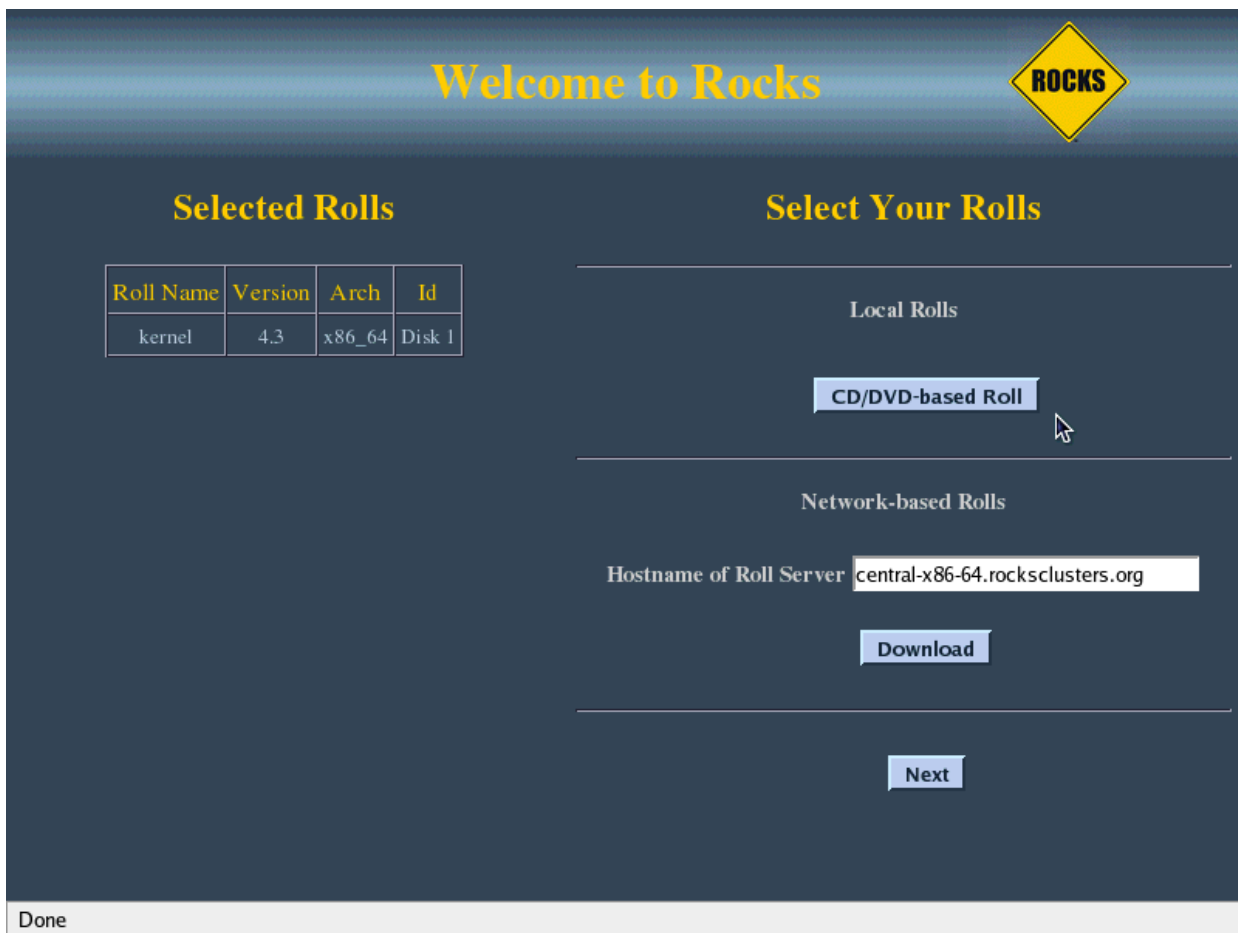
Chapter 2. Installing the CUDA Roll

The CUDA Roll can be installed during the Frontend installation step of your cluster or you can add the CUDA Roll to an existing system.

2.1. Installation on a New System

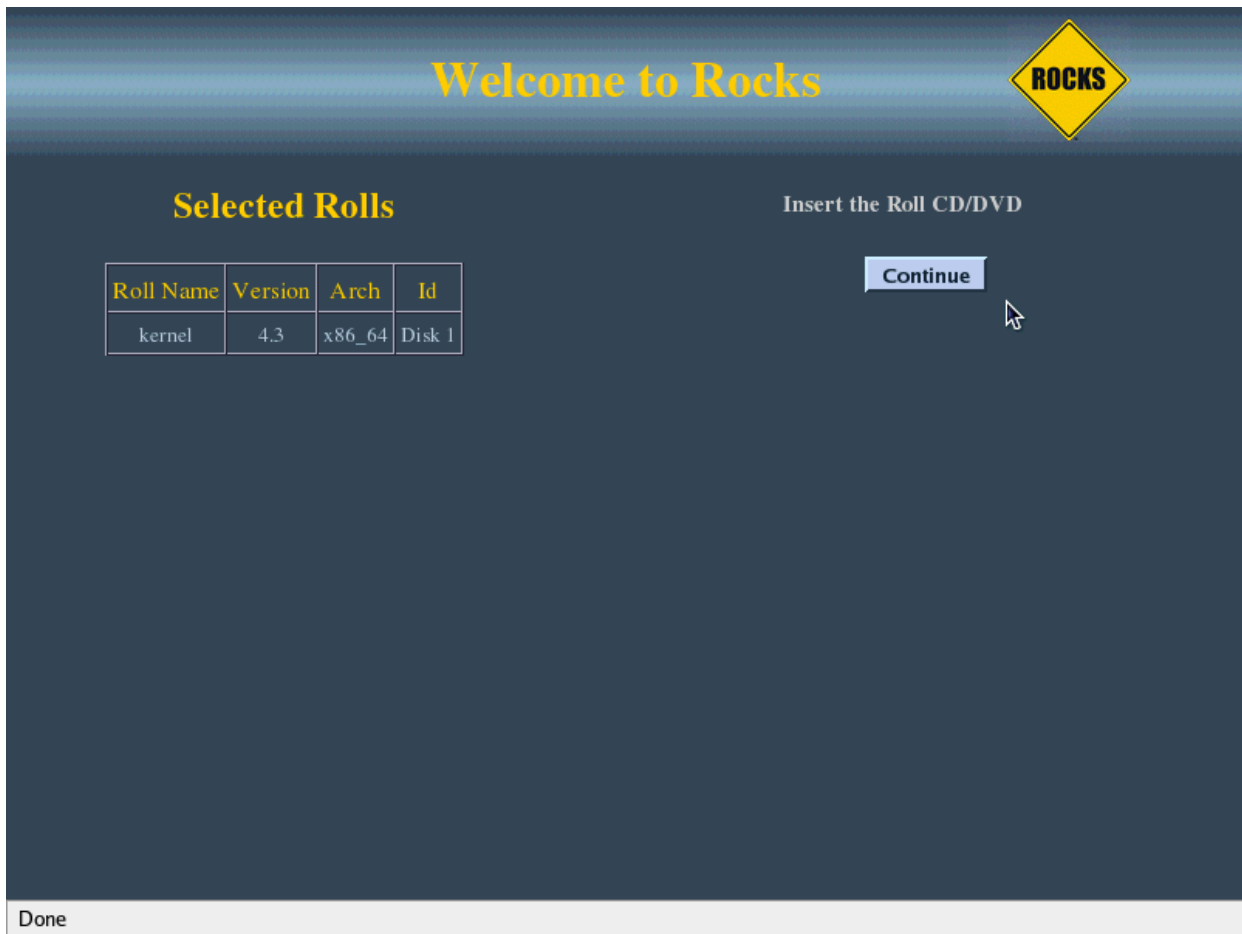
The CUDA Roll is added to a Frontend installation in exactly the same manner as other Rolls. Refer also to Section 1.2 of the Rocks Cluster Distribution: Users Guide for more information.

Figure 2-1. Adding a roll



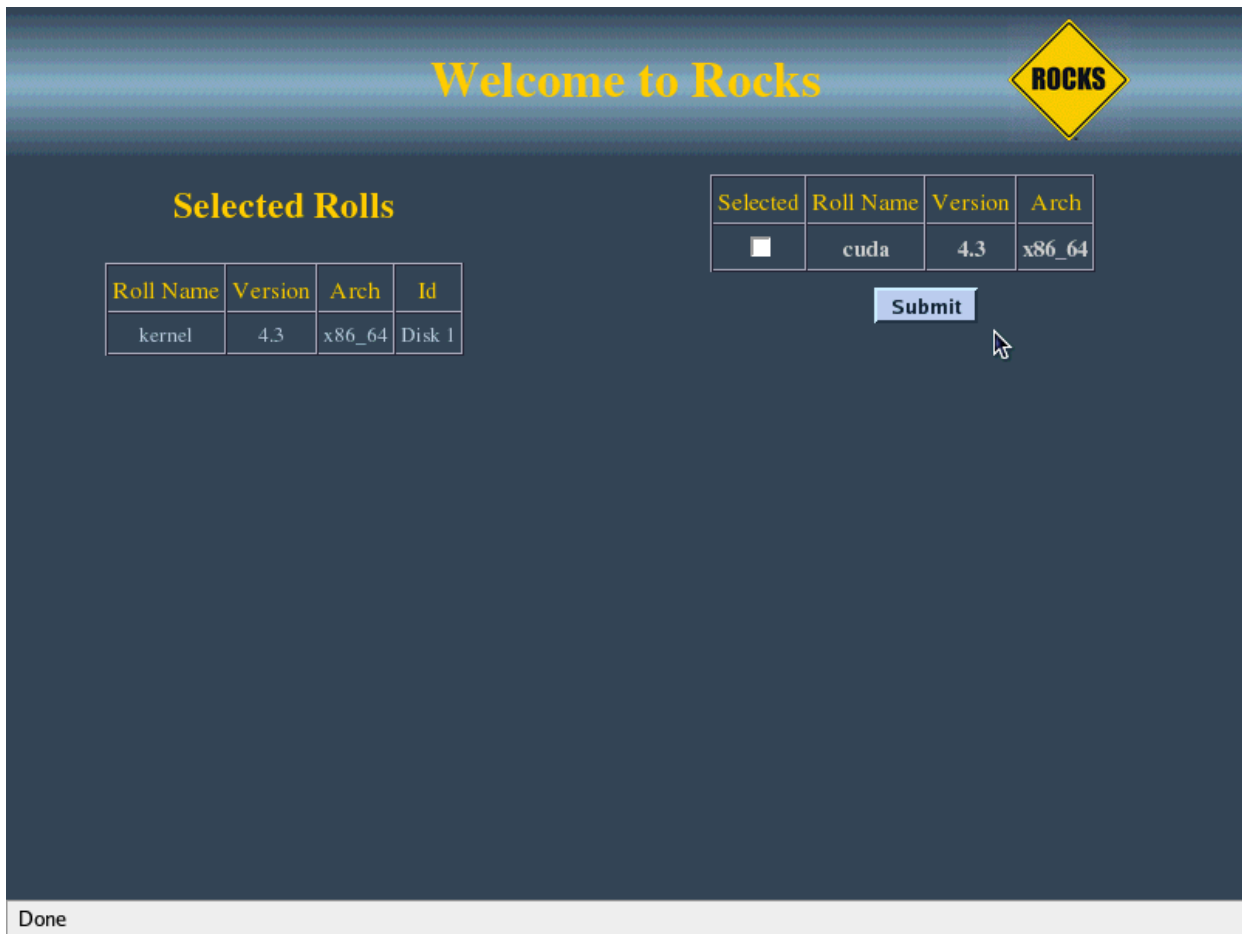
Click on the "CD/DVD-based Roll" button to indicate you have a Roll to add.

Figure 2-2. Loading the roll



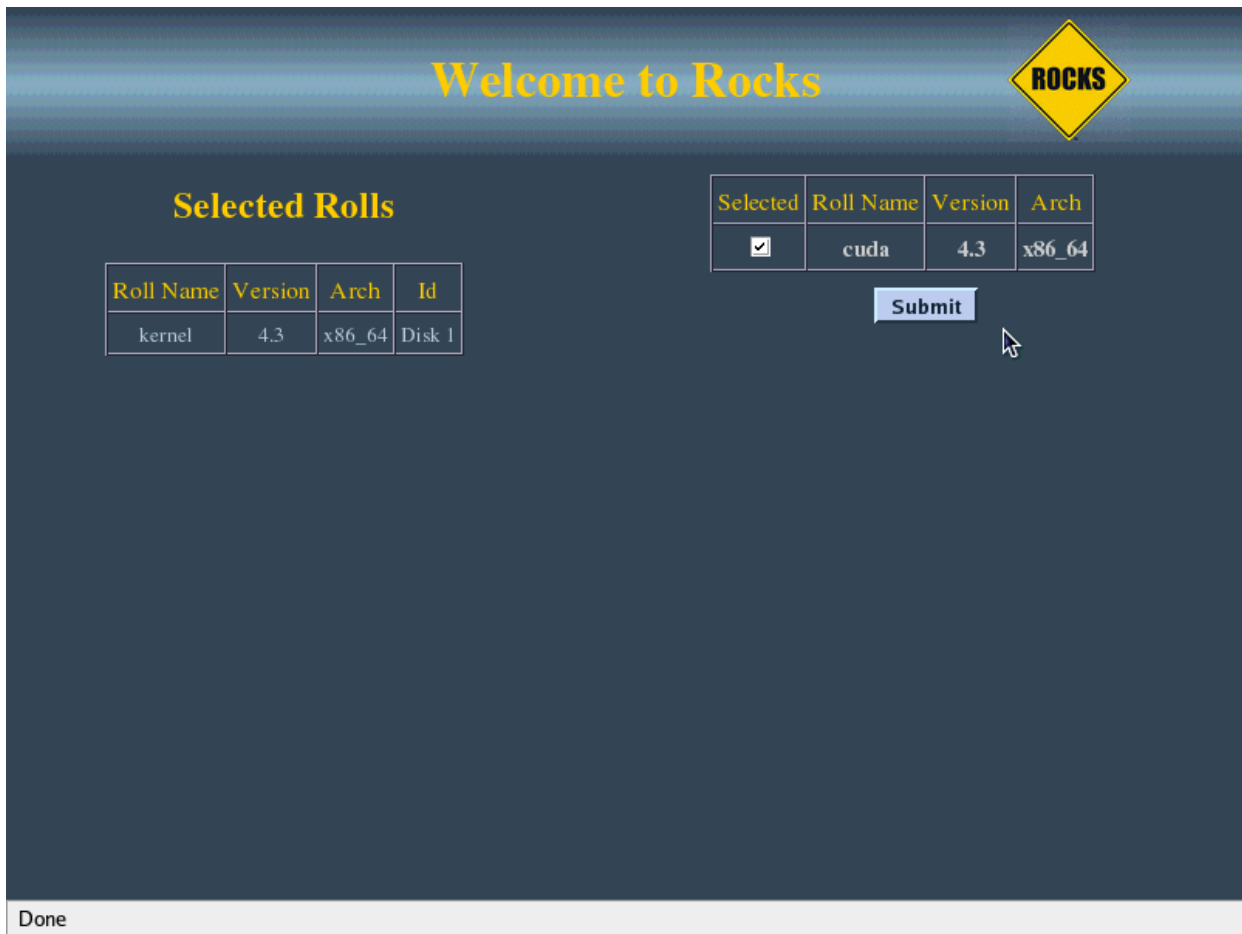
After inserting the CD, click on the "Continue" button.

Figure 2-3. List of available rolls



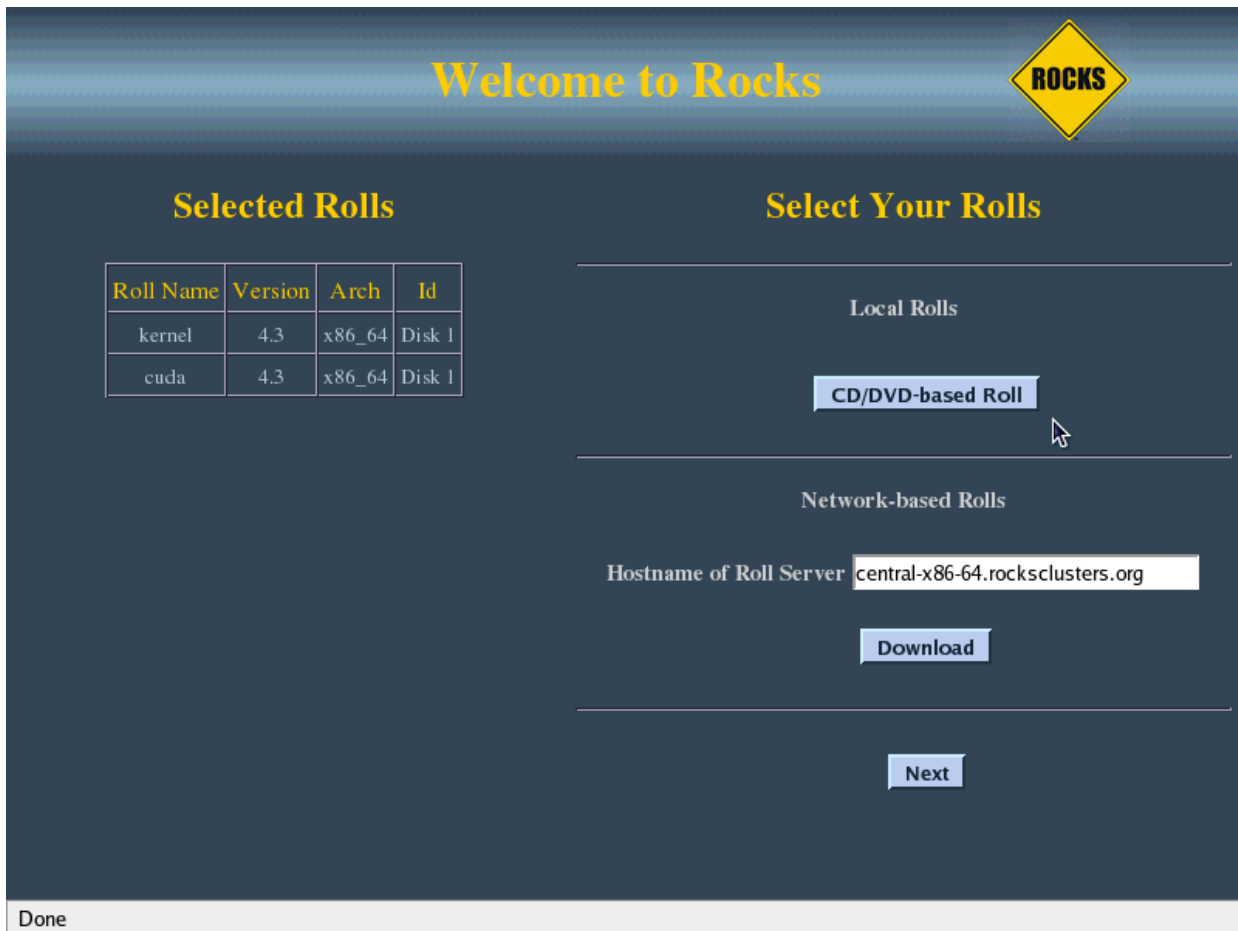
The available rolls will be listed on the right.

Figure 2-4. Selecting the CUDA Roll



Click on the box for CUDA and then click "Submit".

Figure 2-5. CUDA Roll selected for installation



The CUDA Roll will be added to the selected rolls on the left. You can now continue to add and select other rolls or start the installation as necessary.

Note that the device driver will not be installed on the Frontend by default. If you have an CUDA capable device in the Frontend and want to manually install the driver for it you can do so after the machine is up and running. Refer to the commands for manually installing the driver on the Frontend in the last section of this chapter.

2.2. Adding the Roll to an Existing Installation

The CUDA Roll can also be added to an existing system. Mount the CD at /mnt/cdrom or use the iso file directly:

```
# mount -o loop cuda-4.3-0.x86_64.disk1.iso /mnt/cdrom
```

Add the roll to the cluster:

```
# rocks add roll
87883 blocks
Copying roll from media (directory "/mnt/cdrom") into mirror
Copying "cuda" (4.3,x86_64) roll...
```

Make sure the roll is enabled by listing the rolls:

```
# rocks list roll
NAME                VERSION ARCH  ENABLED
kernel:             4.3     x86_64 yes
area51:            4.3     x86_64 yes
base:              4.3     x86_64 yes
ganglia:           4.3     x86_64 yes
grid:              4.3     x86_64 yes
hpc:               4.3     x86_64 yes
java:              4.3     x86_64 yes
sge:               4.3     x86_64 yes
web-server:        4.3     x86_64 yes
Red_Hat_Enterprise_Linux_4: 4.3     x86_64 yes
cuda:              4.3     x86_64 yes
```

Then rebuild the distribution:

```
# cd /home/install/
# rocks-dist dist
Cleaning distribution
Resolving versions (base files)
  including "kernel" (4.3,x86_64) roll...
  including "area51" (4.3,x86_64) roll...
  including "java" (4.3,x86_64) roll...
  including "Red_Hat_Enterprise_Linux_4" (4.3,x86_64) roll...
  including "hpc" (4.3,x86_64) roll...
  including "base" (4.3,x86_64) roll...
  including "grid" (4.3,x86_64) roll...
  including "cuda" (4.3,x86_64) roll...
  including "web-server" (4.3,x86_64) roll...
  including "ganglia" (4.3,x86_64) roll...
  including "sge" (4.3,x86_64) roll...
Including critical RPMS
Resolving versions (RPMs)
  including "kernel" (4.3,x86_64) roll...
  including "area51" (4.3,x86_64) roll...
  including "java" (4.3,x86_64) roll...
  including "Red_Hat_Enterprise_Linux_4" (4.3,x86_64) roll...
  including "hpc" (4.3,x86_64) roll...
  including "base" (4.3,x86_64) roll...
  including "grid" (4.3,x86_64) roll...
  including "cuda" (4.3,x86_64) roll...
  including "web-server" (4.3,x86_64) roll...
  including "ganglia" (4.3,x86_64) roll...
  including "sge" (4.3,x86_64) roll...
Resolving versions (SRPMS)
  including "kernel" (4.3,x86_64) roll...
```

```
including "area51" (4.3,x86_64) roll...
including "java" (4.3,x86_64) roll...
including "Red_Hat_Enterprise_Linux_4" (4.3,x86_64) roll...
including "hpc" (4.3,x86_64) roll...
including "base" (4.3,x86_64) roll...
including "grid" (4.3,x86_64) roll...
including "cuda" (4.3,x86_64) roll...
including "web-server" (4.3,x86_64) roll...
including "ganglia" (4.3,x86_64) roll...
including "sge" (4.3,x86_64) roll...
Creating files (symbolic links - fast)
Applying netstg2.img
Applying updates.img
Applying comps.xml
Installing XML Kickstart profiles
    installing "cuda" profiles...
    installing "area51" profiles...
    installing "hpc" profiles...
    installing "ganglia" profiles...
    installing "base" profiles...
    installing "java" profiles...
    installing "sge" profiles...
    installing "web-server" profiles...
    installing "kernel" profiles...
    installing "grid" profiles...
    installing "site" profiles...
Generating hdlist (rpm database)
duplicate package for comps on x86_64
making "torrent" files for RPMS
Cleaning distribution
Resolving versions (base files)
    including "kernel" (4.3,x86_64) roll...
    including "base" (4.3,x86_64) roll...
Including critical RPMS
Resolving versions (RPMs)
    including "kernel" (4.3,x86_64) roll...
    including "base" (4.3,x86_64) roll...
Resolving versions (SRPMs)
    including "kernel" (4.3,x86_64) roll...
    including "base" (4.3,x86_64) roll...
Creating files (symbolic links - fast)
Applying netstg2.img
Applying updates.img
Applying comps.xml
Installing XML Kickstart profiles
    installing "kernel" profiles...
    installing "base" profiles...
Generating hdlist (rpm database)
Linking boot stages from lan
Building Roll Links
```

Now you can try reinstalling a compute node:

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

After verifying the proper operation of the compute node, reinstall the rest of the nodes in the cluster.

When adding the CUDA Roll on a running system, the CUDA Toolkit and CUDA SDK will not be automatically installed on the Frontend. Install them with the commands:

```
# cd /home/install/rolls/cuda/4.3/x86_64/RedHat/RPMS
# rpm -i cuda*
```

The device driver is not installed on the Frontend by default. If you have an CUDA capable device in the Frontend and want to install the driver for it refer to the commands for manually installing the driver on the Frontend in the last section of this chapter.

2.3. Optional installation of the driver on the Frontend

By default the device driver will not be installed on the Frontend. If you have an CUDA capable device in the Frontend and wish to install the device driver, you can manually install the rpm and load the driver:

```
# cd /home/install/rolls/cuda/4.3/x86_64/RedHat/RPMS
# rpm -i nvidia-driver*
# /etc/rc.d/init.d/nvidia start
```

On subsequent reboots the device driver will be automatically loaded.

Chapter 3. Using the CUDA Roll

The CUDA Roll provides the device driver, toolkit, and SDK for developing and running CUDA enabled programs.

3.1. Summary of Installed Components

The NVIDIA Display Driver is loaded automatically at boot time by the `/etc/rc.d/init.d/nvidia` script. It attempts to load the driver, and if it fails (which happens most often because the driver hasn't been installed for the currently running kernel) will reinstall the driver. The installation of the driver will always happen upon first boot after installation and will add approximately one minute to the boot time.

The CUDA Toolkit is installed in `/usr/local/cuda` and the files `/etc/profile.d/cuda.*` automatically add the proper location to the `PATH` and `LD_LIBRARY_PATH` environment variables.

A copy of the CUDA SDK is placed in `/usr/local/NVIDIA_CUDA_SDK` with precompiled debug and release versions of the SDK examples in `/usr/local/NVIDIA_CUDA_SDK/linux/bin/debug` and `/usr/local/NVIDIA_CUDA_SDK/linux/bin/release` respectively.

3.2. Testing the Installation

The pre-compiled SDK samples can be used to verify proper setup of your cluster. For example, the `deviceQuery` example can be run on a compute node to list the CUDA capable devices:

```
[tux@compute-0-0]$ cd /usr/local/NVIDIA_CUDA_SDK/bin/linux/release
[tux@compute-0-0]$ ./deviceQuery
There are 2 devices supporting CUDA
```

Device 0: "Quadro FX 5600"

Major revision number:	1
Minor revision number:	0
Total amount of global memory:	1609891840 bytes
Total amount of constant memory:	65536 bytes
Total amount of shared memory per block:	16384 bytes
Total number of registers available per block:	8192
Warp size:	32
Maximum number of threads per block:	512
Maximum sizes of each dimension of a block:	512 x 512 x 64
Maximum sizes of each dimension of a grid:	65535 x 65535 x 1
Maximum memory pitch:	262144 bytes
Texture alignment:	256 bytes
Clock rate:	1350000 kilohertz

Device 1: "Quadro FX 5600"

Major revision number:	1
Minor revision number:	0
Total amount of global memory:	1609891840 bytes
Total amount of constant memory:	65536 bytes
Total amount of shared memory per block:	16384 bytes

```
Total number of registers available per block: 8192
Warp size: 32
Maximum number of threads per block: 512
Maximum sizes of each dimension of a block: 512 x 512 x 64
Maximum sizes of each dimension of a grid: 65535 x 65535 x 1
Maximum memory pitch: 262144 bytes
Texture alignment: 256 bytes
Clock rate: 1350000 kilohertz
```

Test PASSED

Press ENTER to exit...

Appendix A. Rocks Copyright

Rocks(tm)
www.rocksclusters.org
version 4.3 (Mars Hill)

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