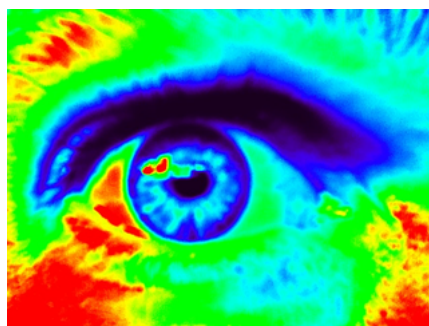
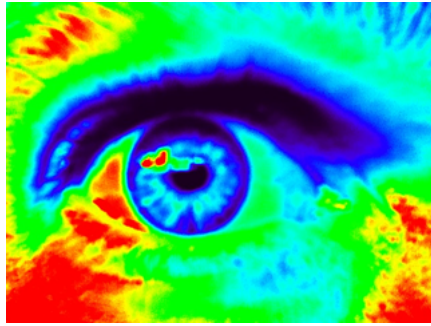


# Viz Roll: Users Guide



Version 5.2 Edition



**Viz Roll: Users Guide:**

Version 5.2 Edition

Published Jun 2009

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# Preface

The Viz Roll is used to build scientific visualization clusters with Rocks. Traditional Rocks-based compute clusters consist of a single Frontend machine and several back end Compute machines. However, a Rocks-based visualization cluster is composed of Tile machines instead of Compute machines. A Tile machine must have an nVidia graphics card and may drive one or two LCD monitors (or projectors). The major visualization-middleware components are DMX<sup>1</sup>, Chromium<sup>2</sup> and SAGE<sup>3</sup>.

DMX is part of the XFree86 project and has origins in the Xinerama code used to create a single X11 root window that spans across two physical monitors. DMX extends this to create a single root window (desktop) that spans across a rectangular wall of monitors or projectors. Although DMX can display OpenGL applications, it is recommended that Chromium be used with DMX for all OpenGL code. This Roll supports the use of DMX with and without Chromium support. It also supports Chromium in stand-alone mode for use without DMX.

SAGE (Scalable Adaptive Graphics Environment) is developed by the Cavern Group at the Electronic Visualization Laboratory (EVL) at the University of Illinois Chicago (UIC). SAGE can display both OpenGL and raw pixel blasting applications at full speed on large-scale tile displays. Applications must be written specifically for the SAGE environment, unlike DMX and Chromium. However, applications such as the SAGE version of mplayer can play HD qualities movies over a 60 tile wall at full speed, which is not possible using DMX (or Chromium).

## Notes

1. <http://dmx.sourceforge.net/>
2. <http://chromium.sourceforge.net/>
3. <http://www.evl.uic.edu/cavern/sage/>

# Chapter 1. Overview

**Table 1-1. Summary**

Name	viz
Version	5.2
Maintained By	Rocks Group
Architecture	x86_64
Compatible with Rocks™	5.2

**Table 1-2. Roll Compatibility**

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

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

# Chapter 2. Attributes

## 2.1. Definitions

**Table 2-1. Tile Appliance**

Name	Type	Default
cuda	bool	false
viz_nvidia_driver_options	string	--no-network -s
viz_nvidia_driver	string	/opt/viz/drivers/nvidia.run
viz_tile_bottom_bezel	int	80
viz_tile_left_bezel	int	100
viz_tile_resolution	string	1920x1200
viz_tile_right_bezel	int	100
viz_tile_top_bezel	int	80
x11	bool	true

### cuda

If set to True all host with this attribute will have the CUDA toolkit included in the packages installed on the machine. If the host is already installed this will take effect on the next re-installation. Enabling this does not automatically set the nVidia driver to be the CUDA driver, and may require the viz\_nvidia\_driver attribute to also be changed.

### viz\_nvidia\_driver\_options

The command line arguments passed to the nVidia driver installation script. The default values work for all drivers included in the Viz Roll, and the attribute should not be modified unless needed.

### viz\_nvidia\_driver

The full pathname of the nVidia driver installation script. The Viz Roll installs both the production nVidia driver and beta-CUDA driver installation script. This attribute is used to select which driver is installed on first boot after a tile node is first installed (or re-installed).

### viz\_tile\_bottom\_bezel

The size in pixels of the tile's bottom edge bezel (mullion).

### viz\_tile\_left\_bezel

The size in pixels of the tile's left edge bezel (mullion).

### viz\_tile\_resolution

The pixel resolution of the tile in the standard X11 format of COLxROW.



`viz_tile_right_bezel`

The size in pixels of the tile's right edge bezel (mullion).

`viz_tile_top_bezel`

The size in pixels of the tile's top edge bezel (mullion).

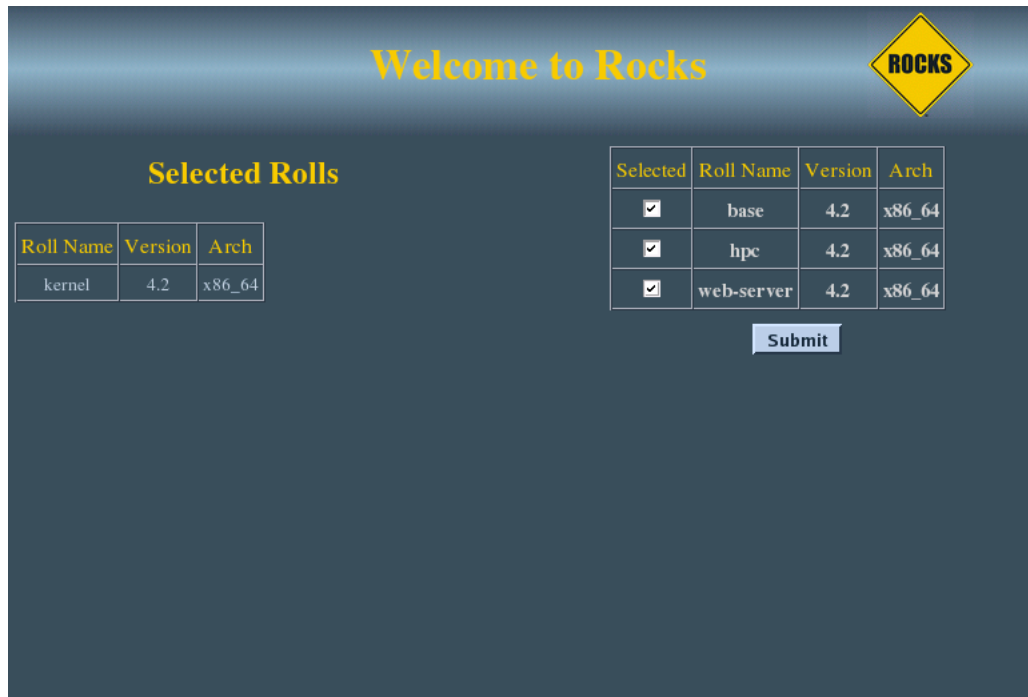
`x11`

If True one of more X11 displays are configured on the tile machine. This attribute is from the Rocks base and should not be changed.

# Chapter 3. Installing

## 3.1. On a New Server

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



The screenshot shows a dark blue background with the text "Welcome to Rocks" in yellow at the top center. To the right is a yellow diamond-shaped logo with the word "ROCKS" in black. Below the title, the heading "Selected Rolls" is displayed in yellow. There are two tables. The first table, on the left, has three columns: "Roll Name", "Version", and "Arch". It contains one row with the values "kernel", "4.2", and "x86\_64". The second table, on the right, has four columns: "Selected", "Roll Name", "Version", and "Arch". It contains three rows, each with a checked checkbox in the "Selected" column, followed by "base", "hpc", and "web-server" in the "Roll Name" column, and "4.2" and "x86\_64" in the "Version" and "Arch" columns respectively. Below the second table is a blue "Submit" button.

Roll Name	Version	Arch
kernel	4.2	x86_64

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

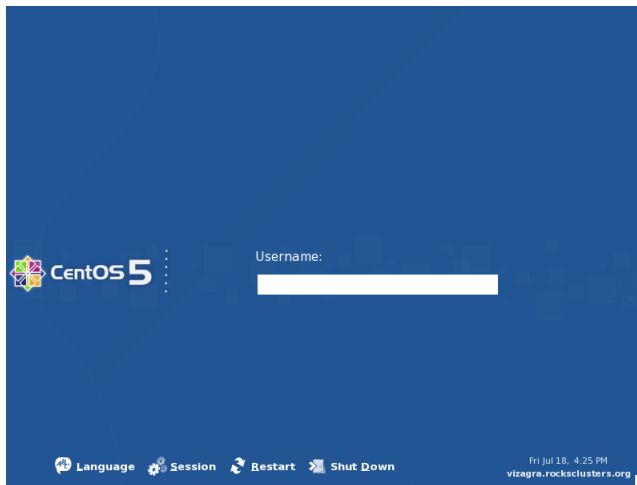
Submit

## 3.2. On an Existing Server

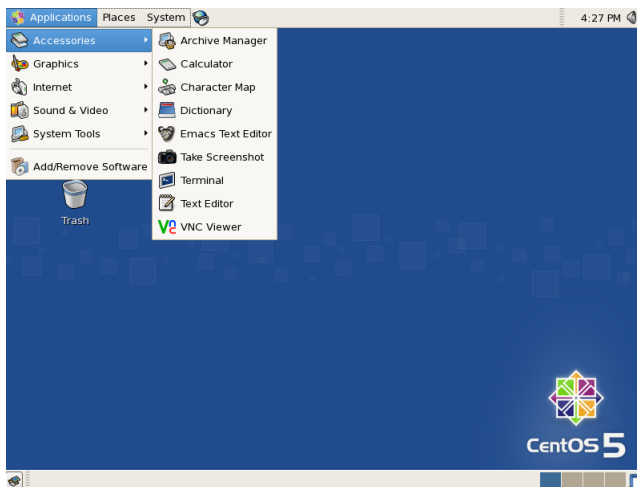
The viz Roll may not be installed on an already existing server. The only supported method of installation is to install the Roll at the time of the server installation.

## 3.3. Configuring the Frontend

1. After the frontend is installed and booted, you'll see an X11-based login screen, as shown below. Login as 'root' using the password you supplied during the frontend installation.



2. Once the root account GNOME session starts use the menus to open a new terminal window.



3. Since this is the first root login you will send to set up your ssh key. This is identical to the standard behavior in Rocks, however, since you are using the Viz Roll the first login is graphical rather than text mode. Hit return to accept the default value for the location of the key (`/root/.ssh/id_rsa`), next enter the passphrase you wish to use for the root SSH key.

It doesn't appear that you have set up your ssh key.

This process will make the files:

```
/root/.ssh/id_rsa.pub
/root/.ssh/id_rsa
/root/.ssh/authorized_keys
```

Generating public/private rsa key pair.

Enter file in which to save the key (`/root/.ssh/id_rsa`):

Created directory `'/root/.ssh'`.

Enter passphrase (empty for no passphrase):

Enter same passphrase again:

Your identification has been saved in `/root/.ssh/id_rsa`.

Your public key has been saved in `/root/.ssh/id_rsa.pub`.

The key fingerprint is:

10:95:6c:71:96:b2:0b:55:4e:fb:0a:2d:6d:b6:46:4f root@vizagra.rockclusters.org

[root@vizagra ~]#

## 3.4. Configuring the Wall

### 3.4.1. Install the Tile Nodes

```
# insert-ethers
```

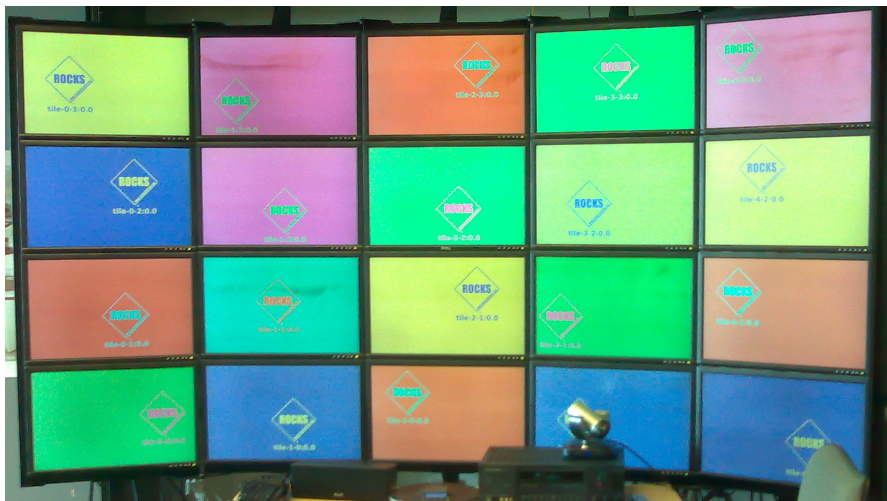
Select 'Tile' as the appliance type and boot the tile node on the bottom left (the bottom node in the first column). Once a node has completed the installation and reboot it will start an X11 session but may have the incorrect video resolution, this will get fixed later on.

After all the tiles in the first column are installed, exit 'insert-ethers' by hitting the 'F8' key. Then, restart insert-ethers with the flag:

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

Now install the bottom node in the second column.

Repeat the above process for each node in each column. Once all the nodes have been installed your wall should look like the following.



### 3.4.2. Multi-Display Support

The Viz Roll supports the construction of walls with either a single LCD display per machine or multiple displays per machine. Multiple displays can be grouped together as a single X11 display using TwinView with or without Xinerama, or each display can be an independent X11 display. The choice of whether to group a host's physical displays together or not is controlled by the `rocks sync tile` command.

The default configuration for Rocks is a single physical display per machine. If this is your configuration skip to the next section. If your wall has multiple displays per host you will need to create an XML an XML file that describes the physical layout of your wall. The syntax is very simple and the XML itself maps to the dimensions of the wall. Each `col` tag describes a vertical column of the wall, with the nodes listed top to bottom. The very first `col` section lists the Tile nodes comprising the far left side of the wall, and from there the next section moves to the right.



When connecting a single video card to two display you must connect the primary video connector to the LCD above (or to the left) of the secondary connector. This is a requirement of the SAGE software.

1. This simplest method to create you layout XML is to start from scratch rather than modifying the defaults as is documented in the non-twinview section above.

```
<wall>

<col>
  <display host="tile-0-0:0.0"/>
  <display host="tile-0-1:0.0"/>
  <display host="tile-0-2:0.0"/>
</col>
<col>
  <display host="tile-0-0:0.1"/>
  <display host="tile-0-1:0.1"/>
  <display host="tile-0-2:0.1"/>
</col>
<col>
  <display host="tile-1-0:0.0"/>
  <display host="tile-1-1:0.0"/>
  <display host="tile-1-2:0.0"/>
</col>
<col>
  <display host="tile-1-0:0.1"/>
  <display host="tile-1-1:0.1"/>
  <display host="tile-1-2:0.1"/>
</col>
<col>
  <display host="tile-2-0:0.0"/>
  <display host="tile-2-1:0.0"/>
  <display host="tile-2-2:0.0"/>
</col>
</wall>
```

2. After you update your tilelayout XML, now apply it to the database:

```
# rocks add tile layout layout.xml
```

3. Finally, reconfigure your tiles:

```
# rocks sync tile mode=meta
```

This will generate xorg.conf files for each tile node, copy them to the tile nodes, then restart the X11 server. Once the Tile nodes restart X11 your wall should look like the following picture. Note that each display is labeled according the connected Tile node.



Completed installation for a TwinView visualization wall.

# Chapter 4. Using

## 4.1. Attributes

### 4.1.1. Resolution

After the layout is configured and the `rocks sync tile` command is run the resolution of each tile display defaults to the preferred probed value from the nVidia driver. Probing the display requires a DVI connection and may fail on a VGA connect display. If the probed value is not correct you can modify the resolution using the `viz_tile_resolution` attribute. For example to set the resolution of all the tile to 1920x1200 use the command `rocks set appliance attr tile viz_tile_resolution 1920x1200`, followup by a `rocks sync tile` command.

### 4.1.2. Bezels Height and Width

The Viz Roll supports the hiding of pixels behind LCD mullions (bezels). Without bezel hiding all images rendered on the wall will display all pixels, This effect can be distracting for movies and other moving images, but is beneficial for static images and text. Bezel hiding is performed at the visualization middle-ware layer. Because this is controlled at the middle-ware layer Chromium and SAGE behave slightly differently, with Chromium allowing the enabling and disabling of bezel hiding, and SAGE only supporting bezel hiding. Despite these differences the following common set of attributes are used to set the bezel height and width.

`viz_tile_left_bezel`

The size (in pixels) of the left-hand side LCD bezel.

`viz_tile_right_bezel`

The size (in pixels) of the right-hand side LCD bezel.

`viz_tile_top_bezel`

The size (in pixels) of the top LCD bezel.

`viz_tile_bottom_bezel`

The size (in pixels) of the bottom LCD bezel.

The Viz Roll default for the the left and right side bezels is 100 pixels, and the default for the top and bottom bezels is 80 pixel. These defaults are a reasonable starting point, but fine tuning will be required for your specific monitors. Since the units of the bezels measurements are in pixels, of you change the resolution of the displays you will need to update the bezels settings as well.

You can use the `rocks set appliance attr` command to set the bezel attributes. For example, to change the left side bezel to 200 pixels use the command `rocks set appliance attr tile viz_tile_left_bezel 200`. If you have non-uniform displays you can also set the bezel sizes on a host basis, although not all middle-ware understands non-uniform tiled display walls. For example, to change the right side bezel of tile-0-0:0.0 to 0 pixels use the command `rocks set host attr tile-0-0:0.0 viz_tile_right_bezel 0`.

### 4.1.3. Video Driver

The Viz Roll includes the latest (at time of release) production nVidia driver and the latest (at time of release) beta-version of the CUDA-enabled driver. The CUDA driver is a superset of the standard driver and simply adds CUDA support to the existing OpenGL rendering support. Standard nVidia drivers are released as `.run` files and the Viz Roll installs these onto the tile nodes runs the driver file on first boot to build and install the driver. The following attributes control the selection of the driver:

`viz_nvidia_driver`

Full pathname to the `.run` driver file. The Viz Roll installs the production driver at `/opt/viz/drivers/nvidia.run`, and the beta-CUDA driver at `/opt/viz/drivers/nvidia.run`.

`viz_nvidia_driver_options`

Command line flags used when executing the `.run` driver file. The defaults are `--no-network -s`. These settings work for both drivers included with the Viz Roll and should not be modified.

To change to the CUDA driver for all tile use the command `rocks set appliance attr viz_nvidia_driver /opt/viz/drivers/cuda.run` and re-install all the tile machines. You can also issue this command before integrating any machine to avoid a second installation.

## 4.2. Chromium

Chromium is used to display the OpenGL frame of applications on the wall. Applications must be dynamically linked to the `libGL.so` library and can be either 64-bit or 32-bit binaries. Although the Viz Roll does include a 32-bit version of Chromium other application libraries may be missing. Some newer applications may contain code written to a later OpenGL specification than is supported by Chromium, however, most applications work without any source code changes.

### 4.2.1. Enabling and Disabling

Enabling and disabling Chromium is done on a per use basis and is not a global setting for all users. In the default disabled state all OpenGL applications started on the frontend of the cluster will display normally in the frontend's X11 display. If Chromium is enabled the application will draw the non-OpenGL components (and window frame) on the frontend display and the OpenGL frame will be rendered across all the tiles in the wall. Chromium is enabled and disabled using the following commands:

```
rocks enable chromium
```

```
rocks disable chromium
```

### 4.2.2. Controlling Bezels

The default for Chromium is to not hide the bezels. The `rocks enable chromium hidebezels` and `rocks disable chromium hidebezels` commands can be used to control this behavior.



### 4.2.3. Application Notes

#### 4.2.3.1. Google Earth

Google Earth is a 32-bit application and may require extra 32-bit libraries installed on the frontend of the cluster (not the tile nodes). Recent version of Google Earth work well under Chromium with the "atmosphere" effects turned off. If the compass does not appear resize the application window on the frontend to set the correct aspect ratio to allow the drawing of the compass.

### 4.2.4. SAGE

SAGE requires every user to have a complete personal copy of the SAGE binaries and libraries, and does not allow the sharing of the application in a common directory. Where a user first starts SAGE a local copy of the SAGE distribution is made in `~/.sage`. All configuration files referred to in the EVL SAGE documentation are in this user specific `~/.sage` directory.

#### 4.2.4.1. Starting and Stopping

SAGE can be started and stopped using the following command. However the SAGE UI shutdown button is the preferred way to exit SAGE.

`rocks start sage` Starting SAGE will create the `~/.sage` directory if one does not exist and will generate all the SAGE configuration files based on the tile layout stored in the Rocks database.

`rocks stop sage` Stopping SAGE can be a slow process. The Viz Roll changes the normal SAGE shutdown process to track down all orphaned SAGE processes on the cluster. While this is not fool-proof it does improve issues of orphaned SAGE applications preventing SAGE from starting.

# Appendix A. Rocks™ Copyright and Trademark

## A.1. Copyright Statement

Rocks(r)  
www.rocksclusters.org  
version 5.2 (Chimichanga)

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**Figure A-1. Rocks™ logo**



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GNU GENERAL PUBLIC LICENSE  
Version 2, June 1991

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```
<one line to give the program's name and a brief idea of what it does.>
Copyright (C) <year> <name of author>
```

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```
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This is free software, and you are welcome to redistribute it
under certain conditions; type `show c' for details.
```

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```
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`Gnomovision' (which makes passes at compilers) written by James Hacker.
```

```
<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice
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This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

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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 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.

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```
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If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline



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<signature of Ty Coon>, 1 April 1990  
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That's all there is to it!

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## C.1. Cg

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See also the CMake web site: <http://www.cmake.org> for more information.

## **C.4. fltk**

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December 11, 2001

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```
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```

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## C.9. mplayer

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## C.10. nVidia Driver

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## C.17. VTK

```
Program:   Visualization Toolkit
Module:    $RCSfile: appendix.sgml,v $
Language:  C++
Date:      $Date: 2009/06/11 23:34:02 $
Version:   $Revision: 1.3 $
```

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1. <http://cvs.rocksclusters.org>