

# **Ganglia Roll: Users Guide**

**Version 5.1 Edition**

**Ganglia Roll: Users Guide :**

Version 5.1 Edition

Published Nov 2008

Copyright © 2008 University of California

This document is subject to the Rocks License (see Appendix: Rocks Copyright).

# Table of Contents

<b>Preface</b> .....	<b>v</b>
<b>1. Overview</b> .....	<b>1</b>
<b>2. Installing</b> .....	<b>3</b>
2.1. On a New Server .....	3
<b>3. Using the ganglia Roll</b> .....	<b>4</b>
3.1. Using the Ganglia Roll.....	4
<b>4. Customizing the Ganglia Roll</b> .....	<b>8</b>
4.1. Customizing Ganglia Monitors .....	8
4.2. Monitoring Multiple Clusters with Ganglia .....	8
<b>A. Frequently Asked Questions</b> .....	<b>11</b>
<b>B. Rocks Copyright</b> .....	<b>12</b>
<b>C. Third Party Copyrights and Licenses</b> .....	<b>14</b>
C.1. Ganglia.....	14
C.2. phpsysinfo.....	14
C.3. rrdtool .....	23

# List of Tables

1-1. Summary..... 1  
1-2. Roll Compatibility ..... 1

# Preface

This Roll installs and configures the Ganglia<sup>1</sup> cluster monitoring system.

## Notes

1. <http://ganglia.info/>

# Chapter 1. Overview

**Table 1-1. Summary**

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

**Table 1-2. Roll Compatibility**

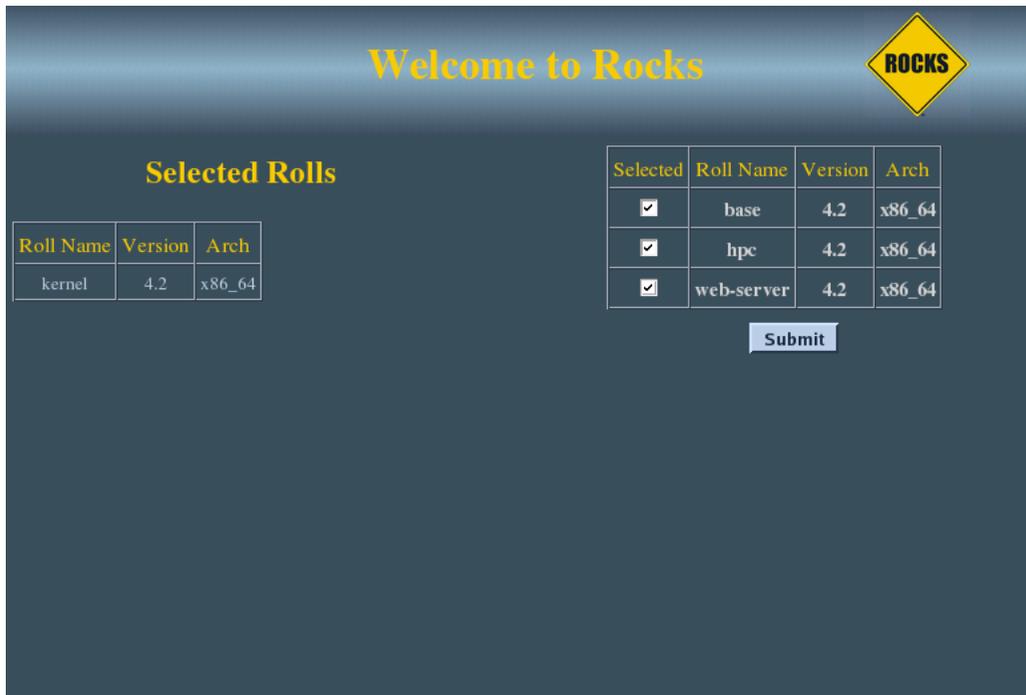
<b>Roll</b>	<b>Requires <sup>a</sup></b>	<b>Optional <sup>b</sup></b>	<b>Conflicts</b>
alpha		X	
area51		X	
base	X		
bio		X	
condor		X	
ganglia	X		
grid		X	
hpc		X	
java		X	
kernel	X		
os (disk 1)	X		
os (disk 2)	X		
os (disk 3)		X	
os (disk 4)		X	
os (disk 5)		X	
os (disk 6)		X	
os (disk 7)		X	
pbs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

<b>Roll</b>	<b>Requires <sup>a</sup></b>	<b>Optional <sup>b</sup></b>	<b>Conflicts</b>
<p>Notes:</p> <ul style="list-style-type: none"><li>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.</li><li>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.</li></ul>			

# Chapter 2. Installing

## 2.1. On a New Server

The ganglia 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 ganglia Roll from the list of available rolls when you see a screen that is similar to the one below.



The screenshot shows a dark blue background with the text "Welcome to Rocks" in yellow at the top center. To the right is a yellow diamond-shaped logo with the word "ROCKS" in black. Below the title, the heading "Selected Rolls" is displayed in yellow. There are two tables: a smaller one on the left and a larger one on the right. The larger table has columns for "Selected", "Roll Name", "Version", and "Arch", with three rows of selected rolls. A "Submit" button is located below the larger table.

Roll Name	Version	Arch
kernel	4.2	x86_64

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

Submit

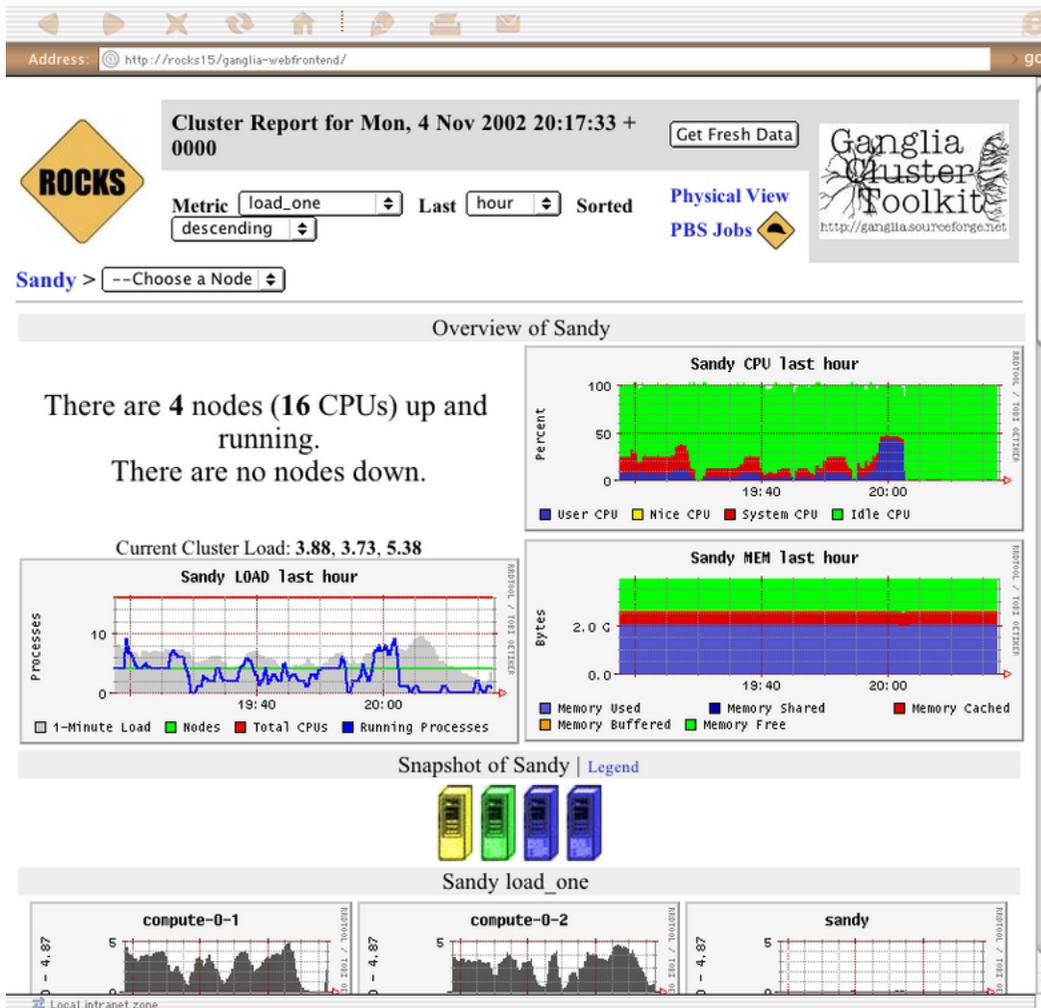
# Chapter 3. Using the ganglia Roll

## 3.1. Using the Ganglia Roll

### 3.1.1. Cluster Status

The webpages available from this link provide a graphical interface to live cluster information provided by Ganglia monitors<sup>1</sup> running on each cluster node. The monitors gather values for various metrics such as CPU load, free memory, disk usage, network I/O, operating system version, etc. These metrics are sent through the private cluster network and are used by the frontend node to generate the historical graphs.

In addition to metric parameters, a heartbeat message from each node is collected by the Ganglia monitors. When a number of heartbeats from any node are missed, this web page will declare it "dead". These dead nodes often have problems which require additional attention, and are marked with the Skull-and-Crossbones icon, or a red background.





The Rocks Cluster Group maintains a similar web page called *Meta* that collects Ganglia information from many clusters built with Rocks software. It may give you a glimpse of the power and scalability of the Ganglia monitors. The meta page is available at <http://meta.rocksclusters.org/>.

Ganglia<sup>3</sup> was designed at Berkeley by Matt Massie ([massie@cs.berkeley.edu](mailto:massie@cs.berkeley.edu)) in 2000, and is currently developed by an open source partnership between Berkeley, SDSC, and others. It is distributed through Sourceforge.net under the GPL software license.

### 3.1.2. Cluster Top

This page is a version of the standard "top" command for your cluster. This page presents process information from each node in the cluster. This page is useful for monitoring the precise activity of your nodes.

The Cluster Top differs from standard top in several respects. Most importantly, each row has a "HOST" designation and a "TN" attribute that specifies its age. Since taking a process measurement itself requires resources, compute nodes report process data only once every 60 seconds on average. A process row with TN=30 means the host reported information about that process 30 seconds ago.

For brevity and minimal performance impact, each node only reports as many processes as it has CPUs. The processes shown had the highest %CPU utilization on the node at the time of reporting. Unfortunately the number of processes per node is not currently adjustable. The restriction lies in the structure of the Ganglia monitoring system, which only delivers information and has no faculty for accepting parameters on the fly. However, showing the most CPU intensive processes should give you a good idea of how the CPUs are being utilized.

The process data is gathered by raw processing of the /proc filesystem on each node. Memory statistics differ slightly from standard "ps" output, and are calculated from the /proc/[pid]/statm virtual file.

#### Process Columns

##### TN

The age of the information in this row, in seconds.

##### HOST

The node in the cluster on which this process is running.

##### PID

The Process ID. A non-negative integer, unique among all processes on this node.

##### USER

The username of this processes.

##### CMD

The command name of this process, without arguments.

**%CPU**

The percentage of available CPU cycles occupied by this process. This is always an approximate figure, which is more accurate for longer running processes.

**%MEM**

The percentage of available physical memory occupied by this process.

**SIZE**

The size of the "text" memory segment of this process, in kilobytes. This approximately relates the size of the executable itself (depending on the BSS segment).

**DATA**

Approximately the size of all dynamically allocated memory of this process, in kilobytes. Includes the Heap and Stack of the process. Defined as the "resident" - "shared" size, where resident is the total amount of physical memory used, and shared is defined below. Includes the the text segment as well if this process has no children.

**SHARED**

The size of the shared memory belonging to this process, in kilobytes. Defined as any page of this process' physical memory that is referenced by another process. Includes shared libraries such as the standard libc and loader.

**VM**

The total virtual memory size used by this process, in kilobytes.

The screenshot shows a web browser window titled "Cluster Top" with the URL "http://onyx.rocksclusters.org/ganglia/addons/rocks/top.php". The page header includes "Onyx Cluster Top" and a yellow diamond logo with the word "ROCKS". Below the header, there is a search bar for "Show only processes by user:" and a "Go" button. The main content is a table with the following columns: TN, HOST, PID, USER, CMD, %CPU, %MEM, SIZE, DATA, SHARED, VM, and Up/Down. The table lists several processes, with the first one being 'sge\_commd' on 'onyx.local' with 99.90% CPU usage and 3760 KB of VM.

TN	HOST	PID	USER	CMD	%CPU	%MEM	SIZE	DATA	SHARED	VM	Up/Down
2	onyx.local	1606	root	sge_commd	99.90	0.36	100	3192	568	3760	
2	onyx.local	8	root	kscand	11.11	0.00	0	0	0	0	
52	compute-0-2.local	8	root	kscand	3.70	0.00	0	0	0	0	
2	onyx.local	1104	root	gschedule	2.47	44.91	680	460876	2012	463112	
93	compute-0-1.local	2162	root	gschedule	1.24	28.27	680	289308	2044	291352	
16	onyx.local	1277	nobody	gmond	1.23	0.15	92	828	684	1512	
2	onyx.local	1	root	init	0.00	0.04	24	24	416	480	
35	onyx.local	2	root	keventd	0.00	0.00	0	0	0	0	

## **Notes**

1. <http://ganglia.info/>
2. <http://meta.rocksclusters.org/>
3. <http://ganglia.info/>

# Chapter 4. Customizing the Ganglia Roll

## 4.1. Customizing Ganglia Monitors

### 4.1.1. Enabling fully aware Ganglia daemons

For maximum performance and scalability, the Ganglia *gmond* daemons on compute nodes in the cluster are run in "deaf" mode. While compute nodes report their own Ganglia data to the frontend, they do not listen for information from their peers. This reduces the resource footprint of compute nodes.

Running the compute node monitors in deaf mode means they cannot be queried for cluster state. This may be a problem if your parallel jobs use Ganglia data for performance analysis or fault tolerance purposes. If you would like to re-enable Ganglia's full functionality on your compute nodes, follow the instructions below.



Ganglia daemons were switched to the deaf mode by default starting in the Matterhorn Rocks release 3.1.0.

- Add a new XML node file called `replace-ganglia-client.xml` (see section "3.2. Customizing Configuration of Compute Nodes" in the Base Roll Documentation for details on how to create a replacement XML node file).

Put the following contents in the new file:

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

<kickstart>

  <description>
    UCB's Ganglia Monitor system for client nodes in the
    cluster.
  </description>

</post>

/sbin/chkconfig --add gmetad

</post>

</kickstart>
```

- Reinstall your compute nodes. They will now have access to the full monitoring tree. This procedure places the compute nodes on the same level monitoring level as the frontend.

## 4.2. Monitoring Multiple Clusters with Ganglia

Ganglia has the ability to track and present monitoring data from multiple clusters. A collection of monitored clusters is called a *Grid* in Ganglia's nomenclature. This section describes the steps required to setup a multi-cluster monitoring grid.

The essential idea is to instruct the gmetad daemon on one of your frontend nodes to track the second cluster in addition to its own. This procedure can be repeated to monitor a large set clusters from one location.

For this discussion, your two clusters are named "A" and "B". We will choose the frontend on cluster "A" to be the top-level monitor.

1. On "A" frontend, add the line to `/etc/gmetad.conf`:

```
data_source "Cluster B" B.frontend.domain.name
```

Then restart the gmetad server on "A" frontend.

2. On "B" frontend, get the IP address of "A.frontend.domain.name" and edit `/etc/gmond.conf` and change the section from:

```
tcp_accept_channel {
  port = 8649
  acl {
    default = "deny"
    access {
      ip = 127.0.0.1
      mask = 32
      action = "allow"
    }
    access {
      ip = 10.0.0.0
      mask = 8
      action = "allow"
    }
  }
}
```

to:

```
tcp_accept_channel {
  port = 8649
  acl {
    default = "deny"
    access {
      ip = 127.0.0.1
      mask = 32
      action = "allow"
    }
    access {
      ip = 10.0.0.0
      mask = 8
      action = "allow"
    }
    access {
```

```

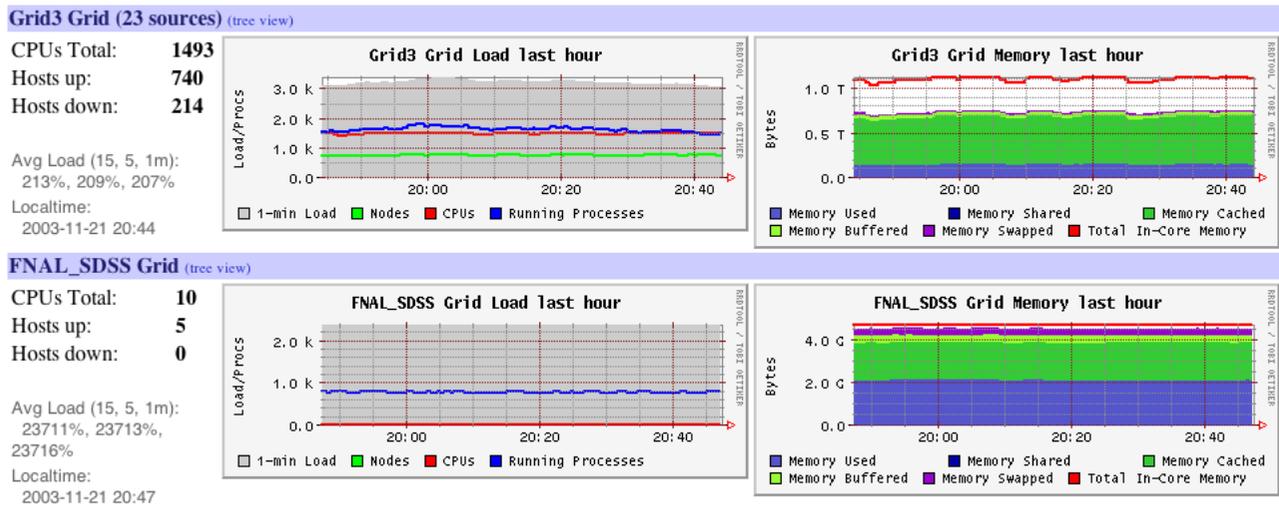
ip = ip-address-of-A.frontend
mask = 32
action = "allow"
}
}
}

```

Then restart gmond server on "B" frontend.

3. Take a look at the Ganglia page on "A". It should include statistics for B, and a summary or "roll-up" view of both clusters.

This screenshot is from the iVDGL Physics Grid3 project. It is a very large grid monitored by Ganglia in a similar manner as specified here.



# Appendix A. Frequently Asked Questions

1. I see IP addresses not names in my Ganglia graphs. Why is this?

The DNS system in the cluster sometimes causes Ganglia to record bogus node names (usually their IP addresses). To clear this situation, restart the "gmond" and "gmetad" services on the frontend. This action may be useful later, as it will flush any dead nodes from the Ganglia output.

```
# service gmond restart
# service gmetad restart
```

This method is also useful when replacing or renaming nodes in your cluster.

2. When looking at the Ganglia page, I dont see graphs, just the error:

```
There was an error collecting ganglia data (127.0.0.1:8652): XML error: not
well-formed (invalid token) at xxx
```

This indicates a parse error in the Ganglia gmond XML output. It is generally caused by non-XML characters (& especially) in the cluster name or cluster owner fields, although any ganglia field (including node names) with these characters will cause this problem.

We hope future versions of Ganglia will correctly escape all names to make them XML safe. If you have a bad name, to edit `/etc/gmond.conf` on the frontend node, remove the offending characters, then restart gmond.

# Appendix B. Rocks Copyright

Rocks(r)  
www.rocksclusters.org  
version 5.1 (VI)

Copyright (c) 2000 - 2008 The Regents of the University of California.  
All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice unmodified and in its entirety, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. All advertising and press materials, printed or electronic, mentioning features or use of this software must display the following acknowledgement:

"This product includes software developed by the Rocks(r)  
Cluster Group at the San Diego Supercomputer Center at the  
University of California, San Diego and its contributors."

4. Except as permitted for the purposes of acknowledgment in paragraph 3, neither the name or logo of this software nor the names of its authors may be used to endorse or promote products derived from this software without specific prior written permission. The name of the software includes the following terms, and any derivatives thereof: "Rocks", "Rocks Clusters", and "Avalanche Installer". For licensing of the associated name, interested parties should contact Technology Transfer & Intellectual Property Services, University of California, San Diego, 9500 Gilman Drive, Mail Code 0910, La Jolla, CA 92093-0910, Ph: (858) 534-5815, FAX: (858) 534-7345, E-MAIL:invent@ucsd.edu

THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS "AS IS AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR 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.



# Appendix C. Third Party Copyrights and Licenses

This section enumerates the licenses from all the third party software components of this Roll. A "best effort" attempt has been made to insure the complete and current licenses are listed. In the case of errors or omissions please contact the maintainer of this Roll. For more information on the licenses of any components please consult with the original author(s) or see the Rocks CVS repository<sup>1</sup>.

## C.1. Ganglia

Copyright (c) 2001, 2002, 2003, 2004, 2005 by  
The Regents of the University of California. All rights reserved.

Permission to use, copy, modify, and distribute this software and its documentation for any purpose, without fee, and without written agreement is hereby granted, provided that the above copyright notice and the following two paragraphs appear in all copies of this software.

IN NO EVENT SHALL THE UNIVERSITY OF CALIFORNIA BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OF THIS SOFTWARE AND ITS DOCUMENTATION, EVEN IF THE UNIVERSITY OF CALIFORNIA HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

THE UNIVERSITY OF CALIFORNIA SPECIFICALLY DISCLAIMS ANY WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE SOFTWARE PROVIDED HEREUNDER IS ON AN "AS IS" BASIS, AND THE UNIVERSITY OF CALIFORNIA HAS NO OBLIGATION TO PROVIDE MAINTENANCE, SUPPORT, UPDATES, ENHANCEMENTS, OR MODIFICATIONS.

## C.2. phpsysinfo

GNU LIBRARY GENERAL PUBLIC LICENSE  
Version 2, June 1991

Copyright (C) 1991 Free Software Foundation, Inc.  
59 Temple Place, Suite 330, Boston, MA 02111-1307 USA  
Everyone is permitted to copy and distribute verbatim copies  
of this license document, but changing it is not allowed.

[This is the first released version of the library GPL. It is  
numbered 2 because it goes with version 2 of the ordinary GPL.]

Preamble

The licenses for most software are designed to take away your freedom to share and change it. By contrast, the GNU General Public Licenses are intended to guarantee your freedom to share and change free software--to make sure the software is free for all its users.

This license, the Library General Public License, applies to some specially designated Free Software Foundation software, and to any other libraries whose authors decide to use it. You can use it for your libraries, too.

When we speak of free software, we are referring to freedom, not price. Our General Public Licenses are designed to make sure that you have the freedom to distribute copies of free software (and charge for this service if you wish), that you receive source code or can get it if you want it, that you can change the software or use pieces of it in new free programs; and that you know you can do these things.

To protect your rights, we need to make restrictions that forbid anyone to deny you these rights or to ask you to surrender the rights. These restrictions translate to certain responsibilities for you if you distribute copies of the library, or if you modify it.

For example, if you distribute copies of the library, whether gratis or for a fee, you must give the recipients all the rights that we gave you. You must make sure that they, too, receive or can get the source code. If you link a program with the library, you must provide complete object files to the recipients so that they can relink them with the library, after making changes to the library and recompiling it. And you must show them these terms so they know their rights.

Our method of protecting your rights has two steps: (1) copyright the library, and (2) offer you this license which gives you legal permission to copy, distribute and/or modify the library.

Also, for each distributor's protection, we want to make certain that everyone understands that there is no warranty for this free library. If the library is modified by someone else and passed on, we want its recipients to know that what they have is not the original version, so that any problems introduced by others will not reflect on the original authors' reputations.

Finally, any free program is threatened constantly by software patents. We wish to avoid the danger that companies distributing free software will individually obtain patent licenses, thus in effect transforming the program into proprietary software. To prevent this, we have made it clear that any patent must be licensed for everyone's free use or not licensed at all.

Most GNU software, including some libraries, is covered by the ordinary GNU General Public License, which was designed for utility programs. This license, the GNU Library General Public License, applies to certain designated libraries. This license is quite different from the ordinary

one; be sure to read it in full, and don't assume that anything in it is the same as in the ordinary license.

The reason we have a separate public license for some libraries is that they blur the distinction we usually make between modifying or adding to a program and simply using it. Linking a program with a library, without changing the library, is in some sense simply using the library, and is analogous to running a utility program or application program. However, in a textual and legal sense, the linked executable is a combined work, a derivative of the original library, and the ordinary General Public License treats it as such.

Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

However, unrestricted linking of non-free programs would deprive the users of those programs of all benefit from the free status of the libraries themselves. This Library General Public License is intended to permit developers of non-free programs to use free libraries, while preserving your freedom as a user of such programs to change the free libraries that are incorporated in them. (We have not seen how to achieve this as regards changes in header files, but we have achieved it as regards changes in the actual functions of the Library.) The hope is that this will lead to faster development of free libraries.

The precise terms and conditions for copying, distribution and modification follow. Pay close attention to the difference between a "work based on the library" and a "work that uses the library". The former contains code derived from the library, while the latter only works together with the library.

Note that it is possible for a library to be covered by the ordinary General Public License rather than by this special one.

GNU LIBRARY GENERAL PUBLIC LICENSE  
TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

0. This License Agreement applies to any software library which contains a notice placed by the copyright holder or other authorized party saying it may be distributed under the terms of this Library General Public License (also called "this License"). Each licensee is addressed as "you".

A "library" means a collection of software functions and/or data prepared so as to be conveniently linked with application programs (which use some of those functions and data) to form executables.

The "Library", below, refers to any such software library or work which has been distributed under these terms. A "work based on the Library" means either the Library or any derivative work under copyright law: that is to say, a work containing the Library or a

portion of it, either verbatim or with modifications and/or translated straightforwardly into another language. (Hereinafter, translation is included without limitation in the term "modification".)

"Source code" for a work means the preferred form of the work for making modifications to it. For a library, complete source code means all the source code for all modules it contains, plus any associated interface definition files, plus the scripts used to control compilation and installation of the library.

Activities other than copying, distribution and modification are not covered by this License; they are outside its scope. The act of running a program using the Library is not restricted, and output from such a program is covered only if its contents constitute a work based on the Library (independent of the use of the Library in a tool for writing it). Whether that is true depends on what the Library does and what the program that uses the Library does.

1. You may copy and distribute verbatim copies of the Library's complete source code as you receive it, in any medium, provided that you conspicuously and appropriately publish on each copy an appropriate copyright notice and disclaimer of warranty; keep intact all the notices that refer to this License and to the absence of any warranty; and distribute a copy of this License along with the Library.

You may charge a fee for the physical act of transferring a copy, and you may at your option offer warranty protection in exchange for a fee.

2. You may modify your copy or copies of the Library or any portion of it, thus forming a work based on the Library, and copy and distribute such modifications or work under the terms of Section 1 above, provided that you also meet all of these conditions:

- a) The modified work must itself be a software library.
- b) You must cause the files modified to carry prominent notices stating that you changed the files and the date of any change.
- c) You must cause the whole of the work to be licensed at no charge to all third parties under the terms of this License.
- d) If a facility in the modified Library refers to a function or a table of data to be supplied by an application program that uses the facility, other than as an argument passed when the facility is invoked, then you must make a good faith effort to ensure that, in the event an application does not supply such function or table, the facility still operates, and performs whatever part of its purpose remains meaningful.

(For example, a function in a library to compute square roots has a purpose that is entirely well-defined independent of the

application. Therefore, Subsection 2d requires that any application-supplied function or table used by this function must be optional: if the application does not supply it, the square root function must still compute square roots.)

These requirements apply to the modified work as a whole. If identifiable sections of that work are not derived from the Library, and can be reasonably considered independent and separate works in themselves, then this License, and its terms, do not apply to those sections when you distribute them as separate works. But when you distribute the same sections as part of a whole which is a work based on the Library, the distribution of the whole must be on the terms of this License, whose permissions for other licensees extend to the entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest your rights to work written entirely by you; rather, the intent is to exercise the right to control the distribution of derivative or collective works based on the Library.

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

3. You may opt to apply the terms of the ordinary GNU General Public License instead of this License to a given copy of the Library. To do this, you must alter all the notices that refer to this License, so that they refer to the ordinary GNU General Public License, version 2, instead of to this License. (If a newer version than version 2 of the ordinary GNU General Public License has appeared, then you can specify that version instead if you wish.) Do not make any other change in these notices.

Once this change is made in a given copy, it is irreversible for that copy, so the ordinary GNU General Public License applies to all subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of the Library into a program that is not a library.

4. You may copy and distribute the Library (or a portion or derivative of it, under Section 2) in object code or executable form under the terms of Sections 1 and 2 above provided that you accompany it with the complete corresponding machine-readable source code, which must be distributed under the terms of Sections 1 and 2 above on a medium customarily used for software interchange.

If distribution of object code is made by offering access to copy from a designated place, then offering equivalent access to copy the source code from the same place satisfies the requirement to distribute the source code, even though third parties are not

compelled to copy the source along with the object code.

5. A program that contains no derivative of any portion of the Library, but is designed to work with the Library by being compiled or linked with it, is called a "work that uses the Library". Such a work, in isolation, is not a derivative work of the Library, and therefore falls outside the scope of this License.

However, linking a "work that uses the Library" with the Library creates an executable that is a derivative of the Library (because it contains portions of the Library), rather than a "work that uses the library". The executable is therefore covered by this License. Section 6 states terms for distribution of such executables.

When a "work that uses the Library" uses material from a header file that is part of the Library, the object code for the work may be a derivative work of the Library even though the source code is not. Whether this is true is especially significant if the work can be linked without the Library, or if the work is itself a library. The threshold for this to be true is not precisely defined by law.

If such an object file uses only numerical parameters, data structure layouts and accessors, and small macros and small inline functions (ten lines or less in length), then the use of the object file is unrestricted, regardless of whether it is legally a derivative work. (Executables containing this object code plus portions of the Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may distribute the object code for the work under the terms of Section 6. Any executables containing that work also fall under Section 6, whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also compile or link a "work that uses the Library" with the Library to produce a work containing portions of the Library, and distribute that work under terms of your choice, provided that the terms permit modification of the work for the customer's own use and reverse engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the Library is used in it and that the Library and its use are covered by this License. You must supply a copy of this License. If the work during execution displays copyright notices, you must include the copyright notice for the Library among them, as well as a reference directing the user to the copy of this License. Also, you must do one of these things:

- a) Accompany the work with the complete corresponding machine-readable source code for the Library including whatever changes were used in the work (which must be distributed under Sections 1 and 2 above); and, if the work is an executable linked with the Library, with the complete machine-readable "work that

uses the Library", as object code and/or source code, so that the user can modify the Library and then relink to produce a modified executable containing the modified Library. (It is understood that the user who changes the contents of definitions files in the Library will not necessarily be able to recompile the application to use the modified definitions.)

b) Accompany the work with a written offer, valid for at least three years, to give the same user the materials specified in Subsection 6a, above, for a charge no more than the cost of performing this distribution.

c) If distribution of the work is made by offering access to copy from a designated place, offer equivalent access to copy the above specified materials from the same place.

d) Verify that the user has already received a copy of these materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

It may happen that this requirement contradicts the license restrictions of other proprietary libraries that do not normally accompany the operating system. Such a contradiction means you cannot use both them and the Library together in an executable that you distribute.

7. You may place library facilities that are a work based on the Library side-by-side in a single library together with other library facilities not covered by this License, and distribute such a combined library, provided that the separate distribution of the work based on the Library and of the other library facilities is otherwise permitted, and provided that you do these two things:

a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities. This must be distributed under the terms of the Sections above.

b) Give prominent notice with the combined library of the fact that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

8. You may not copy, modify, sublicense, link with, or distribute the Library except as expressly provided under this License. Any attempt otherwise to copy, modify, sublicense, link with, or

distribute the Library is void, and will automatically terminate your rights under this License. However, parties who have received copies, or rights, from you under this License will not have their licenses terminated so long as such parties remain in full compliance.

9. You are not required to accept this License, since you have not signed it. However, nothing else grants you permission to modify or distribute the Library or its derivative works. These actions are prohibited by law if you do not accept this License. Therefore, by modifying or distributing the Library (or any work based on the Library), you indicate your acceptance of this License to do so, and all its terms and conditions for copying, distributing or modifying the Library or works based on it.

10. Each time you redistribute the Library (or any work based on the Library), the recipient automatically receives a license from the original licensor to copy, distribute, link with or modify the Library subject to these terms and conditions. You may not impose any further restrictions on the recipients' exercise of the rights granted herein. You are not responsible for enforcing compliance by third parties to this License.

11. If, as a consequence of a court judgment or allegation of patent infringement or for any other reason (not limited to patent issues), conditions are imposed on you (whether by court order, agreement or otherwise) that contradict the conditions of this License, they do not excuse you from the conditions of this License. If you cannot distribute so as to satisfy simultaneously your obligations under this License and any other pertinent obligations, then as a consequence you may not distribute the Library at all. For example, if a patent license would not permit royalty-free redistribution of the Library by all those who receive copies directly or indirectly through you, then the only way you could satisfy both it and this License would be to refrain entirely from distribution of the Library.

If any portion of this section is held invalid or unenforceable under any particular circumstance, the balance of the section is intended to apply, and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any patents or other property right claims or to contest validity of any such claims; this section has the sole purpose of protecting the integrity of the free software distribution system which is implemented by public license practices. Many people have made generous contributions to the wide range of software distributed through that system in reliance on consistent application of that system; it is up to the author/donor to decide if he or she is willing to distribute software through any other system and a licensee cannot impose that choice.

This section is intended to make thoroughly clear what is believed to be a consequence of the rest of this License.

12. If the distribution and/or use of the Library is restricted in certain countries either by patents or by copyrighted interfaces, the original copyright holder who places the Library under this License may add an explicit geographical distribution limitation excluding those countries, so that distribution is permitted only in or among countries not thus excluded. In such case, this License incorporates the limitation as if written in the body of this License.

13. The Free Software Foundation may publish revised and/or new versions of the Library General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library specifies a version number of this License which applies to it and "any later version", you have the option of following the terms and conditions either of that version or of any later version published by the Free Software Foundation. If the Library does not specify a license version number, you may choose any version ever published by the Free Software Foundation.

14. If you wish to incorporate parts of the Library into other free programs whose distribution conditions are incompatible with these, write to the author to ask for permission. For software which is copyrighted by the Free Software Foundation, write to the Free Software Foundation; we sometimes make exceptions for this. Our decision will be guided by the two goals of preserving the free status of all derivatives of our free software and of promoting the sharing and reuse of software generally.

#### NO WARRANTY

15. BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW. EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR OTHER PARTIES PROVIDE THE LIBRARY "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

16. IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED TO IN WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

END OF TERMS AND CONDITIONS

How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the "copyright" line and a pointer to where the full notice is found.

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

```
This library is free software; you can redistribute it and/or  
modify it under the terms of the GNU Library General Public  
License as published by the Free Software Foundation; either  
version 2 of the License, or (at your option) any later version.
```

```
This library is distributed in the hope that it will be useful,  
but WITHOUT ANY WARRANTY; without even the implied warranty of  
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU  
Library General Public License for more details.
```

```
You should have received a copy of the GNU Library General Public  
License along with this library; if not, write to the  
Free Software Foundation, Inc., 59 Temple Place - Suite 330,  
Boston, MA 02111-1307 USA.
```

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

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

```
Yoyodyne, Inc., hereby disclaims all copyright interest in the  
library 'Frob' (a library for tweaking knobs) written by James Random Hacker.
```

```
<signature of Ty Coon>, 1 April 1990  
Ty Coon, President of Vice
```

That's all there is to it!

## C.3. rrdtool

RRDTOOL - Round Robin Database Tool

A tool for fast logging of numerical data graphical display of this data.

Copyright (c) 1998-2006 Tobias Oetiker

All rights reserved.

GNU GPL License

=====

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.

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program; if not, write to the Free Software Foundation, Inc., 59 Temple Place - Suite 330, Boston, MA 02111-1307, USA

FLOSS License Exception

=====

(Adapted from <http://www.mysql.com/company/legal/licensing/foss-exception.html>)

I want specified Free/Libre and Open Source Software ("FLOSS") applications to be able to use specified GPL-licensed RRDtool libraries (the "Program") despite the fact that not all FLOSS licenses are compatible with version 2 of the GNU General Public License (the "GPL").

As a special exception to the terms and conditions of version 2.0 of the GPL:

You are free to distribute a Derivative Work that is formed entirely from the Program and one or more works (each, a "FLOSS Work") licensed under one or more of the licenses listed below, as long as:

1. You obey the GPL in all respects for the Program and the Derivative Work, except for identifiable sections of the Derivative Work which are not derived from the Program, and which can reasonably be considered independent and separate works in themselves,
2. all identifiable sections of the Derivative Work which are not derived from the Program, and which can reasonably be considered independent and separate works in themselves,
  1. are distributed subject to one of the FLOSS licenses listed below, and

2. the object code or executable form of those sections are accompanied by the complete corresponding machine-readable source code for those sections on the same medium and under the same FLOSS license as the corresponding object code or executable forms of those sections, and

3. any works which are aggregated with the Program or with a Derivative Work on a volume of a storage or distribution medium in accordance with the GPL, can reasonably be considered independent and separate works in themselves which are not derivatives of either the Program, a Derivative Work or a FLOSS Work.

If the above conditions are not met, then the Program may only be copied, modified, distributed or used under the terms and conditions of the GPL.

#### FLOSS License List

=====

License name	Version(s)/Copyright	Date
Academic Free License	2.0	
Apache Software License	1.0/1.1/2.0	
Apple Public Source License	2.0	
Artistic license	From Perl 5.8.0	
BSD license	"July 22 1999"	
Common Public License	1.0	
GNU Library or "Lesser" General Public License (LGPL)	2.0/2.1	
Jabber Open Source License	1.0	
MIT License (As listed in file MIT-License.txt)	-	
Mozilla Public License (MPL)	1.0/1.1	
Open Software License	2.0	
OpenSSL license (with original SSLeay license)	"2003" ("1998")	
PHP License	3.0	
Python license (CNRI Python License)	-	
Python Software Foundation License	2.1.1	
Sleepycat License	"1999"	
W3C License	"2001"	
X11 License	"2001"	
Zlib/libpng License	-	
Zope Public License	2.0	

## Notes

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