GROUNDWORK
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GroundWork Monitor
Ganglia Integration Module
System Administrator Guide

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1 Overview

This document describes the system administrator tasks required to install and administer the software which integrates GroundWork Monitor with Ganglia, referred to as the *Ganglia Integration Module*. This software allows information gathered by the Ganglia monitoring system to be processed by a GroundWork Monitor system.

Ganglia is an agent-based, cluster-oriented monitoring system. It is useful for large installations with many similar hosts. It is efficient and scalable, and can collect and graph many different metrics. Ganglia, however, does not include threshold values for these metrics, or notifications when these thresholds are violated. Nor does it include reporting. These functions are part of GroundWork Monitor, via the Nagios® monitoring system and GroundWork's user interfaces and databases. This integration module brings these projects together by allowing GroundWork Monitor operator views, dashboards, reports, notifications, and configuration tools to be applied to Ganglia data.

The Ganglia Integration Module has the following features.

- A "collector" gathers information for each host running the Ganglia `gmond` agent, and relays that information to a GroundWork Monitor host. For each monitored host, selected metrics are compared against warning and critical thresholds. If the thresholds are exceeded for a configured duration, a service alert is generated.
- A web interface called the Ganglia Configuration Administration tool is provided. This interface allows the administrator to:
  - Define Ganglia metrics to monitor (i.e., select a subset of the metrics that Ganglia is collecting, for purposes of watching for extreme values).
  - Define warning, critical, and duration thresholds for the watched metrics.
  - Assign watched-metric thresholds globally (to all Ganglia clusters), to specific Ganglia clusters, or to specific hosts.
  - View the current metric state of certain metrics monitored by the Ganglia interface, for particular hosts.
  - Conveniently access the web pages provided by Ganglia itself.
- An import script that automatically defines the Ganglia hosts to the GroundWork Monitor system is also included. The Monarch Nagios configuration database is updated by the import script, and Monarch procedures are called to automatically commit the changes to Nagios.

The integration module package consists of the following main components:

- Check Ganglia daemon, `check_ganglia.pl`. This module reads a set of Ganglia `gmetad` and/or `gmond` XML streams and extracts the metrics for each host. It compares these metrics to the defined watched-metric thresholds to determine if a metric is in violation of its associated thresholds. It then sends passive service check results to the Nagios command pipe. The daemon also updates the `ganglia` database.
- `ganglia` PostgreSQL database. (MySQL is also supported, for legacy systems, using older releases of the Ganglia Integration Module.) This database contains:
  - The default, per-cluster, and per-host watched-metric thresholds.
  - The current metric measurements for each host.
- Ganglia configuration administration CGI programs, presented as portal applications within GroundWork Monitor Enterprise Edition. The standard security mechanisms available to similar portal applications (e.g., limiting access to only certain Roles) are also available for these portal pages.
- Auto-import script. This script, `autoimport.pl`, queries the `ganglia` PostgreSQL (or MySQL) database for hosts reported by the check ganglia daemon. It then queries the `monarch` database for hosts defined in Nagios, and finds Ganglia hosts that are not in Nagios, which it adds to the `monarch` database. It applies a default `ganglia` profile to such new hosts, and optionally commits the changes to Nagios.

The detailed design of the system is described below.

2 Installation

The following software prerequisites are required to install the Ganglia Integration Module.

- GroundWork Monitor Enterprise Edition version 6.4.0 or later. (That is the general requirement, covering historical releases of the Ganglia Integration Module. GWMEE 7.0.0 and later are only supported using changes made for the Ganglia Integration Module version 7.0.0 release. But that release only works with GWMEE 7.1.1 or later, which leaves a hole in the supported GWMEE releases.)
- Ganglia Version 3.0.x or later monitoring your infrastructure. (Ganglia 3.7.2 is current as of this writing.) Note: it is not necessary to install `gmond` or `gmetad` on the GroundWork server, but if you do not, you must ensure that the GroundWork server can access the XML feed on at least one `gmond` or `gmetad` instance.
- To install the Ganglia Integration Module version 7.0.0 or later, the `patch`, `unzip`, and `zip` programs must be installed on the GroundWork Monitor server where you will install the Ganglia Integration Module. They usually reside in `/usr/bin/patch`, `/usr/bin/unzip`, and `/usr/bin/zip`, respectively, and come from the `patch`, `unzip`, and `zip` packages available in your Linux distribution.

The Ganglia Integration Module is supplied as a set of RPM packages:

- `groundwork-ganglia-integration`
- `groundwork-autoimport`

Multiple RPMs are used to provide appropriate granularity for upgrades as this software and the base product both evolve. Currently, RPMs are provided for the Red Hat Enterprise Linux 7 64-bit platform.

Certain customer-specific extensions may be supplied to those customers as separate RPMs:

- `groundwork-ganglia-`*customername*
- `groundwork-autoimport-`*customername*

The `check_ganglia.pl` script which is at the heart of this software runs continually under control of the GroundWork Monitor `gwservices` service. To enable us to automatically install all the software in its intended locations without having it disrupt system operation before it is properly configured, the daemon script looks for the `enable_processing` setting in its configuration file. If the option is turned off, as it is in the default installed configuration file, the script will just emit a log message saying that processing is not enabled, and it will then sleep for a very long time.

To install, you will need to perform the following steps:

- Set up GroundWork Monitor Enterprise Edition.
- Set up Ganglia, and in particular make sure you understand where the `gmond` and/or `gmetad` XML feeds are accessible.
- Install the required Ganglia Integration RPM.
- Optionally install the Autoimport RPM.
- Configure and start the software.

The rest of this chapter contains basic instructions for performing these steps.

2.1 GroundWork Monitor

Install GroundWork Monitor according to the standard product installation procedures. If you are upgrading from GWMEE 6.5.0 or earlier to GWMEE 6.6.1 or later, and you had the Ganglia Integration Module already installed on the original system, you must read Section 2.3.2, Upgrading from a MySQL- to a PostgreSQL-based GroundWork Monitor Release, on page 9 before you begin the upgrade. For this type of upgrade, some adjustments are necessary, and installation/upgrade of the new Ganglia Integration Module is slightly intertwined with the installation of the base GroundWork Monitor product.

2.2 Fresh Installation of the Ganglia Integration Module

All the Ganglia Integration RPMs get installed on your top-level GroundWork Monitor system, which is where the `check_ganglia.pl` script will run.

Note: Installation of the RPMs will restart both of the apache and gwservices components of GroundWork Monitor. This will disrupt existing, running sessions where users are accessing GroundWork Monitor. Thus, you may wish to wait until a convenient period of low use to perform these steps.

Install the RPMs for your platform. Here we specify them as individual `rpm` commands, but you may combine them on a single `rpm` command if you wish. The `groundwork-ganglia-`*customername* and/or `groundwork-autoimport-`*customername* RPMs will only be installed at particular customer sites.

```
rpm -Uvh groundwork-ganglia-integration-release-build.platform.rpm
rpm -Uvh groundwork-ganglia-customername-release-build.platform.rpm
rpm -Uvh groundwork-autoimport-release-build.platform.rpm
rpm -Uvh groundwork-autoimport-customername-release-build.platform.rpm
```

where platform is `i386` for a 32-bit platform, `x86_64` for a 64-bit platform, or `noarch` for either platform.

Once the software is installed, take the following steps:

- Create the `ganglia` database. This is a destructive operation (it will wipe out any previous database named `ganglia`). Creating the database is not done automatically during RPM installation because we cannot make assumptions about where you want to have this database reside.
  - For a PostgreSQL-based GroundWork Monitor release (6.6.0 or later), use the following commands, to first create the database itself and then to create the tables and other objects within it:

    ```
    cd /usr/local/groundwork/core/databases/postgresql
    /usr/local/groundwork/postgresql/bin/psql -h host -U postgres < create-ganglia-db.sql
    /usr/local/groundwork/postgresql/bin/psql -h host -U ganglia < ganglia-db.sql
    ```

    where, if you are just connecting to PostgreSQL running on the same machine, the `-h` *host* option can be either specified as `-h localhost` or omitted entirely. Note that two different database users (`postgres` and `ganglia`) are used in these two commands. The `postgres` user must be specified on the first command so you have permission to create the `ganglia` database itself. The `ganglia` user is used on the second command as a simple way both to log in as that user and to default the database you connect to as the `ganglia` database.

    If this is a completely fresh install of the Ganglia Integration Module, not part of an upgrade from a previous release, you must also load the database with a small amount of seed data. (In an upgrade situation, this data will be migrated from the prior release, so you must not execute these commands in that case.)

    ```
    cd /usr/local/groundwork/core/databases/postgresql
    /usr/local/groundwork/postgresql/bin/psql -h host -U ganglia < ganglia-seed.sql
    ```

    Each `psql` command will prompt you for the corresponding database password; these will generally be different for the two users. See the `create-ganglia-db.sql` script for the initial password for the `ganglia` user; later, you can use ordinary PostgreSQL facilities to change this as you wish:

    ```
    alter role ganglia with password 'foobar';
    ```

    If you do change the password, keep track if it, as the new value will be needed in several of the configuration files for the Ganglia Integration Module.

  - For a MySQL-based GroundWork Monitor release, use:

    ```
    /usr/local/groundwork/mysql/bin/mysql options \
        < /usr/local/groundwork/core/databases/ganglia_db_create.sql
    ```

    where the *options* are whatever you need to access the proper MySQL instance as the administrative user, such as:

    ```
    mysql -h host -u root -p < ganglia_db_create.sql
    ```

    Note: If you don't have a password for the MySQL root account (definitely not a recommended setup!), just type Return at the password prompt.

- Set up the `/usr/local/groundwork/config/check_ganglia.conf` config file (Section 4.1.1, Check Ganglia Configuration, on page 27). In particular:
  - Check that the `GANGLIA_GMOND_PORT` and `GANGLIA_GMETAD_PORT` definitions match the port numbers in use at your site.
  - Define the hosts and ports at which Ganglia XML streams should be accessed to obtain metric data (`<ganglia_hosts>` section).
  - List the names of the particular Ganglia clusters you wish to monitor (`ganglia_cluster` lines).
  - Adjust the database-access parameters (`ganglia_dbtype` through `ganglia_dbpass`) to fit your local site.
  - Set `enable_processing = yes` (this parameter appears at the top of the file) once all the other setup in this file is ready.
- Set up the `/usr/local/groundwork/config/GangliaConfigAdmin.conf` config file (Section 4.1.2, Ganglia Threshold Administration Configuration, on page 30). In particular, adjust the database-access parameters (`ganglia_dbtype` through `ganglia_dbpass`) to fit your local site.
- Set up the `/usr/local/groundwork/config/GangliaWebServers.conf` config file (Section 4.1.3, Ganglia Web Server Viewing Configuration, on page 31). In particular, define the hosts and URLs at which your Ganglia Web Server pages are available for viewing (`<ganglia_web_servers>` section). Also, if you wish, choose a default Ganglia web server to display (see the comments in the configuration file.)
- Set up the `/usr/local/groundwork/config/autoimport.conf` config file (Section 4.3, Auto-Import Configuration, on page 41). In particular:
  - Check the `commit_changes` value to make sure it will reflect your local usage of auto-import.
  - Check the `process_wg_hostgroups` value to make sure it reflects your local usage. Almost all customers will set this to `no`.
  - Check the `custom_hostgroup_package` and `custom_hostgroup_package_options` values to make sure they reflect your local usage. Most customers will set the `custom_hostgroup_package` to an empty string; this option must be set properly even if `process_wg_hostgroups` is set to `no`.
  - Adjust the database-access parameters (`ganglia_dbtype` through `ganglia_dbpass`, and possibly `cacti_dbtype` through `cacti_dbpass`) to fit your local site.
  - Check the `process_cacti_hosts` value to make sure it reflects your local usage.
- This step applies to the Ganglia Integration Module 7.0.0 and later. Add the necessary portal objects to the JBoss portal, by running the following command. This must be done while the GroundWork server is up and running. You will need the GroundWork user-interface root-account username and password. The script performs no validation of these credentials before attempting to use them, so you should do so yourself before running this command. You can do so by logging in to the GroundWork UI using those credentials.

  ```
  /usr/local/groundwork/ganglia/scripts/add-ganglia-portal-objects rootuser rootpassword
  ```
- Create various objects within Monarch that will be needed by auto-import. See Section 4.3, Auto-Import Configuration, on page 41 for details.
- Possibly set up a `nagios`-user cron job for auto-import. (See Section 4.3, Auto-Import Configuration, on page 41 for information on how the `autoimport.pl` script is run.)
- Kill the `check_ganglia.pl` daemon so it restarts (under control of `gwservices`) using the modified configuration file. Finding the right process to kill is a bit complicated because of the manner in which Perl is installed in GroundWork Monitor. You can either restart all of `gwservices`:

  ```
  service groundwork restart gwservices
  ```

  or target just the `check_ganglia.pl` daemon. This command will do the trick (or complain with a usage message if the daemon is not running):

  ```
  kill `ps -w -w --no-headers -C .perl.bin -o pid,args | fgrep check_ganglia.pl | awk '{print $1}'`
  ```

Note that all of the configuration files above (`check_ganglia.conf`, `GangliaConfigAdmin.conf`, `GangliaWebServers.conf`, and `autoimport.conf`) have definite controlled ownership (`nagios:nagios`) and permissions (`600`). These settings are not optional; the configuration files are checked for access rights

each time the associated program runs, and each program will not run if access to the configuration file is not restricted.

At this point, all of the components are installed and ready to begin collecting data and monitoring your infrastructure. Please read the main body of this document to learn how to get the database populated with your Ganglia-monitored hosts, import them into GroundWork Monitor, set up the thresholds on the metrics, and start getting results.

You may also want to modify the default access controls set up for the Ganglia Integration Module's UI pages. See Section 4.1.4, Ganglia Portal Access Permissions, on page 32 for details.

2.3 Upgrading from a Previous Release of the Ganglia Integration Module

Read through the entire applicable subsection before beginning. Some steps must be taken manually on the old system to capture configuration data there and transfer it to the new system.

2.3.1 Upgrading to a MySQL-based GroundWork Monitor Release

The material in this section is largely of historical interest. GroundWork Monitor has used PostgreSQL instead of MySQL since GWMEE 6.6.0, and the Ganglia Integration Module 7.0.0 and later releases assume the use of a PostgreSQL database. However, some material here is referenced later on in the procedures for an upgrade from a MySQL-based GWMEE release to a PostgreSQL-based GWMEE release.

For a MySQL-to-MySQL upgrade, the `ganglia` database schema for this release is compatible with that from the Ganglia Integration Module version 4.X.X and 5.X.X releases. The configuration files are largely compatible with prior releases, but the configuration variable names used for database access credentials have been normalized to be more consistent with the naming conventions we have used for similar credentials elsewhere within GroundWork Monitor.

The basic upgrade strategy is multi-step, **and is subject to the caveats listed below**:

1. Save your old database and configuration files in a safe place.
2. Run the Fresh Installation procedure in the previous section. The "`rpm -Uvh ...`" commands given there will upgrade your existing installation if it is on the same machine, or install for the first time if it is on a new machine.
3. Put back your old database and settings from the old configuration files as needed.

The following caveats apply:

- You may create the `ganglia` database as noted under Fresh Installation, but you will then replace its content with that of the old database, to restore the metric thresholds you previously configured.
  - To back up your old database before upgrading the Ganglia Integration Module, run a copy of `mysqldump` that knows where your `ganglia` database is located. For instance, on a GroundWork Monitor 5.1.3 system with the database on the same machine, the command would be:

    ```
    /usr/bin/mysqldump -u root -p ganglia > /tmp/gangla-db.dump
    ```

    On a GroundWork Monitor 6.4 system with the database on the same machine, the commands would be:

    ```
    cd /usr/local/groundwork/mysql/bin
    ./mysqldump -u root -p ganglia > /tmp/gangla-db.dump
    ```

  - To restore the database dump on the upgraded system, after moving it to the `/tmp` directory on your GWMEE 6.4 or GWMEE 6.5 system, use the following commands:

    ```
    cd /usr/local/groundwork/mysql/bin
    ./mysql -h host -u root -p ganglia < /tmp/ganglia-db.dump
    ```

- The `gangliaconfig.conf` file from very old releases is no longer used.
- Attributes of the `check_cacti.conf` and `GangliaConfigAdmin.conf` files must be as established by the new release for the ownership (`nagios:nagios`) and permissions (`600`) on these files.
- The `/usr/local/groundwork/etc/check_ganglia.conf` file in much older releases has been moved. Its new location is listed above, in the Fresh Installation section.

- When you install the new RPMs, your existing `check_ganglia.conf` will remain untouched, and a new copy will appear as the `/usr/local/groundwork/config/check_ganglia.conf.rpmnew` file. You may compare the two files to see what has changed in the new version.
- Certain parameters in the `check_ganglia.conf` file may no longer be relevant in the upgraded environment. In particular:
  - `custom_metrics_package` should be set to `""` if you will not be using a customer-specific package (`groundwork-ganglia-`*customername* RPM) to process metric data.
  - Database-access parameters should be re-examined, because you may be running the `ganglia` database on new hardware in conjunction with an upgrade to the GWMEE 6.5 release.
  - As of the Ganglia Integration Module 6.0.0 release, the names of the database-access configuration variables have been modified. The old options:

    ```
    dBHost
    dBName
    dBUser
    dBPass
    ```

    have been replaced by similar new options:

    ```
    ganglia_dbtype
    ganglia_dbhost
    ganglia_dbname
    ganglia_dbuser
    ganglia_dbpass
    ```

    Note that the `ganglia_dbtype` option is new, and for this type of upgrade its value must be set to `"mysql"` (including those enclosing quotes).
- The `/usr/local/groundwork/etc/GangliaConfigAdmin.conf` file in much older releases has been moved. Its new location is listed above, in the Fresh Installation section.
- When you install the new RPMs, your existing `GangliaConfigAdmin.conf` will remain untouched, and a new copy will appear as the `/usr/local/groundwork/config/GangliaConfigAdmin.conf.rpmnew` file. You may compare the two files to see what has changed in the new version.
- Certain parameters in the `GangliaConfigAdmin.conf` file may have changed in the upgraded environment. In particular:
  - Database-access parameters should be re-examined, because you may be running the `ganglia` database on new hardware in conjunction with an upgrade to the GWMEE 6.5 release.
  - As of the Ganglia Integration Module 6.0.0 release, the names of the database-access configuration variables have been modified. The old options:

    ```
    DatabaseHost
    DatabaseName
    DatabaseUser
    DatabasePass
    ```

    have been replaced by similar new options:

    ```
    ganglia_dbtype
    ganglia_dbhost
    ganglia_dbname
    ganglia_dbuser
    ganglia_dbpass
    ```

    Note that the `ganglia_dbtype` option is new, and for this type of upgrade its value must be set to `"mysql"` (including those enclosing quotes).
- The `GangliaWebServers.conf` file was new with the Ganglia Integration Module 5.0.0 release. Its form and usage have not changed in the Ganglia Integration Module 6.0.0 release. If you are upgrading from a release prior to 5.0.0, the content of this file must be configured from scratch.

- When you install the new RPMs, your existing `autoimport.conf` file will remain untouched, and a new copy will appear as the `/usr/local/groundwork/config/autoimport.conf.rpmnew` file. You may compare the two files to see what has changed in the new version.
- Certain parameters in the `autoimport.conf` file may have changed in the upgraded environment. In particular:
  - As of the Auto-Import 2.0.0 release, logging now pays more attention to the configured debug level. For this reason, you probably want to set the `debug_level` to 5 (log statistical data) to capture operational statistics in the log file.
  - As of the Auto-Import 2.0.0 release, the standard `logfile` path has changed. It is now:

    ```
    # Where to put all the log messages from autoimport processing.
    logfile = "/usr/local/groundwork/nagios/var/log/autoimport.log"
    ```

    (Note that the RPM installation will create a symlink to this path in the `/usr/local/groundwork/logs/` directory, for convenient access.)
  - You may wish to revisit your settings for the `custom_hostgroup_package` and `custom_hostgroup_package_options` options, if you have `process_wg_hostgroups` enabled and there are any recent changes to the packages you have available for assigning hostgroups to hosts.
  - Database-access parameters should be re-examined, because you may be running the `ganglia` and `cacti` databases on new hardware in conjunction with an upgrade to the GWMEE 6.5 release.
  - As of the Auto-Import 3.0.0 release, the names of the database-access configuration variables have been modified. The old options:

    ```
    ganglia_database
    ganglia_host
    ganglia_dbuser
    ganglia_dbpwd
    ```

    and:

    ```
    cacti_database
    cacti_host
    cacti_dbuser
    cacti_dbpwd
    ```

    have been replaced by similar new options:

    ```
    ganglia_dbtype
    ganglia_dbname
    ganglia_dbhost
    ganglia_dbuser
    ganglia_dbpass
    ```

    and:

    ```
    cacti_dbtype
    cacti_dbname
    cacti_dbhost
    cacti_dbuser
    cacti_dbpass
    ```

    Note that the `ganglia_dbtype` and `cacti_dbtype` options are new, and for this type of upgrade their values must be set to `"mysql"` (including those enclosing quotes).

2.3.2 Upgrading from a MySQL- to a PostgreSQL-based GroundWork Monitor Release

The material in this section is complicated by the fact that the Ganglia Integration Module 7.0.0 release can only be installed on GWMEE 7.1.1 and later. Because of restrictions on GWMEE upgrade paths, this means you will not be able to carry out a direct same-machine upgrade of the Ganglia Integration Module to its version 7.0.0 on GWMEE 7.1.1 at the same time you are making the transition from MySQL to PostgreSQL. The full process for running a separate-machine upgrade in this situation has not been fully vetted, so there might be some undocumented exceptions to the procedures described below for this case.

For a MySQL-to-PostgreSQL upgrade, the `ganglia` database schema for this release has necessarily changed from that used with the Ganglia Integration Module version 4.X.X and 5.X.X releases. The basic structure mirrors the MySQL version, but the field types have been modified to work as expected with the new database engine, and new sequence objects have been added to support the auto-increment behavior of the primary ID columns in the tables. The configuration files are largely compatible with prior releases, but the configuration variable names used for database access credentials have been normalized to be more consistent with the naming conventions we have used for similar credentials elsewhere within GroundWork Monitor.

The basic upgrade strategy is multi-step, and is carried out in conjunction with the upgrade of the GroundWork Monitor release. It involves stopping the monitoring of the Ganglia data stream only for as long as it takes to copy the data between MySQL and PostgreSQL databases, through the end of the upgrade.

1. If the machine that will run a PostgreSQL-based release of GroundWork Monitor **is the same machine** as the initial MySQL-based machine:
   a. Upgrade the Ganglia Integration Module on the MySQL system, as described in the previous subsection (Section 2.3.1). That will install scripts which will be needed during the remainder of this process.
   b. At this point, the upgraded software should be working on the MySQL system.
      - Exercise the Web UI (the Ganglia > Ganglia Thresholds tab, and the Ganglia → Ganglia Views tab).
      - Check the log file for the Check Ganglia plugin for errors (`/usr/local/groundwork/logs/check_ganglia.log`).
      - Run an autoimport (see Section 4.3, Auto-Import Configuration, on page 41).
      - Check the log file for the auto-import for errors (`/usr/local/groundwork/logs/autoimport.log`).
   c. If the Ganglia Integration Module isn't working, diagnose and fix the problem before you proceed.
   d. Run the following script to check for duplicate rows that will prevent applying unique constraints to the `ganglia` database:

      ```
      cd /usr/local/groundwork/ganglia/scripts
      /usr/local/groundwork/mysql/bin/mysql -u root -p -v -v -v < mysql_ganglia_show_duplicates.sql
      ```

      If there are any duplicate rows, they will be displayed as tables in the output of this script. You will need to eliminate all such duplicates before you can proceed, generally by some manual work at the database level. Some degree of detailed investigation may be needed to choose which of the alternate rows in each set should be deleted and which should be kept. When you have all duplicates dealt with, the script should run with:

      ```
      Empty set (0.00 sec)
      ```

      as the result for all of the queries in the script.
   e. Once the `mysql_ganglia_show_duplicates.sql` script shows no duplicate rows, run the following script to apply various unique constraints to the existing MySQL database. Doing this now in the MySQL database will prevent any trouble when the data is migrated to the PostgreSQL database, where these constraints will already be in place.

      ```
      cd /usr/local/groundwork/ganglia/scripts
      /usr/local/groundwork/mysql/bin/mysql -u root -p < mysql_ganglia_unique_constraints.sql
      ```

      If you see any errors when running this script, you will need to dig in and figure out what the problem is, before you proceed with the rest of the upgrade. All of the unique constraints listed in this script should be present before upgrading to PostgreSQL. Note that the following SQL command may be of help when investigating problems in this area:

      ```
      show index from table;
      ```

2. Run the first portion of the standard upgrade to the new GroundWork Monitor release, through the "Install Cleanup Scripts" step in this section of the install instructions:

   https://kb.groundworkopensource.com/display/SUPPORT/Installing+or+Upgrading+to+GroundWork+Monitor+6.7.0#InstallingorUpgradingtoGroundWorkMonitor6.7.0-InstallCleanupScripts

   Stop before you run the "Cleanup of MySQL Databases" step. At this point, you will have the standard cleanup scripts installed, but you will need to run an alternate cleanup script instead.

3. If the machine that will run a PostgreSQL-based release of GroundWork Monitor **is not the same machine** as the initial MySQL-based machine:
   a. Install the Ganglia Integration Module as a fresh install on the new GroundWork Monitor machine, following the procedure outlined in Section 2.2, Fresh Installation of the Ganglia Integration Module, on page 5, with one exception noted below. This will get the software in place and an empty `ganglia` database established. During this installation, compare the Ganglia Integration Module configuration files on the old and new machines, and copy over any customized values as needed. The file paths on the new machine will be:

      ```
      /usr/local/groundwork/config/autoimport.conf
      /usr/local/groundwork/config/check_ganglia.conf
      /usr/local/groundwork/config/GangliaConfigAdmin.conf
      /usr/local/groundwork/config/GangliaWebServers.conf
      ```

      The paths on the old machine may be slightly different if you are starting from a very old release of the Ganglia Integration Module; see Section 2.3.1, Upgrading to a MySQL-based GroundWork Monitor Release, on page 7 for details if this is an issue for you.
   b. The exception mentioned above is that, when you edit the `check_ganglia.conf` file, you should leave the `enable_processing` option set to `no` for now.
   c. Copy one script from the new machine back to the old (MySQL-based) machine:

      ```
      cd /usr/local/groundwork/ganglia/scripts
      scp -p mysql_ganglia_unique_constraints.sql root@oldmachine:/tmp
      ```

   d. Back on the old machine, run the script, in order to apply various unique constraints to the existing MySQL database. The primary reason to do this now in the MySQL database is to verify that there won't be any trouble when the data is migrated to the PostgreSQL database, where these constraints will already be in place.

      ```
      cd /usr/local/groundwork/mysql/bin
      ./mysql -u root -p ganglia < /tmp/mysql_ganglia_unique_constraints.sql
      ```

      If you see any errors when running this script, you will need to dig in and figure out what the problem is, before you proceed with the rest of the upgrade. All of the unique constraints listed in this script should be present before upgrading to PostgreSQL. Note that the following SQL command may be of help when investigating problems in this area:

      ```
      show index from table;
      ```

4. In this step, you will clean up the old databases.
   - If you are migrating to GWMEE 6.7.0 or earlier, then in the "Cleanup of MySQL Databases" step, you will need to run a modified version of the `master_migration_to_pg.pl` script, installed from the Ganglia Integration Module. Instead of this command:

     ```
     /usr/local/groundwork/core/migration/postgresql/master_migration_to_pg.pl -c
     ```

     you will run this command instead:

     ```
     /usr/local/groundwork/ganglia/scripts/master_migration_to_pg.pl.6.7.0_extended -c
     ```

     The alternative command will recognize how to deal with the `ganglia` database.
   - For upgrades to GWMEE releases later than 6.7.0, the special modifications should have been already folded into the standard script for the new release, so you can run the standard version shown in the GWMEE installation/upgrade instructions.
5. Continue with the installation process for the GWMEE upgrade, through the "Final Pre-Upgrade Backup" step in this section of the install instructions:

   https://kb.groundworkopensource.com/display/SUPPORT/Installing+or+Upgrading+to+GroundWork+Monitor+6.7.0#InstallingorUpgradingtoGroundWorkMonitor6.7.0-FinalPreUpgradeBackup

   Stop before you run the "MySQL to PostgreSQL Data Migration" step. At this point, you will have the PostgreSQL database software installed, as either a local or remote database.
6. If the machine that will run a PostgreSQL-based release of GroundWork Monitor **is the same machine** as the initial MySQL-based machine:

a. In this step, you will briefly disable the Ganglia data feed, so it does not interfere with any of the database-data copying. This will, of course, cause the monitored devices to eventually go into alarm state, when Nagios detects that no data has come in for awhile. You should be prepared for that, and disable notifications beforehand if needed.

b. Disable the data feed by setting the `enable_processing` option in the `check_ganglia.conf` file to `no`, and killing the running copy of the `check_ganglia.pl` script so it will pick up the new configuration and go to sleep (essentially forever) when it is automatically restarted.

c. Create the PostgreSQL copy of the `ganglia` database, and its tables and other associated objects.

```
cd /usr/local/groundwork/core/databases/postgresql
/usr/local/groundwork/postgresql/bin/psql -U postgres < create-ganglia-db.sql
/usr/local/groundwork/postgresql/bin/psql -U ganglia < ganglia-db.sql
```

Note that two different database users (`postgres` and `ganglia`) are used in these two commands. The `postgres` user must be specified on the first command so you have permission to create the `ganglia` database itself. The `ganglia` user is used on the second command as a simple way both to log in as that user and to default the database you connect to as the `ganglia` database.

Each `psql` command will prompt you for the corresponding database password; these will generally be different for the two users. See the `create-ganglia-db.sql` script for the initial password for the `ganglia` user; later, you can use ordinary PostgreSQL facilities to change this as you wish:

```
alter role ganglia with password 'foobar';
```

If you do change the password, keep track if it, as the new value will be needed in several of the configuration files for the Ganglia Integration Module.

7. You will next move back to the main installation procedure for upgrading your copy of GroundWork Monitor. However, in the next step you will carry out,"MySQL to PostgreSQL Data Migration":

https://kb.groundworkopensource.com/display/SUPPORT/Installing+or+Upgrading+to+GroundWork+Monitor+6.7.0#InstallingorUpgradingtoGroundWorkMonitor6.7.0-MySQLtoPostgreSQLDataMigration

you must take special care when you run the master migration script.

- If you are migrating to GWMEE 6.7.0 or earlier, then the standard `master_migration_to_pg.pl` script provided as part of the GWMEE upgrade must be ignored, and you must run an altered version instead, as shown here. The modified version knows where to find the database access credentials for the old `ganglia` database, and how to copy its data into the new database.

```
service groundwork stop gwservices
/usr/local/groundwork/ganglia/scripts/master_migration_to_pg.pl.6.7.0_extended -m
```

- For upgrades to GWMEE releases later than 6.7.0, the special modifications should have been already folded into the standard script for the new release, so you can run the standard version shown in the GWMEE installation/upgrade instructions.

8. After migrating the data in all databases from MySQL to PostgreSQL, return back to the procedure here before continuing the GWMEE installation. Save aside the configuration files that you have previously customized, so you can restore them after the GWMEE installation is completed.

```
cd /usr/local/groundwork/config
cp -p autoimport.conf         /usr/local/groundwork/ganglia/backups
cp -p GangliaConfigAdmin.conf /usr/local/groundwork/ganglia/backups
cp -p GangliaWebServers.conf  /usr/local/groundwork/ganglia/backups
cp -p check_ganglia.conf      /usr/local/groundwork/ganglia/backups
```

If you have any customer-specific packages related to the Ganglia Integration Module installed, you will need to back up their configuration files as well. For example:

```
cp -p Site_Code_Name.conf     /usr/local/groundwork/ganglia/backups
```

9. Go back to the standard installation process for the GWMEE upgrade, starting wih the "Upgrade of GWMEE Components" step. Run through that step, and stop before the "Final Steps" section. When editing the `httpd.conf` file to bring back any prior customized settings, it is not necessary to install the Ganglia-related changes, as they will be re-applied automatically in the following step, when you re-install the packages.

10. Most of the files from the Ganglia Integration Module that were previously installed are now lost, so you will need to re-install them. The `--force` option is necessary here because the system knows that these RPMs were previously installed, and it will ordinarily reject a request to install the same version of a package. As before, the `groundwork-ganglia-`*customername* and/or `groundwork-autoimport-`*customername* RPMs will only be installed at particular customer sites.

    ```
    rpm -Uvh --force groundwork-ganglia-integration-release-build.platform.rpm
    rpm -Uvh --force groundwork-ganglia-customername-release-build.platform.rpm
    rpm -Uvh --force groundwork-autoimport-release-build.platform.rpm
    rpm -Uvh --force groundwork-autoimport-customername-release-build.platform.rpm
    ```

11. Restore the configuration files you backed up above:

    ```
    cd /usr/local/groundwork/ganglia/backups
    cp -p GangliaConfigAdmin.conf /usr/local/groundwork/config
    cp -p GangliaWebServers.conf  /usr/local/groundwork/config
    cp -p autoimport.conf         /usr/local/groundwork/config
    cp -p check_ganglia.conf      /usr/local/groundwork/config
    ```

    If you have any customer-specific packages related to the Ganglia Integration Module installed, you will need to restore those configuration files as well. For example:

    ```
    cp -p Site_Code_Name.conf     /usr/local/groundwork/config
    ```

12. Edit the database-access credentials in the restored files to reflect the new PostgreSQL-based setup:

    ```
    cd /usr/local/groundwork/config
    vim GangliaConfigAdmin.conf
    vim autoimport.conf
    vim check_ganglia.conf
    ```

    At a minimum, you will need to change the `ganglia_dbtype` and `cacti_dbtype` values from `"mysql"` to `"postgresql"`, but you should check the other parameters as well. You should be using the ordinary `ganglia` user, not the administrative `postgres` user, to access the `ganglia` database. See the sample files in this document (Section 4.1.1, Check Ganglia Configuration, on page 27; Section 4.1.2, Ganglia Threshold Administration Configuration, on page 30; Section 4.3, Auto-Import Configuration, on page 41) for examples.

13. Make sure the Ganglia data feed is enabled on the new GroundWork Monitor system, by setting the `enable_processing` option in the `check_ganglia.conf` file to `yes` and killing the running `check_ganglia.pl` process so it will pick up the new configuration when it is automatically restarted.

14. Go back to the main install procedure for the GWMEE upgrade, and continue with the "Final Steps". Be sure to bounce the entire system as the first step, as described in those instructions. If you disabled notifications in Step 6a above, re-enable them before running the Commit operation listed in the "Final Steps".

15. This step applies to the Ganglia Integration Module 7.0.0 and later, and only if you have not previously used the Ganglia Integration Module with GWMEE 7.0.0 or later (so the necessary JBoss portal objects are not yet present in the system). Once you have reached the final GWMEE release you will be using and it is fully installed, take this step to add objects to the JBoss portal configuration so you can access the screens for the Ganglia Integration Module. You must run the following command while the GroundWork server is up and running. You will need the GroundWork user-interface root-account username and password. The script performs no validation of these credentials before attempting to use them, so you should do so yourself before running this command. You can do so by logging in to the GroundWork UI using those credentials.

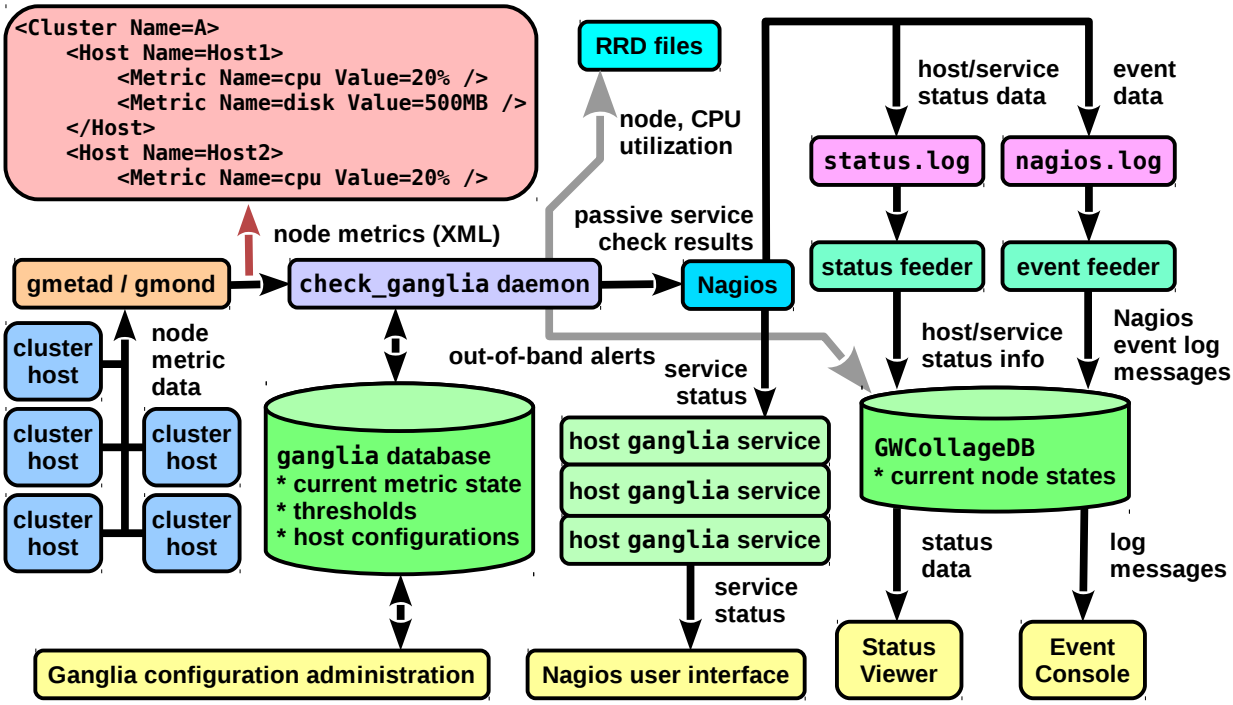
    ```
    /usr/local/groundwork/ganglia/scripts/add-ganglia-portal-objects rootuser rootpassword
    ```

3 Detailed Description

The operation of the Ganglia Integration Module is described in the following sections.

3.1 Check Ganglia and Nagios

The following diagram illustrates the system operation.



Ganglia data for an entire grid or cluster can be queried from the `gmond` or `gmetad` agents. The agents output their data in a standard XML stream format, documented in the Ganglia manuals. You can inspect this stream by entering the command "telnet <ganglia host> <port #>" where <ganglia host> is the host name or IP address of the host executing the Ganglia `gmond` or `gmetad` agent and <port #> is the TCP port where `gmond` or `gmetad` is configured to attach. Typically, this is 8649 for a host running `gmond` and 8651 for a host running `gmetad`.

The check_ganglia daemon reads this XML stream to find the metrics for each host. The XML stream describes the cluster-host-metric hierarchy. Be aware that the XML data envelopes do differ between the `gmond` and `gmetad` streams. The check_ganglia daemon is capable of interpreting both. In general, if you are running `gmetad`, you will use that XML data stream.

The check_ganglia daemon is implemented as the `check_ganglia.pl` script. This is not a Nagios plugin, despite its resident directory and the similar-looking filename. It is not launched as an active check by the Nagios scheduler. Instead, it runs under the `supervise` director program, which will restart programs under its control. The `supervise` program is itself run as part of the GroundWork Monitor `gwservices` component.

The check_ganglia daemon polls every 5 minutes by default, maintaining the current status states and metric values in memory. When it starts, `check_ganglia.pl` first reads the last state and metric values from the `ganglia` MySQL database. This initial read of the data allows the daemon to detect state transitions even on the first polling cycle. At the beginning of each polling cycle, the thresholds are read anew from the `ganglia` database, to pick up any recent changes. After each poll, the daemon compares the last values with the thresholds and sets the state of each metric to either OK, WARNING, or CRITICAL. It then sends these results to Nagios by writing to the Nagios command pipe, located in `/usr/local/groundwork/nagios/var/nagios.cmd`, or wherever the configuration file specifies. `check_ganglia.pl` then updates the `ganglia` database with the latest state and metric values.

The `check_ganglia.pl` script prints operational statistics in its log file at the end of each polling cycle. The log file can be most easily found through the `/usr/local/groundwork/logs/check_ganglia.log` symlink.

`check_ganglia.pl` provides for several types of alerting options — value duration, special metrics, and custom metrics.

- To ensure alerts are generated only for consistent problems rather than transient ones, a duration threshold can be specified for each metric. A metric must have exceeded its Warning or Critical threshold continuously (insofar as the periodic check_ganglia polling cycles can see) for more than the Duration threshold in order for that state to be set.

  For example, if a critical CPU threshold is set for 95% and the duration threshold is 1 hour, the first time the CPU measurement is greater than 95% will NOT set the state to CRITICAL. Each successive poll for the next 1 hour must show the CPU usage greater than 95% before it is set to CRITICAL. A metric is reset to an OK state when a single poll measurement is less than the configured state-recognition threshold.

- Derived metrics are those metrics that do not originate from Ganglia, but are calculated using multiple Ganglia metrics. This feature enables alert thresholds for certain types of conditions to be set more easily.

  An example of one such derived metric is `swap_free_percent`. An out-of-the-box Ganglia install gathers metrics for `swap_total` and `swap_free`, but not for `swap_free_percent`. It is not uncommon for clusters and compute grids to contain systems that have varying swap configurations. A derived metric like `swap_free_percent` could prove useful when applying universal thresholds to all machines or to subsets of machines on the grid. Clearly, setting thresholds on a per host basis using the standard Ganglia metrics is tedious in this case. The check_ganglia daemon makes this process considerably less painful by actually computing, storing, and alerting on these derived metrics.

  As currently written and included in this module, check_ganglia supports four derived metrics:

  - `mem_cached_percent`
  - `mem_free_percent`
  - `swap_free_percent`
  - `time_since_last_update`

  This set can be expanded further by the administrator, though all derived metrics must be directly coded into the `check_ganglia.pl` script. If you do decide to create more special metrics, please contribute your modifications back to GroundWork for folding into future releases.

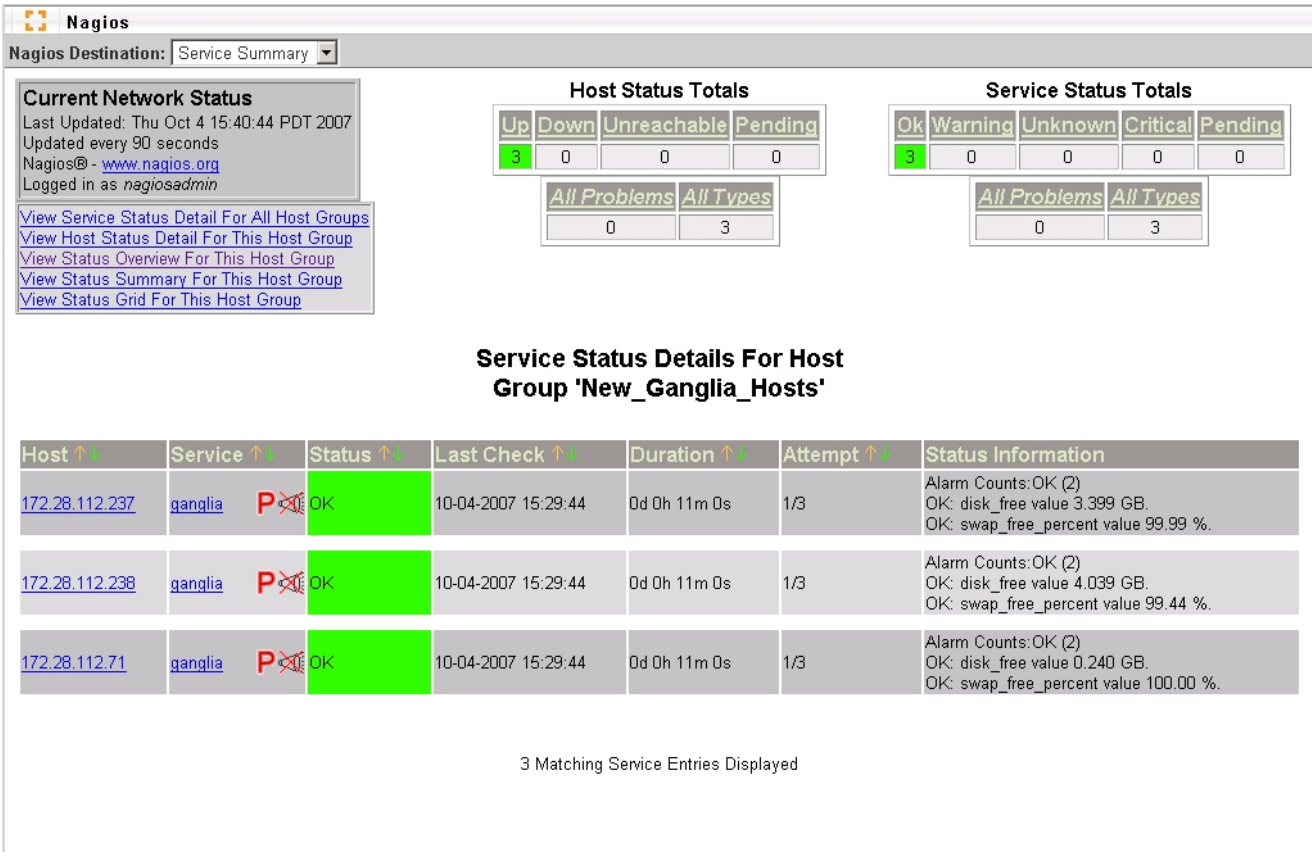
- Boottime metric. When check_ganglia notices that a monitored machine's Ganglia `boottime` metric has changed since the last time the machine's state was checked, a temporary WARNING service state will be generated starting with that polling cycle of that host. The duration of this pulsed state is configured at a global level to reflect site preferences. This state will appear in the Console messages so the operators are able to sense when machines get rebooted even if they are otherwise in an OK state when each state-data polling cycle occurs. The pulse duration allows such conditions to be noticed even when operators are distracted or out of the room for some period.

- Custom metrics. Some customers have specialized needs beyond those which can be handled by the metrics listed above. Certain internal interfaces have been designed to enable call-outs to a external Perl module which can contain arbitrary extensions. Typically, an external module like this is used to adapt to the peculiar environment at the customer site in a manner which is not appropriate for a general product to support. The APIs for these module calls are not currently documented.

Processing of derived, boottime, and custom metrics is controlled via options in the `check_ganglia.conf` configuration file rather than through the threshold-configuration GUI. See Section 4.1.1, Check Ganglia Configuration, on page 27 for details.

There are also several options for defining how Nagios integrates with check_ganglia. The Nagios system may be set up to have a single service that represents all Ganglia-related metrics for that host, or a separate service for each metric.[1] These options are described below.

The Nagios service detail screen for a single service, named, for example, "ganglia", would look like this:



In this case, if any metric comprising the "ganglia" service for a host goes into the WARNING or CRITICAL state, the service will go into that state. If there are multiple metrics in alert, the state of the service is set to the highest severity. The service text will show the metrics that are in the WARNING or CRITICAL state with the last measurements. The `consolidate_metrics_service_output_detail` option in the `check_ganglia.conf` configuration file controls the level of detail that is displayed in the service output text.

In the above example, a low level of detail is shown — if OK, no metric measurements are shown and if non-OK, only the non-OK metrics and measurements are shown. If the high detail setting is chosen, the state and last value for every metric is shown. A standard, non-GroundWork Nagios configuration will only show 64 characters on the service output text. On a GroundWork Monitor implementation of Nagios, this field has been expanded to 2048 characters to accommodate this option.

The second option is to define a separate service for each metric. In this case, each Ganglia metric is defined as a service under the host, for example, "ganglia_cpu_wio", "ganglia_cpu_sys", "ganglia_load_1", etc. The `check_ganglia.pl` script will send separate passive service results to Nagios for each metric in this case.

When choosing whether to consolidate, or to "roll" or "unroll" the Ganglia service checks in Nagios, note that there is a significant performance impact with unrolling the ganglia checks into multiple Nagios service checks. The next section details this further. Rolling all Ganglia checks into a single Nagios service check allows for simpler configuration and navigation, especially for large data centers. In contrast, using multiple service checks provides for greater granularity during alerting and reporting.

1 Because of the significant system loading it imposes, the separate-service model is not supported in the current release of the Ganglia Integration Module (GWMON-5461).

3.2 Performance Considerations

A number of factors influence the performance of the system. The primary driver is the number of Ganglia hosts that need to be monitored by the Nagios system. A corollary to this is the total number of services that the Nagios system needs to support. In testing various configurations, GroundWork has noticed the following potential bottlenecks in Nagios.

1. A large number of services will cause Nagios to take a long time to verify or commit. GroundWork has observed this when the number of services is greater than 20,000.[2]
2. The Nagios command pipe, `nagios.cmd`, can only read and buffer a limited number of passive service check results at one time. If the internal buffer becomes full and Nagios stops reading the pipe, check_ganglia will delay while writing to this pipe. This can be partially remedied by setting a non-default value for the "External command buffer slots" option in Page 2 of the "Configuration → Control → Nagios main configuration" settings. The default value built into Nagios is 4096; a value of 16000 is more suitable for a very large site.
3. Historically, there are other issues with the Nagios handling of a large volume of passive service checks that are outside the scope of this document; customers with a support contract can contact GroundWork for details and a workaround.
4. Nagios can only process a limited number of state changes at any one time. State transitions from OK to CRITICAL appear to be especially problematic. Nagios 3.x will not process any other host or service checks when it is verifying a host alert.[3] Depending on the host check command, the number of retries, and the retry interval, this can significantly delay Nagios updates when the number of down hosts is large.

Care must be taken so that passive check result messages do not overload the Nagios command pipe, causing a condition where the number of queued messages keeps increasing. In this case, Nagios may fall behind and never catch up. check_ganglia has several features that attempt to avoid this condition. The intent of these features is to minimize the number of service check results that are sent from check_ganglia to the Nagios command pipe for each poll, and to optimize the writing of results that do get sent to the command pipe.

1. Passive service checks can be sent on every poll or only when a state has changed. This behavior is controlled by a pair of options in the config file:

   ```
   send_updates_even_when_state_is_persistent
   suppress_most_updates_for_persistent_non_okay_states
   ```

   If the first of these options is disabled, either the state is OK or the second option is enabled, and the state has not changed, a passive service check will not be sent. The `maximum_service_non_update_time` parameter can be set so a service can be guaranteed an update within a defined time interval, even when the first and second options are set as described. This allows a periodic passive check to be submitted into Nagios even when the underlying state has not changed. Setting this latter option to less than the Nagios freshness check thresholds will ensure that results are submitted in time to avoid a false positive alarm, and still limit the latency to detect an error condition that prevents the host or service from sending data to Nagios.
2. As stated in the previous section, you can consolidate the metrics into a single service or have a separate service for each metric. Using multiple metrics increases the overall services count and has a tendency to add additional delay into the Nagios verify and startup operations. In addition, multiple metrics also cause more passive results to be written to the Nagios command pipe and thus cause more service state changes to be processed.
3. If the `send_after_each_service` option is set to "`yes`", the daemon will write the passive service check results after each service state is processed. If it is set to "`no`", it will write all service results at one time. We have found that the write time to the Nagios command pipe is minimized if this is set to "`no`".
4. A throttle parameter called `throttle_state_change_threshold` can be set to limit the number of state changes that are sent to Nagios at any one time. If this threshold is reached, check_ganglia will break the current batch of state change messages into smaller batches, insert each batch into the Nagios command pipe, wait the number of seconds specified in the `throttle_state_change_threshold_wait` parameter, and then transmit the next batch. This continues until all messages have been sent.

2 A variety of performance improvements in the GroundWork and Nagios processing of Commit operations have been made since this original observation. Testing with a current release of the product is in order.

3 That was true for Nagios 2. We need to verify the claim for Nagios 3 and Nagios 4.

5. The `send_to_foundation` option can be set to send the service check results directly to the Foundation database, avoiding Nagios altogether. Foundation can process state changes more quickly than Nagios, so this can be an option if the operator is using only the GroundWork-specific user interface components (Status Viewer and Event Console). Of course, this will render the Nagios web pages and notification engine unusable for Ganglia service checks, as they will be out of sync with the service checks data stream. Special setup for Nagios would be needed in this case so that Nagios would not feel starved for input on these services.

All of these options and several other operating parameters are documented in the `check_ganglia.conf` configuration file installed by the RPM. The initial settings in this file represent a good starting point and should be checked and adjusted as needed. Before you change values in this file, you may wish to first make a backup copy, to make it easy to refer to the original settings.

Another performance issue has to do with the content of the Ganglia XML streams. Compared to a Ganglia 3.0.4 stream, a Ganglia 3.1.2 (or later) stream may contain some additional data. The older stream would contain an element like this:

```
<METRIC NAME="proc_total" VAL="121" TYPE="uint32" UNITS="" TN="44" TMAX="950" DMAX="0" SLOPE="both"
SOURCE="gmond"/>
```

whereas the newer stream may contain additional related elements, substantially increasing the amount of text in the XML stream:

```
<METRIC NAME="proc_total" VAL="89" TYPE="uint32" UNITS=" " TN="188" TMAX="950" DMAX="0" SLOPE="both">
<EXTRA_DATA>
<EXTRA_ELEMENT NAME="GROUP" VAL="process"/>
<EXTRA_ELEMENT NAME="DESC" VAL="Total number of processes"/>
<EXTRA_ELEMENT NAME="TITLE" VAL="Total Processes"/>
</EXTRA_DATA>
</METRIC>
```

The new <EXTRA...> elements are not handled in any way by the present `check_ganglia.pl` script, other than to parse and then ignore them. We might consider using these elements in a future version of the script to automatically add information about new metrics to our `ganglia` database. But for the time being, and on an ongoing basis, their presence simply adds undesired overhead in data transmission and parsing. To disable the sending of these elements on a continual basis, the `allow_extra_data` attribute in the `globals` section of the `gmond.conf` file on each Ganglia server can be set to `false`.[4] That will significantly improve the efficiency of the overall processing. See also the `send_metadata_interval` attribute; it may be related to this issue.

Perhaps the ideal situation would be to have the receiving client specify the level of detail desired, rather than have that setting be permanently fixed on the Ganglia server. This could be done either by an initial two-way exchange of data between client and server, or by connecting to a particular dedicated port which has been configured to only send restricted content in the XML stream. If there is a need to occasionally access such data, one might consider contributing such a solution upstream to the Ganglia project.

Finally, as a note about the future evolution of this software, we might look closely at how the Ganglia XML stream is parsed within the `check_ganglia.pl` script. We have not looked at our implementation in a long time, but it may be worth delving into how the script parses the XML. If it tries to look at the entire document all at once, that could consume a lot of memory, slowing down the overall processing due to the expected effects of exceeding hardware cache sizes. It might be fruitful to see if some kind of incremental stream parsing could sidestep much of that memory overhead, and speed up processing. Comparative benchmarking would be needed to prove any guesses and suspicions in this area.

3.3 `ganglia` Database

The `ganglia` database contains the following tables:

- `cluster` – clusters monitored.
- `clusterhost` – relates clusters to hosts. Populated by configuration, and used for host thresholds.
- `host` – hosts monitored.
- `hostinstance` – relates hosts to clusters. Populated by check_ganglia. Has all the hosts Ganglia knows about.

4 On concern here is parochial. We have not evaluated the effect that such a configuration might have on the processing and information displayed in the Ganglia Web Server screens.

- `location` – locations reference. Used only in limited ways — reserved for future use.
- `metric` – holds abstract metric definitions and default thresholds, to be copied as initial values when these metrics are applied during configuration to specific clusters or hosts.
- `metricinstance` – last metric state and value reported by check_ganglia.
- `metricvalue` – stores the actual metric thresholds to be applied, whether they are at the global default level, the cluster level, or the host level.

The `metricvalue` table should have been named `metricthreshold`, to better reflect its actual content. This situation will be corrected in a future update to this package.

3.3.1 `ganglia` Database (PostgreSQL version)

Each table's field structure is described below, along with basic data about its indexes and foreign keys. Not shown here is detail about the associated sequence objects that implement auto-incrementing of the respective ID columns when new rows are added to these tables.

3.3.1.1 PostgreSQL `public.cluster` Table

```
+-------------+----------+-------------------------------------------------------------+
|   Column    |   Type   |                          Modifiers                          |
+-------------+----------+-------------------------------------------------------------+
| clusterid   | integer  | not null default nextval('cluster_clusterid_seq'::regclass) |
| name        | text     | not null                                                    |
| description | text     |                                                             |
| regex       | smallint |                                                             |
+-------------+----------+-------------------------------------------------------------+
Indexes:
    "cluster_pkey" PRIMARY KEY, btree (clusterid)
    "cluster_name_key" UNIQUE CONSTRAINT, btree (name)
Referenced by:
    TABLE "clusterhost" CONSTRAINT "clusterhost_clusterfk" FOREIGN KEY (clusterid) REFERENCES
cluster(clusterid) ON UPDATE RESTRICT ON DELETE RESTRICT
    TABLE "hostinstance" CONSTRAINT "hostinstance_clusterfk" FOREIGN KEY (clusterid) REFERENCES
cluster(clusterid) ON UPDATE RESTRICT ON DELETE RESTRICT
    TABLE "metricvalue" CONSTRAINT "metricvalue_clusterfk" FOREIGN KEY (clusterid) REFERENCES
cluster(clusterid) ON UPDATE RESTRICT ON DELETE RESTRICT
```

3.3.1.2 PostgreSQL `public.clusterhost` Table

```
+--------------+---------+-------------------------------------------------------------------+
|    Column    |  Type   |                             Modifiers                             |
+--------------+---------+-------------------------------------------------------------------+
| clusterhostid | integer | not null default nextval('clusterhost_clusterhostid_seq'::regclass) |
| clusterid    | integer | not null                                                          |
| hostid       | integer | not null                                                          |
+--------------+---------+-------------------------------------------------------------------+
Indexes:
    "clusterhost_pkey" PRIMARY KEY, btree (clusterhostid)
    "clusterhost_hostid_clusterid_key" UNIQUE CONSTRAINT, btree (hostid, clusterid)
    "clusterhost_clusterhost_clusterfk" btree (clusterid)
    "clusterhost_clusterhost_hostfk" btree (hostid)
Foreign-key constraints:
    "clusterhost_clusterfk" FOREIGN KEY (clusterid) REFERENCES cluster(clusterid) ON UPDATE RESTRICT
ON DELETE RESTRICT
    "clusterhost_hostfk" FOREIGN KEY (hostid) REFERENCES host(hostid) ON UPDATE RESTRICT ON DELETE
RESTRICT
```

3.3.1.3 PostgreSQL `public.host` Table

```
+-------------+-----------------------+-------------------------------------------------------+
|   Column    |         Type          |                       Modifiers                       |
+-------------+-----------------------+-------------------------------------------------------+
| hostid      | integer               | not null default nextval('host_hostid_seq'::regclass) |
| name        | text                  | not null                                              |
| ipaddress   | character varying(45) |                                                       |
| description | text                  |                                                       |
| regex       | smallint              |                                                       |
+-------------+-----------------------+-------------------------------------------------------+
```

```
Indexes:
    "host_pkey" PRIMARY KEY, btree (hostid)
    "host_name_key" UNIQUE CONSTRAINT, btree (name)
Referenced by:
    TABLE "clusterhost" CONSTRAINT "clusterhost_hostfk" FOREIGN KEY (hostid) REFERENCES host(hostid)
ON UPDATE RESTRICT ON DELETE RESTRICT
    TABLE "hostinstance" CONSTRAINT "hostinstance_hostfk" FOREIGN KEY (hostid) REFERENCES
host(hostid) ON UPDATE RESTRICT ON DELETE RESTRICT
    TABLE "metricvalue" CONSTRAINT "metricvalue_hostfk" FOREIGN KEY (hostid) REFERENCES host(hostid)
ON UPDATE RESTRICT ON DELETE RESTRICT
```

3.3.1.4 PostgreSQL `public.hostinstance` Table

```
+---------------+---------+-------------------------------------------------------------------+
|     Column    |  Type   |                             Modifiers                             |
+---------------+---------+-------------------------------------------------------------------+
| hostinstanceid | integer | not null default nextval('hostinstance_hostinstanceid_seq'::regclass) |
| clusterid      | integer | not null                                                          |
| hostid         | integer | not null                                                          |
| locationid     | integer | not null                                                          |
+---------------+---------+-------------------------------------------------------------------+
Indexes:
    "hostinstance_pkey" PRIMARY KEY, btree (hostinstanceid)
    "hostinstance_hostid_clusterid_key" UNIQUE CONSTRAINT, btree (hostid, clusterid)
    "hostinstance_hostinstance_clusterfk" btree (clusterid)
    "hostinstance_hostinstance_hostfk" btree (hostid)
    "hostinstance_hostinstance_locationfk" btree (locationid)
Foreign-key constraints:
    "hostinstance_clusterfk" FOREIGN KEY (clusterid) REFERENCES cluster(clusterid) ON UPDATE RESTRICT
ON DELETE RESTRICT
    "hostinstance_hostfk" FOREIGN KEY (hostid) REFERENCES host(hostid) ON UPDATE RESTRICT ON DELETE
RESTRICT
    "hostinstance_locationfk" FOREIGN KEY (locationid) REFERENCES location(locationid) ON UPDATE
RESTRICT ON DELETE RESTRICT
Referenced by:
    TABLE "metricinstance" CONSTRAINT "metricinstance_hostinstancefk" FOREIGN KEY (hostinstanceid)
REFERENCES hostinstance(hostinstanceid) ON UPDATE RESTRICT ON DELETE RESTRICT
```

3.3.1.5 PostgreSQL `public.location` Table

```
+-------------+----------+-------------------------------------------------------------+
|   Column    |   Type   |                          Modifiers                          |
+-------------+----------+-------------------------------------------------------------+
| locationid  | integer  | not null default nextval('location_locationid_seq'::regclass) |
| name        | text     | not null                                                    |
| description | text     |                                                             |
| regex       | smallint |                                                             |
+-------------+----------+-------------------------------------------------------------+
Indexes:
    "location_pkey" PRIMARY KEY, btree (locationid)
    "location_name_key" UNIQUE CONSTRAINT, btree (name)
Referenced by:
    TABLE "hostinstance" CONSTRAINT "hostinstance_locationfk" FOREIGN KEY (locationid) REFERENCES
location(locationid) ON UPDATE RESTRICT ON DELETE RESTRICT
    TABLE "metricvalue" CONSTRAINT "metricvalue_locationfk" FOREIGN KEY (locationid) REFERENCES
location(locationid) ON UPDATE RESTRICT ON DELETE RESTRICT
```

3.3.1.6 PostgreSQL `public.metric` Table

```
+-------------+----------------------+-----------------------------------------------------+
|   Column    |         Type         |                      Modifiers                      |
+-------------+----------------------+-----------------------------------------------------+
| metricid    | integer              | not null default nextval('metric_metricid_seq'::regclass) |
| name        | text                 | not null                                            |
| description | text                 |                                                     |
| units       | character varying(45) |                                                     |
| critical    | numeric(64,10)       |                                                     |
| warning     | numeric(64,10)       |                                                     |
| duration    | numeric(64,10)       |                                                     |
+-------------+----------------------+-----------------------------------------------------+
```

```
Indexes:
    "metric_pkey" PRIMARY KEY, btree (metricid)
    "metric_name_key" UNIQUE CONSTRAINT, btree (name)
Referenced by:
    TABLE "metricinstance" CONSTRAINT "metricinstance_metricfk" FOREIGN KEY (metricid) REFERENCES
metric(metricid) ON UPDATE RESTRICT ON DELETE RESTRICT
    TABLE "metricvalue" CONSTRAINT "metricvalue_metricfk" FOREIGN KEY (metricid) REFERENCES
metric(metricid) ON UPDATE RESTRICT ON DELETE RESTRICT
```

3.3.1.7 PostgreSQL `public.metricinstance` Table

```
+--------------------+---------+-------------------------------------------------------------------+
|       Column       |  Type   |                             Modifiers                             |
+--------------------+---------+-------------------------------------------------------------------+
| metricinstanceid   | integer | not null default nextval('metricinstance_metricinstanceid_seq'::regclass) |
| hostinstanceid     | integer | not null                                                          |
| metricid           | integer | not null                                                          |
| description        | text    |                                                                   |
| laststate          | text    |                                                                   |
| lastupdatetime     | integer | not null                                                          |
| laststatechangetime | integer | not null                                                          |
| lastvalue          | text    |                                                                   |
+--------------------+---------+-------------------------------------------------------------------+
Indexes:
    "metricinstance_pkey" PRIMARY KEY, btree (metricinstanceid)
    "metricinstance_hostinstanceid_metricid_key" UNIQUE CONSTRAINT, btree (hostinstanceid, metricid)
    "metricinstance_metricinstance_hostinstancefk" btree (hostinstanceid)
    "metricinstance_metricinstance_metricfk" btree (metricid)
Foreign-key constraints:
    "metricinstance_hostinstancefk" FOREIGN KEY (hostinstanceid) REFERENCES hostinstance(hostinstanceid) ON UPDATE
RESTRICT ON DELETE RESTRICT
    "metricinstance_metricfk" FOREIGN KEY (metricid) REFERENCES metric(metricid) ON UPDATE RESTRICT ON DELETE RESTRICT
```

3.3.1.8 PostgreSQL `public.metricvalue` Table

```
+--------------+---------------+-------------------------------------------------------------------+
|    Column    |      Type     |                             Modifiers                             |
+--------------+---------------+-------------------------------------------------------------------+
| metricvalueid | integer       | not null default nextval('metricvalue_metricvalueid_seq'::regclass) |
| clusterid    | integer       | not null                                                          |
| hostid       | integer       | not null                                                          |
| locationid   | integer       | not null                                                          |
| metricid     | integer       | not null                                                          |
| description  | text          |                                                                   |
| critical     | numeric(64,10) |                                                                   |
| warning      | numeric(64,10) |                                                                   |
| duration     | numeric(64,10) |                                                                   |
+--------------+---------------+-------------------------------------------------------------------+
Indexes:
    "metricvalue_pkey" PRIMARY KEY, btree (metricvalueid)
    "metricvalue_hostid_clusterid_metricid_key" UNIQUE CONSTRAINT, btree (hostid, clusterid, metricid)
    "metricvalue_metricvalue_clusterfk" btree (clusterid)
    "metricvalue_metricvalue_hostfk" btree (hostid)
    "metricvalue_metricvalue_locationfk" btree (locationid)
    "metricvalue_metricvalue_metricfk" btree (metricid)
Foreign-key constraints:
    "metricvalue_clusterfk" FOREIGN KEY (clusterid) REFERENCES cluster(clusterid) ON UPDATE RESTRICT ON DELETE RESTRICT
    "metricvalue_hostfk" FOREIGN KEY (hostid) REFERENCES host(hostid) ON UPDATE RESTRICT ON DELETE RESTRICT
    "metricvalue_locationfk" FOREIGN KEY (locationid) REFERENCES location(locationid) ON UPDATE RESTRICT ON DELETE
RESTRICT
    "metricvalue_metricfk" FOREIGN KEY (metricid) REFERENCES metric(metricid) ON UPDATE RESTRICT ON DELETE RESTRICT
```

3.3.2 `ganglia` Database (MySQL version)

Each table's field structure is described below, along with basic data about its indexes.

3.3.2.1 MySQL `cluster` Table

```
+-------------+------------------+------+-----+---------+----------------+
| Field       | Type             | Null | Key | Default | Extra          |
+-------------+------------------+------+-----+---------+----------------+
| ClusterID   | int(11) unsigned | NO   | PRI | NULL    | auto_increment |
| Name        | text             | NO   |     |         |                |
| Description | text             | YES  |     | NULL    |                |
| Regex       | tinyint(1)       | YES  |     | NULL    |                |
+-------------+------------------+------+-----+---------+----------------+
```

```
+---------+------------+----------+--------------+-------------+-----------+
| Table   | Non_unique | Key_name | Seq_in_index | Column_name | Collation |
+---------+------------+----------+--------------+-------------+-----------+
| cluster |          0 | PRIMARY  |            1 | ClusterID   | A         |
+---------+------------+----------+--------------+-------------+-----------+
```

3.3.2.2 MySQL `clusterhost` Table

```
+---------------+------------------+------+-----+---------+----------------+
| Field         | Type             | Null | Key | Default | Extra          |
+---------------+------------------+------+-----+---------+----------------+
| ClusterHostID | int(11) unsigned | NO   | PRI | NULL    | auto_increment |
| ClusterID     | int(11) unsigned | NO   | MUL |         |                |
| HostID        | int(11) unsigned | NO   | MUL |         |                |
+---------------+------------------+------+-----+---------+----------------+

+-------------+------------+-----------------------+--------------+---------------+-----------+
| Table       | Non_unique | Key_name              | Seq_in_index | Column_name   | Collation |
+-------------+------------+-----------------------+--------------+---------------+-----------+
| clusterhost |          0 | PRIMARY               |            1 | ClusterHostID | A         |
| clusterhost |          1 | ClusterHost_ClusterFK |            1 | ClusterID     | A         |
| clusterhost |          1 | ClusterHost_HostFK    |            1 | HostID        | A         |
+-------------+------------+-----------------------+--------------+---------------+-----------+
```

3.3.2.3 MySQL `host` Table

```
+-------------+------------------+------+-----+---------+----------------+
| Field       | Type             | Null | Key | Default | Extra          |
+-------------+------------------+------+-----+---------+----------------+
| HostID      | int(11) unsigned | NO   | PRI | NULL    | auto_increment |
| Name        | text             | NO   |     |         |                |
| IPAddress   | varchar(45)      | YES  |     | NULL    |                |
| Description | text             | YES  |     | NULL    |                |
| Regex       | tinyint(1)       | YES  |     | NULL    |                |
+-------------+------------------+------+-----+---------+----------------+

+-------+------------+----------+--------------+-------------+-----------+
| Table | Non_unique | Key_name | Seq_in_index | Column_name | Collation |
+-------+------------+----------+--------------+-------------+-----------+
| host  |          0 | PRIMARY  |            1 | HostID      | A         |
+-------+------------+----------+--------------+-------------+-----------+
```

3.3.2.4 MySQL `hostinstance` Table

```
+----------------+------------------+------+-----+---------+----------------+
| Field          | Type             | Null | Key | Default | Extra          |
+----------------+------------------+------+-----+---------+----------------+
| HostInstanceID | int(11) unsigned | NO   | PRI | NULL    | auto_increment |
| ClusterID      | int(11) unsigned | NO   | MUL |         |                |
| HostID         | int(11) unsigned | NO   | MUL |         |                |
| LocationID     | int(11) unsigned | NO   | MUL |         |                |
+----------------+------------------+------+-----+---------+----------------+

+--------------+------------+-------------------------+--------------+----------------+-----------+
| Table        | Non_unique | Key_name                | Seq_in_index | Column_name    | Collation |
+--------------+------------+-------------------------+--------------+----------------+-----------+
| hostinstance |          0 | PRIMARY                 |            1 | HostInstanceID | A         |
| hostinstance |          1 | HostInstance_ClusterFK  |            1 | ClusterID      | A         |
| hostinstance |          1 | HostInstance_HostFK     |            1 | HostID         | A         |
| hostinstance |          1 | HostInstance_LocationFK |            1 | LocationID     | A         |
+--------------+------------+-------------------------+--------------+----------------+-----------+
```

3.3.2.5 MySQL `location` Table

```
+-------------+------------------+------+-----+---------+----------------+
| Field       | Type             | Null | Key | Default | Extra          |
+-------------+------------------+------+-----+---------+----------------+
| LocationID  | int(11) unsigned | NO   | PRI | NULL    | auto_increment |
| Name        | text             | NO   |     |         |                |
| Description | text             | YES  |     | NULL    |                |
| Regex       | tinyint(1)       | YES  |     | NULL    |                |
+-------------+------------------+------+-----+---------+----------------+
```

```
+----------+------------+----------+--------------+-------------+-----------+
| Table    | Non_unique | Key_name | Seq_in_index | Column_name | Collation |
+----------+------------+----------+--------------+-------------+-----------+
| location |          0 | PRIMARY  |            1 | LocationID  | A         |
+----------+------------+----------+--------------+-------------+-----------+
```

3.3.2.6 MySQL `metric` Table

```
+-------------+------------------+------+-----+---------+----------------+
| Field       | Type             | Null | Key | Default | Extra          |
+-------------+------------------+------+-----+---------+----------------+
| MetricID    | int(11) unsigned | NO   | PRI | NULL    | auto_increment |
| Name        | text             | NO   |     |         |                |
| Description | text             | YES  |     | NULL    |                |
| Units       | varchar(45)      | YES  |     | NULL    |                |
| Critical    | decimal(64,10)   | YES  |     | NULL    |                |
| Warning     | decimal(64,10)   | YES  |     | NULL    |                |
| Duration    | decimal(64,10)   | YES  |     | NULL    |                |
+-------------+------------------+------+-----+---------+----------------+

+--------+------------+----------+--------------+-------------+-----------+
| Table  | Non_unique | Key_name | Seq_in_index | Column_name | Collation |
+--------+------------+----------+--------------+-------------+-----------+
| metric |          0 | PRIMARY  |            1 | MetricID    | A         |
+--------+------------+----------+--------------+-------------+-----------+
```

3.3.2.7 MySQL `metricinstance` Table

```
+--------------------+------------------+------+-----+---------+----------------+
| Field              | Type             | Null | Key | Default | Extra          |
+--------------------+------------------+------+-----+---------+----------------+
| MetricInstanceID   | int(11) unsigned | NO   | PRI | NULL    | auto_increment |
| HostInstanceID     | int(11) unsigned | NO   | MUL |         |                |
| MetricID           | int(11) unsigned | NO   | MUL |         |                |
| Description        | text             | YES  |     | NULL    |                |
| LastState          | text             | YES  |     | NULL    |                |
| LastUpdateTime     | int(11) unsigned | NO   |     |         |                |
| LastStateChangeTime| int(11) unsigned | NO   |     |         |                |
| LastValue          | text             | YES  |     | NULL    |                |
+--------------------+------------------+------+-----+---------+----------------+

+---------------+------------+-----------------------------+--------------+-----------------+-----------+
| Table         | Non_unique | Key_name                    | Seq_in_index | Column_name     | Collation |
+---------------+------------+-----------------------------+--------------+-----------------+-----------+
| metricinstance |          0 | PRIMARY                     |            1 | MetricInstanceID | A         |
| metricinstance |          1 | MetricInstance_HostInstanceFK |            1 | HostInstanceID   | A         |
| metricinstance |          1 | MetricInstance_MetricFK     |            1 | MetricID         | A         |
+---------------+------------+-----------------------------+--------------+-----------------+-----------+
```

3.3.2.8 MySQL `metricvalue` Table

```
+---------------+------------------+------+-----+---------+----------------+
| Field         | Type             | Null | Key | Default | Extra          |
+---------------+------------------+------+-----+---------+----------------+
| MetricValueID | int(11) unsigned | NO   | PRI | NULL    | auto_increment |
| ClusterID     | int(11) unsigned | NO   | MUL |         |                |
| HostID        | int(11) unsigned | NO   | MUL |         |                |
| LocationID    | int(11) unsigned | NO   | MUL |         |                |
| MetricID      | int(11) unsigned | NO   | MUL |         |                |
| Description   | text             | YES  |     | NULL    |                |
| Critical      | decimal(64,10)   | YES  |     | NULL    |                |
| Warning       | decimal(64,10)   | YES  |     | NULL    |                |
| Duration      | decimal(64,10)   | YES  |     | NULL    |                |
+---------------+------------------+------+-----+---------+----------------+
```

```
+-------------+------------+-----------------------+--------------+---------------+-----------+
| Table       | Non_unique | Key_name              | Seq_in_index | Column_name   | Collation |
+-------------+------------+-----------------------+--------------+---------------+-----------+
| metricvalue |          0 | PRIMARY               |            1 | MetricValueID | A         |
| metricvalue |          1 | MetricValue_ClusterFK |            1 | ClusterID     | A         |
| metricvalue |          1 | MetricValue_HostFK    |            1 | HostID        | A         |
| metricvalue |          1 | MetricValue_LocationFK|            1 | LocationID    | A         |
| metricvalue |          1 | MetricValue_MetricFK  |            1 | MetricID      | A         |
+-------------+------------+-----------------------+--------------+---------------+-----------+
```

3.4 Ganglia Web Interface

The Ganglia web interface consists of two parts.

3.4.1 Threshold Configuration

Configuration of thresholds within the `ganglia` database is controlled by the `GangliaConfigAdmin.cgi` CGI Perl script. Settings for this script are defined in the `GangliaConfigAdmin.conf` file (see Section 4.1.2, Ganglia Threshold Administration Configuration, on page 30). The following functions are available in this interface.

- Define the Ganglia metrics to be monitored, by adding the metric names to the database. Each configured name must exactly match the corresponding Ganglia metric name.
- Define the clusters to be monitored, by adding the cluster names to the database. This setup should match the set of `ganglia_cluster` definitions you specify separately in the `check_ganglia.conf` file.
- Define hosts to be monitored. Hosts are automatically added to the `ganglia` database by check_ganglia. This allows you to modify a host's settings by selecting from a list of existing hosts. check_ganglia will also put the host's configuration information in the host description field.
- Define the Warning, Critical, and Duration thresholds for each metric.
  - You *must* define metric thresholds for the "Default" cluster. These are global, default settings which will apply if there are no other settings defined at the cluster or host level.
  - You *may* define metric thresholds for a specific cluster. These settings will override the default cluster settings. These settings are overridden by host metric thresholds, if they exist.
  - You *may* define metric thresholds for a specific host. These settings will override the default or specific cluster settings.
  - Be sure to specify threshold values that make sense for the metric. In some cases, you may want the metric value to normally be above a certain level, and to alert you when it falls below the thresholds you specify. In this case, simply set the Warning threshold higher than the Critical threshold, and this setup will properly analyze the state.
- You may also delete clusters, hosts, or metrics from the `ganglia` database.[5] Note that this will not affect Monarch or Nagios, until and unless `autoimport.pl` is run.

3.4.2 Access to Ganglia Web Servers

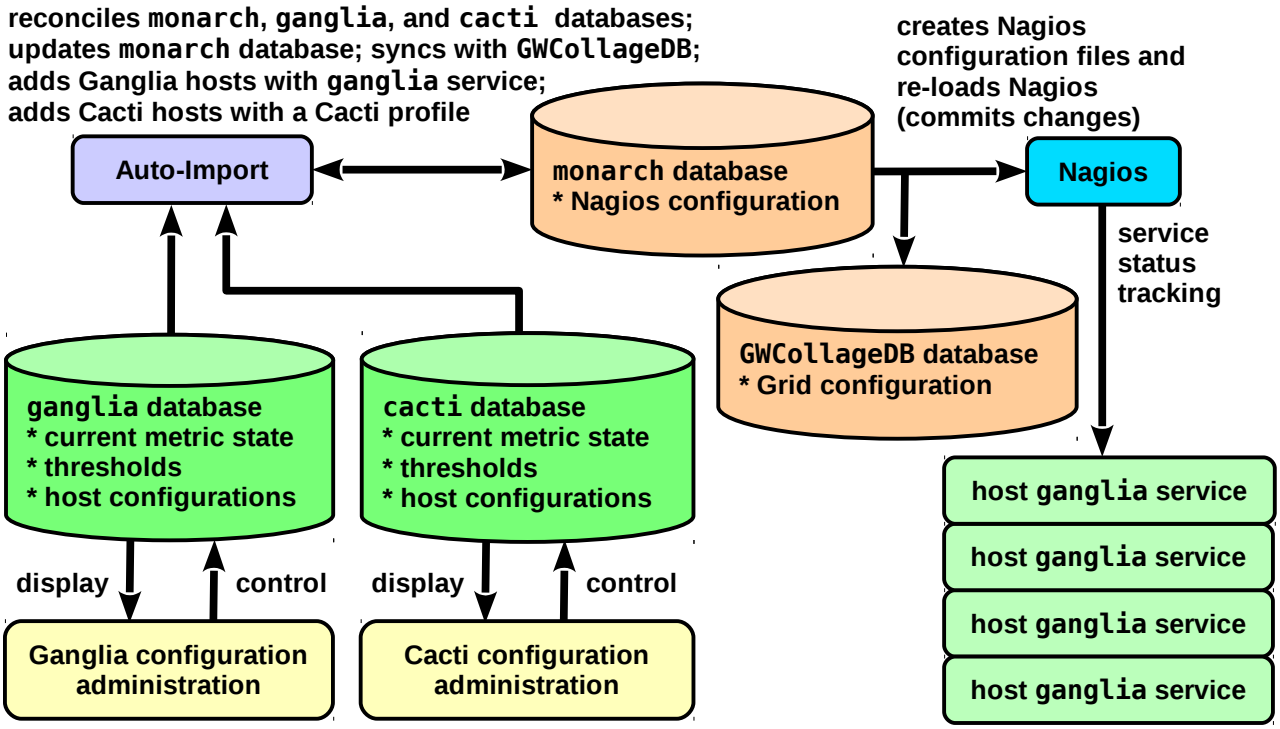
The Ganglia Integration Module provides a simple way to access the web interface provided by Ganglia itself, without exiting the GroundWork Monitor environment. The Advanced → Ganglia Web Servers menu item presents a list of Ganglia web servers, whose hostnames (or alternative descriptive labels) and access URLs are configured in the `GangliaWebServers.conf` file (see Section 4.1.3, Ganglia Web Server Viewing Configuration, on page 31). The `GangliaWebServers.cgi` script uses this configuration data to present a screen with links to the Ganglia servers; web pages from those servers are presented in a frame beneath these links.

5 Inasmuch as hosts known to Ganglia will be automatically added back to the `ganglia` database when check_ganglia runs, it only makes sense to delete hosts after you have either removed them from service or when you stop monitoring the cluster in which they reside. Note that other Ganglia nodes in the cluster will hang on to knowledge about a host for some time after it has gone missing (see, for example, the `host_dmax` and `cleanup_threshold` parameters in `gmond.conf` files).

3.5 Auto-Import

The majority of Ganglia implementations are large. One of the big advantages of Ganglia is its ability to monitor a large infrastructure. Integrating it with Nagios has therefore traditionally been difficult, because of the extremely tedious process of creating all those host and service definitions. One of the great things about GroundWork Monitor, though, is that we can import host definitions and automatically assign service profiles. The auto-import script does that, both for Ganglia and for Cacti, though of course here we are dealing only with Ganglia. You can run the auto-import script as a regularly scheduled (cron) job on the GroundWork server, or as needed, manually.

The auto-import process is shown in the following diagram.



The auto-import script optionally reads the `ganglia` database to find the current hosts that are in the Ganglia XML stream, and optionally reads the `cacti` database to find the current hosts known to Cacti. It also queries the `monarch` database to determine the hosts currently defined in the Nagios system. For hosts in Ganglia but not in Nagios, the script will add the new host to Monarch using the hostname and IP address determined from the Ganglia XML, and matching that stored in the `ganglia` database. A default host profile must be specified in the `autoimport.conf` configuration file. This host profile, which defines the services to be applied to a host, is then applied to each imported host. This host profile must be pre-defined in Monarch. You can easily create this profile via the Monarch GUI. Note that the default host profile must have a one-to-one correspondence with the type of service checks set in the check_ganglia configuration — a single service check for all Ganglia metrics, or a separate service check definition for each metric. The auto-import script will also optionally assign the host to a default "New_Ganglia_Hosts" hostgroup.[6] This host group must also be pre-defined.

If a host known to Ganglia is to be deleted from Nagios with Monarch, it must also be deleted from the `ganglia` database using the Ganglia Threshold Configuration web interface. If not, the host will be added back to Monarch the next time auto-import executes.

If a host is in Monarch, but is no longer in the Ganglia database, the host is optionally assigned by auto-import to a "deleted hosts" host group.[7] Collecting all such hosts together in one place this way allows you to manually delete hosts more easily by reviewing the hosts in this host group.

6 The name of this hostgroup is configurable in the `autoimport.conf` file.

7 The standard name of this hostgroup is `_DELETED_HOSTS`. It is likewise configurable, and whatever the choice of name, this hostgroup must also be pre-defined in Monarch.

Certain special features are configurable in the `autoimport.conf` file (see Section 4.3, Auto-Import Configuration, on page 41). These include:

- Assignment of hosts to custom non-default hostgroups, with the assigned hostgroup for each host derived from the host name (and possibly external data, not part of auto-import itself).
- Application of non-default host profiles named after the Ganglia clusters in which the hosts reside, instead of using a single default host profile for all hosts. (This can simplify administration, for instance, if cluster boundaries correspond to functional or machine-type groupings.)
- Selection of whether Ganglia hosts or Cacti hosts (or both) are to be auto-imported. A site would choose to ignore importing from Cacti, for instance, if no Cacti monitoring were configured.

4 Administration

The administration tasks for the Ganglia Integration Module are described in this section.

4.1 Ganglia-Related Configuration

4.1.1 Check Ganglia Configuration

The following parameters control the options in the `check_ganglia.pl` script (see Section 3.1, Check Ganglia and Nagios, on page 14). These are found in the `check_ganglia.conf` file, and represent a common starting point. To configure the `check_ganglia.pl` script, simply edit this file in `/usr/local/groundwork/config/`, and restart `gwservices`.

```
# Configuration file for the check_ganglia.pl script.

#########################################################
#
#   General Program Execution Options
#
#########################################################

# Process Ganglia XML streams?  If not, just sleep forever.
# This option is turned off (the value "no", but without quotes) in the default
# configuration file simply so the script can be safely installed before it is
# locally configured.  To get the software to run, it must be turned on here
# (the value "yes", but without quotes) once the rest of the setup is correct
# for your site.
enable_processing = no

# Auto-flush the logging output.
#  no = normal processing, for efficiency
# yes = autoflush the log output on every single write, for debugging mysterious failures
autoflush_log_output = no

# Global Debug Level Flag;  No debug = 0, Statistics = 5, Normal debug = 6,
#                           Detail debug = 7 (gmond XML and metric attribute parsing)
# More precisely, specify one of the following numbers:
# NONE    = 0; turn off all debug info
# FATAL   = 1; the application is about to die
# ERROR   = 2; the application has found a serious problem, but will attempt to recover
# WARNING = 3; the application has found an anomaly, but will try to handle it
# NOTICE  = 4; the application wants to inform you of a significant event
# STATS   = 5; the application wants to log statistical data for later analysis
# INFO    = 6; the application wants to log a potentially interesting event
# DEBUG   = 7; the application wants to log detailed debugging data
debug_level = 5

# Send to Nagios?
# [yes/no]
send_to_nagios = yes

# Send updates to the database and Nagios even when the state does not change?
# (If not, update in any case on the next iteration after maximum_service_non_update_time.)
# [yes/no]
send_updates_even_when_state_is_persistent = no

# Avoid sending updates to the database and Nagios when the state is not changing?
# (Even if so, send them in any case on the next iteration after maximum_service_non_update_time.)
# [yes/no]
suppress_most_updates_for_persistent_non_okay_states = yes

# Absolute pathname of the Nagios command pipe.
nagios_cmd_pipe = "/usr/local/groundwork/nagios/var/spool/nagios.cmd"

# Consolidate metric results?
#  no = send individual metric results
# yes = send all metric results as a single service
consolidate_metrics = yes
```

```
# Service name used for consolidated metrics.
consolidate_metrics_service_name = "ganglia"

# Detail for metric service output.
# [yes/no]; yes = show more detail, no = low detail
consolidate_metrics_service_output_detail = yes

# How to group writes of service results to Nagios.
#  no = send all results in a single write
# yes = send to Nagios after each service result
send_after_each_service = no

# How to select the part of a hostname to report out, if the host is not an IP address.
# This pattern must include exactly one part enclosed in parentheses.
# If you don't want any hostname stripping, set this pattern to "".
# For example, to strip the full domain, and only use an unqualified name, use:
# short_hostname_pattern = "(\S+?)\."
short_hostname_pattern = ""

# What external package to call to process custom metrics.
# Set to an empty string if you have no such external package.
# If you don't know what these are, set this to "".
custom_metrics_package = ""

# Output a warning if the host has rebooted since the last reporting cycle?
output_reboot_warning = yes

# Set to the number of seconds to continue to report a reboot warning, if $output_reboot_warning is
set.
# Anything shorter than the value for cycle_time (below) is effectively equal to zero.
# Simple arithmetic (e.g., 5*60) is allowed in this expression.
output_reboot_warning_duration = 10*60

# Output the mem_free_percent calculated metric?
output_mem_free_percent = no

# Output the mem_cached_percent calculated metric?
output_mem_cached_percent = no

# Output the swap_free_percent calculated metric?
output_swap_free_percent = yes

# Output the time since Ganglia received an update for each host?
output_time_since_last_update = yes

#########################################################
#
#   Performance Throttling Parameters
#
#########################################################

# Time interval for each ganglia poll, in seconds.
# Standard period is 5 minutes.
# Simple arithmetic (e.g., 5*60) is allowed in this expression.
cycle_time = 5*60

# Maximum time interval in seconds between service checks sent to Nagios.
# That is, we will always send a service check result to Nagios on the next
# iteration after this time period has elapsed.
# Simple arithmetic (e.g., 15*60) is allowed in this expression.
maximum_service_non_update_time = 10*60

# Maximum number of state changes that will be sent for each write to Nagios.
# If the number of outstanding state changes is greater than this, check_ganglia
# will wait for throttle_state_change_threshold_wait seconds before sending the
# remaining messages.
throttle_state_change_threshold = 500
```

```
# When throttle_state_change_threshold is exceeded, time in seconds to wait
# before sending the remaining state change message buffer.
# Simple arithmetic (e.g., 2*60) is allowed in this expression.
throttle_state_change_threshold_wait = 6

# The number of slots to pre-allocate for queueing Nagios service messages
# before they are sent to the command pipe.  This number should be a little
# more than the total number of hosts in your grid.
initial_bulk_messages_size = 15000

# The number of slots to pre-allocate for queueing metric-instance update rows before
# they are sent to the database.  This number should be a little more than the total
# number of metrics you expect to process in each cycle.  Bear in mind that you will
# typically have configured at least several metrics to be thresholded per host.
initial_metric_values_size = 100000

# The maximum number of metric value rows you want to have updated in one database
# statement.  For efficient updates, it should be at least several thousand.
max_bulk_update_rows = 5000

# The maximum time in seconds to wait for any single write to the output command pipe
# to complete.
max_command_pipe_wait_time = 3*60

# The maximum size in bytes for any single write operation to the output command pipe.
# The value chosen here must be no larger than PIPE_BUF (getconf -a | fgrep PIPE_BUF)
# on your platform, unless you have an absolute guarantee that no other process will
# ever write to the command pipe.
max_command_pipe_write_size = 4096

# Send a check_ganglia service check result at the end of each polling cycle?
# [yes/no]
send_check_ganglia_service_check = yes

#########################################################
#
#   Ganglia Parameters
#
#########################################################

# Where to talk to the Ganglia gmond to fetch node-state data.
# Default gmond port is 8649.
GANGLIA_GMOND_PORT = 8649

# Where to talk to the Ganglia gmetad to fetch node-state data.
# Default gmetad port is 8651.
GANGLIA_GMETAD_PORT = 8651

# List of Ganglia gmond or gmetad hosts to query.
# For convenience, to disable a given entry you need only comment out
# its port definition, not the entire <host ...></host> block.
# You may also refer to symbols defined above, like $GANGLIA_GMOND_PORT,
# to document your choices.
<ganglia_hosts>

    <host localhost>
        port = $GANGLIA_GMOND_PORT
    </host>
    <host mygmetadhost>
        # port = $GANGLIA_GMETAD_PORT
    </host>
    <host 192.168.1.99>
        # port = 8648
    </host>

</ganglia_hosts>
```

```
# Clusters to monitor.
# Define as many as you need, on separate lines; enclose each value in "double quotes".
# If you define some ganglia_cluster values here, only the clusters listed will be monitored.
# If you don't define any ganglia_cluster values, then all clusters will be monitored.
# Examples:
# ganglia_cluster = "GroundWork Cluster 002"
# ganglia_cluster = "GroundWork Compute Farm"
ganglia_cluster = "GroundWork Cluster 001"

# Ganglia thresholds database connection parameters.
# ganglia_dbtype can be either "mysql" or "postgresql".
ganglia_dbtype = "postgresql"
ganglia_dbhost = "localhost"
ganglia_dbname = "ganglia"
ganglia_dbuser = "ganglia"
ganglia_dbpass = "gwrk"

#########################################################
#
#   Foundation Options (used if send_to_foundation=yes)
#
#########################################################

# Send host/service status updates to Foundation?
# [yes/no]
send_to_foundation = no

# This monitoring server name; used as update content (message source).
this_server = "localhost"

# Where to connect to Foundation to send the updates.
# Usual foundation_port is 4913.
foundation_host = "localhost"
foundation_port = 4913
```

4.1.2 Ganglia Threshold Administration Configuration

The following parameters control the options in the `GangliaConfigAdmin.cgi` script (see Section 3.4.1, Threshold Configuration, on page 24). These are found in the `GangliaConfigAdmin.conf` file. You will need to adjust the database-access parameters in this file to match your local site. To configure this user interface, simply edit this file in `/usr/local/groundwork/config/`.

```
# Configuration file for the GangliaConfigAdmin.cgi script.

#########################################################
#
#   General Program Execution Options
#
#########################################################

# Global Debug Level Flag.
# 0 = no debug output
# 1 = Normal debug output
debug_level = 0

# The max number of hosts to process in one DELETE statement.  (This just puts a limit on
# a single statement; repeated statements will still be used to process longer lists.)
max_delete_hosts = 1000

# Ganglia thresholds database connection parameters.
# ganglia_dbtype can be either "mysql" or "postgresql".
ganglia_dbtype = "postgresql"
ganglia_dbhost = "localhost"
ganglia_dbname = "ganglia"
ganglia_dbuser = "ganglia"
ganglia_dbpass = "gwrk"
```

4.1.3 Ganglia Web Server Viewing Configuration

The following parameters control the options in the `GangliaWebServers.cgi` script (see Section 3.4.2, Access to Ganglia Web Servers, on page 24). These are found in the `GangliaWebServers.conf` file. You will need to adjust the set of Ganglia web server hosts and their respective URLs to specify the ones you want to make available through the GroundWork Monitor UI. To configure this user interface, simply edit this file in `/usr/local/groundwork/config/`.

Most likely, you will want to choose one entry as the default Ganglia Web Server, so it shows up automatically when this screen is first displayed. Use the `default` specification for that, as described in the configuration file comments.

```
# Configuration file for the GangliaWebServers.cgi script.

######################################################
#
#   General Program Execution Options
#
######################################################

# Global Debug Level Flag.
# 0 = no debug output
# 1 = Normal debug output
debug_level = 0

# List of Ganglia web servers to allow access to.
#
# For convenience, to disable a given entry you need only comment out
# its url definition, not the entire <host ...></host> block.
#
# If exactly one entry with an active url definition has "default = true" as
# part of its entry, then that entry's Ganglia web server page will appear
# automatically when the screen is first opened.  Otherwise, the screen's
# enclosed frame will initially be blank, and the user will need to manually
# select a link for an initial Ganglia web server page to appear.
#
<ganglia_web_servers>

    <host work>
        url = "http://work/ganglia/"
    </host>
    <host geco-15-4>
        url = "http://geco-15-4/ganglia/"
        default = true
    </host>
    <host mygmetadhost>
        # url = "http://mygmetadhost/ganglia/"
    </host>
    <host 192.168.1.99>
        # url = "http://192.168.1.99/ganglia/"
        default = false
    </host>

</ganglia_web_servers>
```

It is not necessary for the `<host ABC>` parameter to name the specific host in the associated URL. The `<host>` parameter is really just a descriptive string that must be unique across all the `<host>` entries within the `<ganglia_web_servers>` section of the file. That string will appear in the Advanced → Ganglia Web Servers screen as the link label for the URL. So for instance, you might have entries like these:

```
<ganglia_web_servers>
    <host Migration Velocities Cluster>
        url = "http://honmb032/ganglia/"
        default = false
    </host>
    <host 3D Visualization Cluster>
        url = "http://htnma011/ganglia/"
        default = false
    </host>
    <host R&D Cluster>
        url = "http://hsnmc003/ganglia/"
        default = true
    </host>
</ganglia_web_servers>
```

That would result in the following labels shown at the top of the Advanced → Ganglia Web Servers screen, when the screen is first accessed:

The labels in the config file are automatically sorted alphabetically before being used to construct these links. The currently displayed link is colored orange, while the other links are colored blue. The link colors will change as different links are clicked, to make it visually obvious which one was last selected.

4.1.4 Ganglia Portal Access Permissions

This section describes at a high level the JBoss facilities for controlling access to the UI pages for the Ganglia Integration Module.

4.1.4.1 Portal Access in GWMEE 6.4.0 Through GWMEE 6.7.0

The GroundWork 6.4.0 environment uses the JBoss authentication/authorization facilities for controlling access to the elements within the top-level Ganglia tab within GroundWork Monitor, just as it does for other facilities within the base product. By default, a fresh installation allows access only to users with the GWAdmin role. However, it may be helpful to allow operators (who are not GroundWork Monitor administrators) access to the Ganglia → Ganglia Views page, for quick access to the data the Ganglia web servers can present, while still preventing them from accessing the Ganglia → Ganglia Thresholds page.

The Ganglia Integration Module makes the following objects accessible to an administrator under the Administration tab, for modifying access permissions as needed in the local environment.

- Portal Management → Portal Objects → groundwork-monitor → ganglia-integration
- Portal Management → Portal Objects → groundwork-monitor → ganglia-integration → ganglia-thresholds
- Portal Management → Portal Objects → groundwork-monitor → ganglia-integration → ganglia-views

The following additional objects are provided by the Ganglia Integration Module. Do not change the settings on these objects without first consulting with GroundWork Support.

- Portal Management → Portlet Instances → GWGangliaThresholdsInstance
- Portal Management → Portlet Instances → GWGangliaViewsInstance
- Portal Management → Portlet Definitions → Ganglia Metric Threshold Configuration Portlet
- Portal Management → Portlet Definitions → Ganglia Web Server Views Portlet

The steps needed to modify any of these objects are beyond the scope of this document. For details, see the PORTAL ADMINISTRATION section of the Bookshelf within GroundWork Monitor.

4.1.4.2 Portal Access in GWMEE 7.0.0 Onward

The information in this section applies starting with the Ganglia Integration Module 7.0.0 release.

The GroundWork 7.X.X environment uses the JBoss Portal authentication/authorization facilities for controlling access to the Configuration → Ganglia Thresholds and Advanced → Ganglia Web Servers menu items, just as it does for other facilities within the base product. By default, a fresh installation or upgrade to the Ganglia Integration Module 7.0.0 release allows access only to users associated with the "Ganglia" resource. Effectively, only the root and admin users will have access to these new screens. However, it may be helpful to allow operators (who are not GroundWork Monitor administrators) access to the Advanced → Ganglia Web Servers

page, for quick access to the data the Ganglia web servers can present, while still preventing them from accessing the Configuration → Ganglia Thresholds page.

The Ganglia Integration Module makes the "Ganglia" resource accessible to an administrator under the "Group → Organization → Users and groups management" tab, and thence under the "Membership Management" link, for modifying access permissions as needed in the local environment.

The default settings are that the Ganglia resource is assigned to the gw-monitoring-operator, gw-monitoring-administrator, and gw-portal-administrator membership names, but not to any of the other membership names. That controls access to the two Ganglia Integration Module pages for the respective users assigned to those membership names. Assigning users to memberships is handled through the sibling "Group Management" link.

Assigning the Ganglia resource to a membership controls access to the underlying pages, but not to the associated navigational-menu items that provide access to those pages. The menu items are separately managed. In a fresh installation or upgrade, they will show up for the root and admin users (or whatever those user names have been renamed to), but not for other users since the top-level Configuration and Advanced menus are entirely suppressed for other users. The setup for related portal elements can be managed by the root user through the following pages:

- Group → Portal Administration → Application Registry

  Clicking the Portlet item reveals the following two portlets in the Ganglia-app group:

  - Ganglia Metric Threshold Configuration Portlet
  - Ganglia Web Server Views Portlet

  These portlets are not assigned to any other Categories by default, but they could be so assigned if there were a need to shuffle the menu items around.

- Group → Portal Administration → Page Management

  This screen is tricky. Most items don't show up until you attempt to scroll down to see whatever else might be present in the table. Two pages are provided by the Ganglia Integration Module:

  - portal::classic::ganglia-thresholds-page
  - portal::classic::ganglia-web-servers-page

  and access permissions for these pages can be edited though this screen.

- Group → Portal Administration → Portal Navigation

  Under "Edit Navigation", particular menu items can be located. You can then right-click to perform various operations on those menu items. In particular, under "Edit Node's Page", there is a "View Page properties" button that allows editing of access permissions. Also, if you click the "Containers" tab, and then move your mouse to the left side of the screen, a "Container" element will pop up, with a pencil icon indicating that certain properties of the container can be edited if you click on that icon. Some of those properties involve access permissions. Similarly, if you click the "Applications" tab, and then move your mouse to the left side of the screen, a "Ganglia Thresholds Portlet" or "Ganglia Web Servers Portlet" element will pop up, with a pencil icon indicating that certain properties of the portlet can be edited if you click on that icon. Access permissions are once again among those properties.

Editing access permissions through these screens is tricky and involves some special unobvious button clicks to actually get any changes saved properly. Consequently, the full procedure for making changes is beyond the scope of this document. Consult with GroundWork Support if you have a need to make such modifications.

4.2 Ganglia Database Administration

4.2.1 Defining Thresholds

To set up monitoring of Ganglia metrics via thresholds, you will need to:

1. define them, and
2. apply them to the clusters, hosts, and metrics that Ganglia is now collecting for you.

The minimal steps required are:

1. Add a metric name for each metric you want to monitor. If special (derived, boot time, or custom) metrics are defined and enabled, you have to add them as well if you want them to be monitored.
2. Select the Default cluster, which contains the global default threshold settings.
3. Add the metric names you want to monitor to the Default cluster, and define the Warning, Critical, and Duration thresholds for them.

You can also create more specific thresholds which apply to individual clusters and hosts.

1. Add specific clusters.
   a. Select the cluster, and add the metrics for which you want to override the Default cluster settings for this specific cluster.
   b. Define the Warning, Critical, and Duration thresholds for each cluster-level override of the global settings.
2. Optionally, add or select specific hosts.
   a. Select the cluster in which this host is defined (i.e., set the Threshold Cluster for the host) and update the host.
   b. Add the metrics for which you want to override the Default and specific-cluster settings.
   c. Define the Warning, Critical, and Duration thresholds for each host-level override of the global and cluster-level settings.

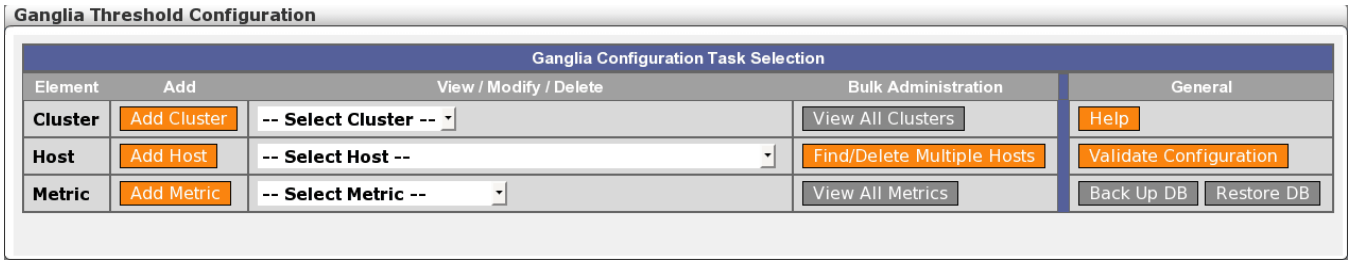
Some things to remember:

- The metric names have to match those from Ganglia exactly. It's a good idea to have the Ganglia web interface up while you work on the thresholds, so you can see the precise format of the metrics and define the thresholds in ways that make sense.[8] Accessing GroundWork Monitor through several windows in the same browser is supported in current GWMEE releases. So if you want, you can access the Ganglia Web Server pages through the Advanced → Ganglia Web Servers screen.
- Warning thresholds and critical thresholds can be high or low, so make sure you see the metric values and alert on them properly. If the warning threshold is less than or equal to the critical threshold, you will get an alarm when the value rises. If the warning threshold is greater than the critical threshold, you will get an alarm when the value falls.
- The units of measure are important for thresholds. For example, the disk_free metric is in *gigabytes* by default. If you want an alarm when you have 500 *megabytes* left, set the threshold to 0.5.
- Duration thresholds are specified in seconds.

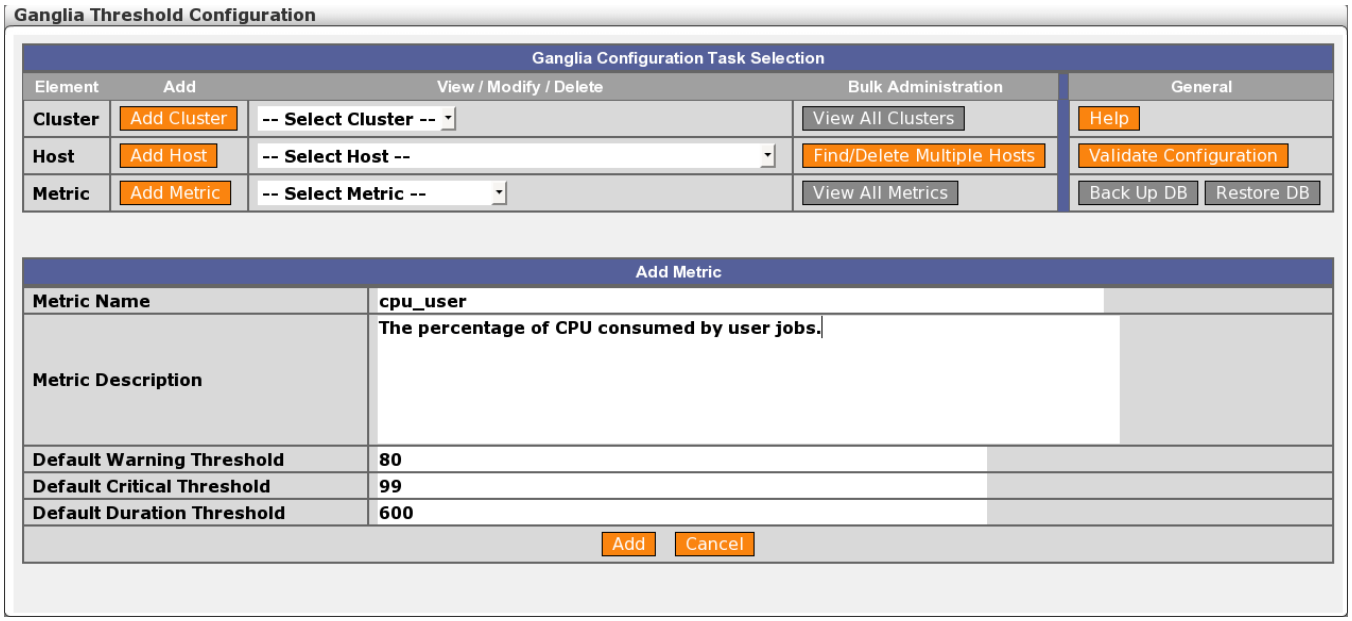
The remainder of this section walks through setting up thresholds on a few metrics to get you started. There is also help in the form of tool tips and a help page, but It's probably a good idea to read this section first and make sure you understand how to set up thresholds before just diving in. Once you are familiar with the tasks involved, the tool tips will serve to remind you of what to do and how to use the more advanced features.

8 Accessing GroundWork Monitor through several windows in the same browser is supported in current GWMEE releases. So if you want, you can access the Ganglia Web Server pages through the Advanced → Ganglia Web Servers screen.

The initial screen of the Ganglia threshold-configuration web interface is shown below.



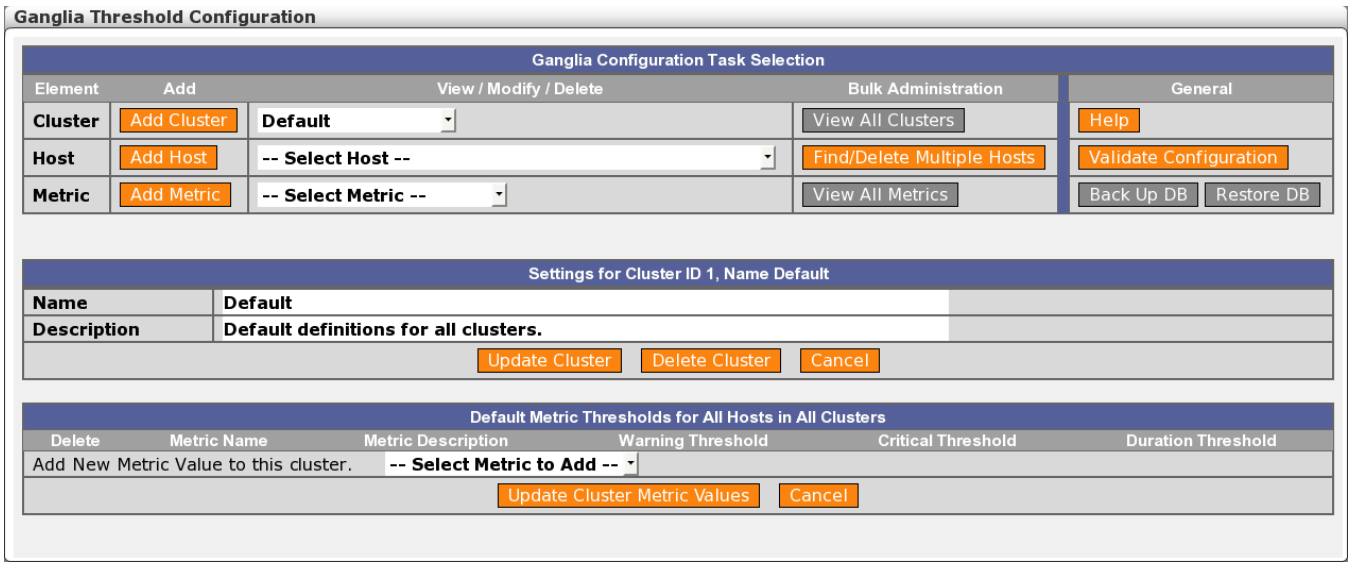
Your first task is to set up metrics. To define a new metric, select the "Add Metric" button. This will present the following screen.



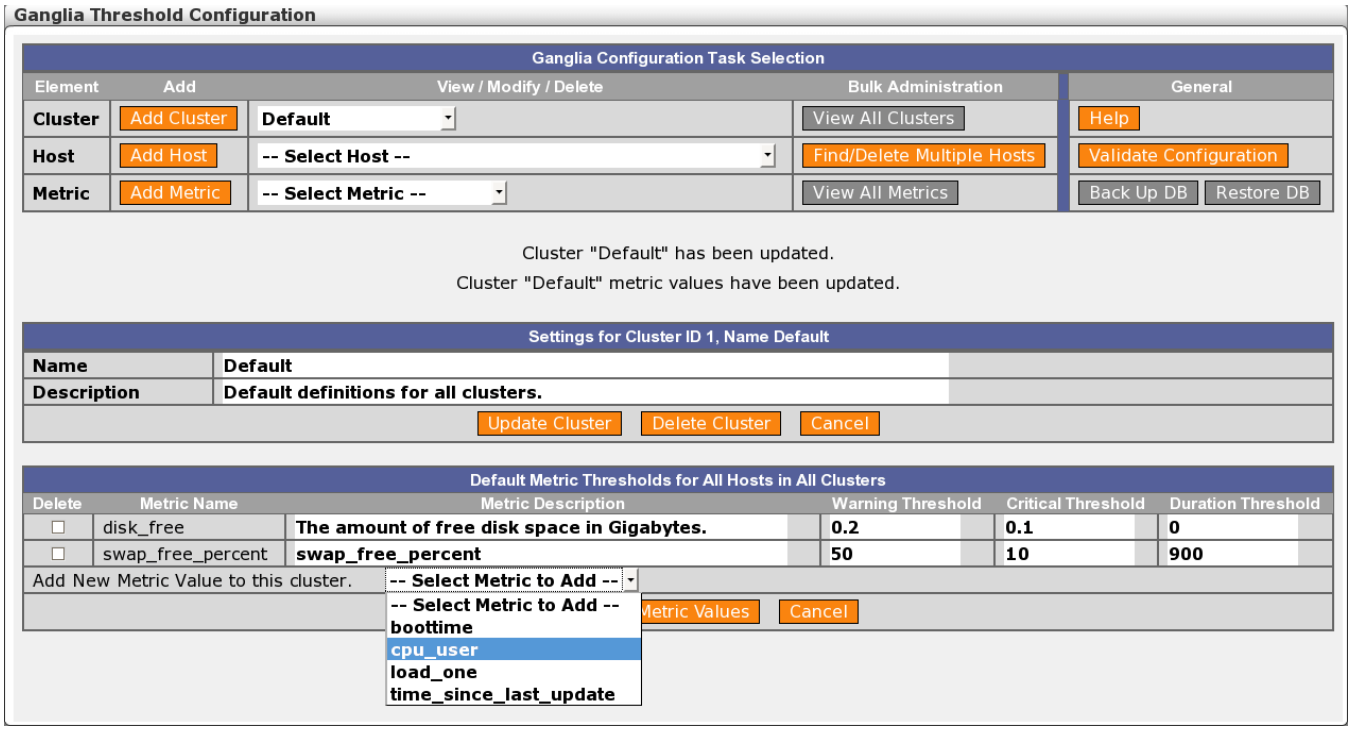
Enter the metric name, exactly as defined in Ganglia. The example here is cpu_user, a common metric. A free text field is available for the metric description. Also define the default Warning, Critical, and Duration threshold values that will be filled in when this metric is applied to a cluster or host, and click the Add button. After a metric is added, it will appear in the metric drop-down lists.

Once you have at least one metric, it can be applied to a cluster or host. You will probably want to set up several metrics before you proceed to this step.

First, the metric must be applied to the "Default" cluster so that a global default threshold exists for any host. To do this, select the "Default" cluster from the cluster drop down list under View/Modify/Delete. The following page is presented:



By selecting a metric from the "Add New Metric Value to this cluster" drop down, one of the metrics you have defined will be added to the list. If desired, update the metric description, or the Warning, Critical, or Duration thresholds. Continue until all the metrics you wish to monitor are defined and applied to the Default cluster.

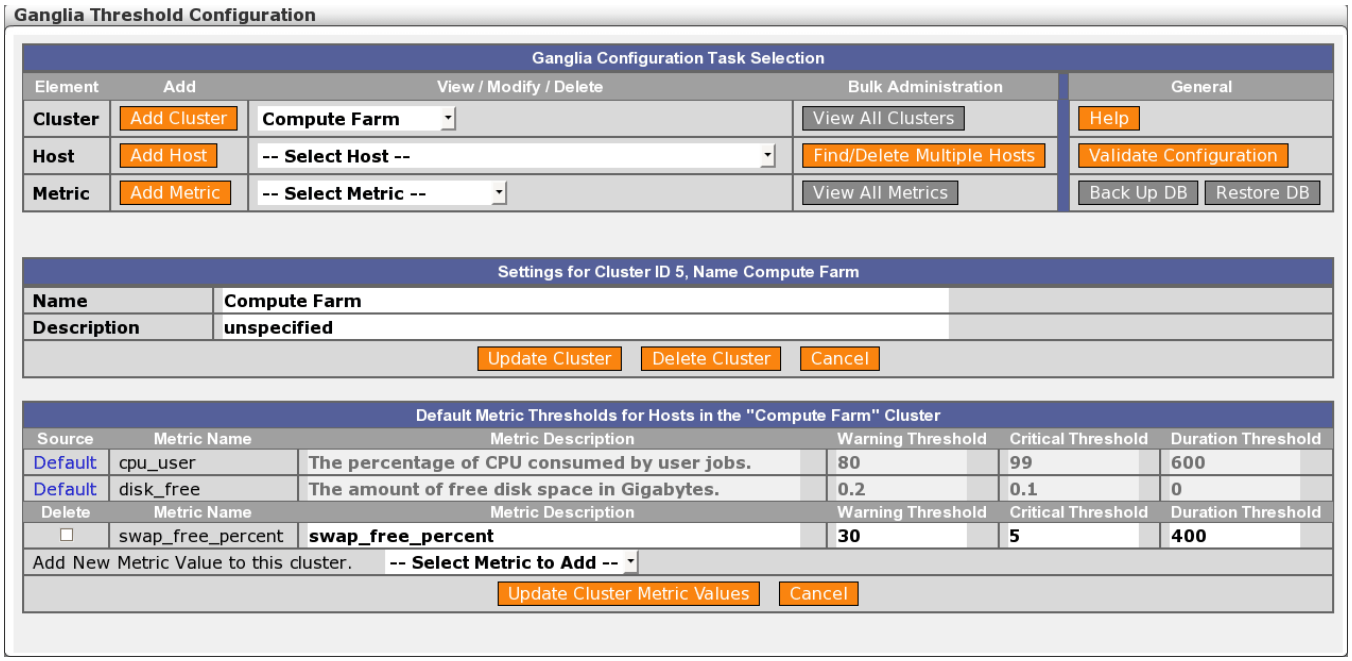


To delete metrics from a cluster, select their Delete checkboxes, then click the "Update Cluster Metric Values" button.

You can also delete definitions for this entire cluster by clicking the "Delete Cluster" button. DO NOT DO THIS for the Default cluster!

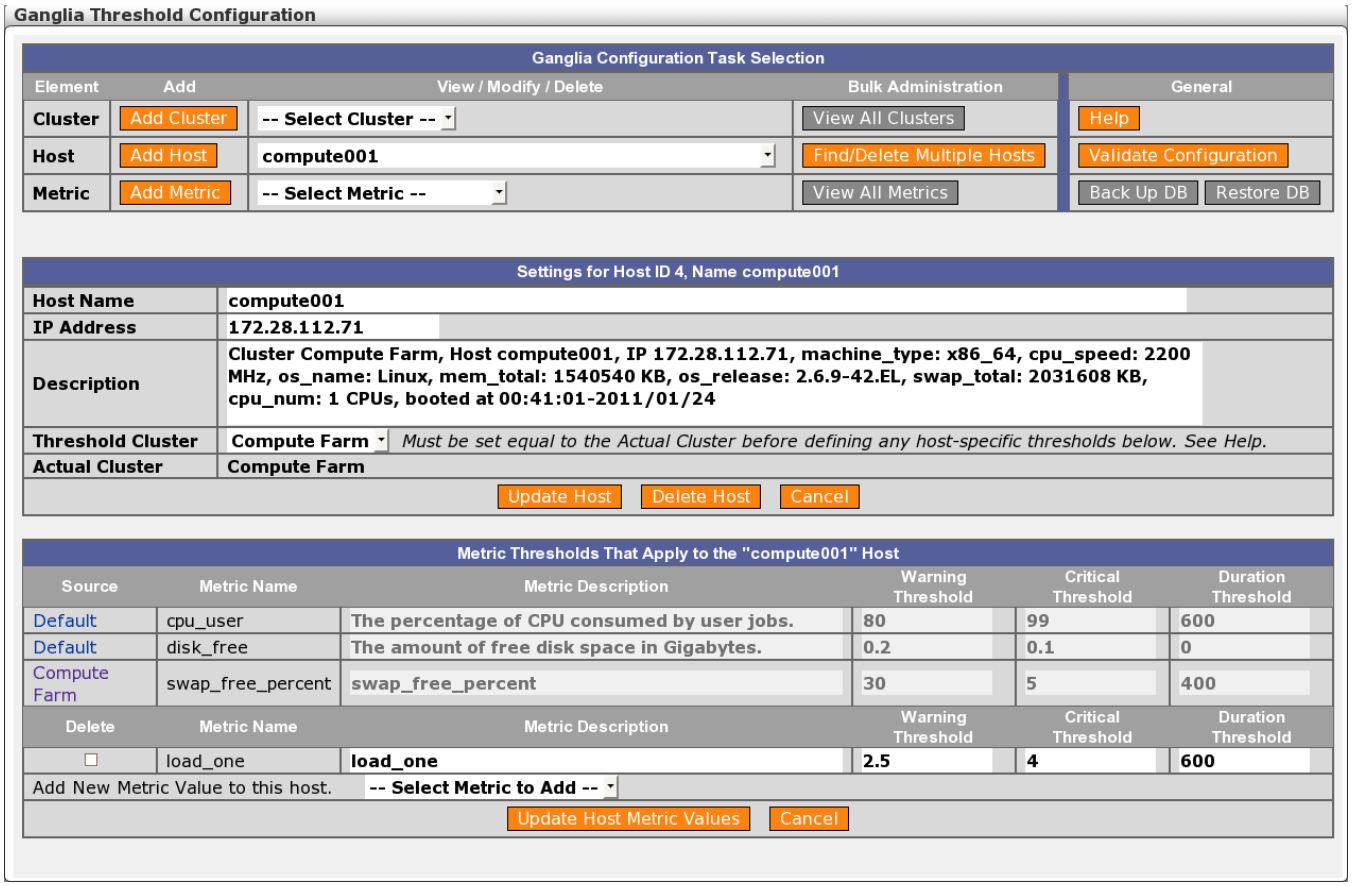
After defining the Default cluster, you may click the "Add Cluster" button to define a new cluster, then repeat this process to define metric thresholds for that cluster. Note that if you don't define a metric for this cluster, it will still

be monitored using the thresholds defined and applied to the Default cluster. Those global settings are shown as read-only copies above the per-cluster metric thresholds, as shown in the figure below. This gives you a complete picture of all the thresholds that will be applied to hosts in the cluster, all in one screen. The Source field is a link to the screen where these default settings are established, so these global values can be quickly accessed and adjusted if needed. Only define metric thresholds in a specific cluster if you want to override the settings in the Default cluster. If you do define per-cluster thresholds for some metrics, the display of the corresponding Default cluster thresholds for those metrics will be suppressed, as they will no longer apply to this particular cluster.



Generally speaking, you will want to stop at this stage and not go further to define per-host metric thresholds. That's because treating hosts in a grid as individual objects adds complexity to the setup and extra administrative burden to maintain it. Uniformity of monitoring across groups of similar hosts makes the configuration much easier to understand. However, if you do have hosts with particular characteristics that should be monitored in a special way, you can proceed to the next step and set up metric thresholds at the host level.

You may manually define hosts to the `ganglia` database by selecting "Add Host", but note that hosts are automatically added to the database by check_ganglia. It is much easier to allow check_ganglia to execute at least once, then select the existing host from the "Modify Host Metric Values" drop-down list and modify its metric settings. You can also use the Find/Delete Multiple Hosts function to generate a list, from which you can click the host name link to reach the particular host's screen. When you select an existing host with one of these methods, the following page appears.



To define per-host metric thresholds, first select the Cluster that this host belongs to in the "Threshold Cluster" field, and click the "Update Host" button to add the host to that cluster in the database. This step is necessary since the database is not populated with this information by check_ganglia.[9]

As on the cluster page, you may add metrics and thresholds to this host. These values will override any thresholds for the same metrics specified at the cluster level, as well as the Default-cluster thresholds for those metrics if no cluster-level thresholds are defined. Note that if you don't define a metric for this host, it will still be monitored if it is defined in the Default cluster or this specific cluster. Only define metrics for a host if you want to override the setting in the specific cluster or the Default cluster. The screen for this host shows all the thresholds that apply to this host if the corresponding metrics are sensed by Ganglia, with the source of each threshold clearly identified.

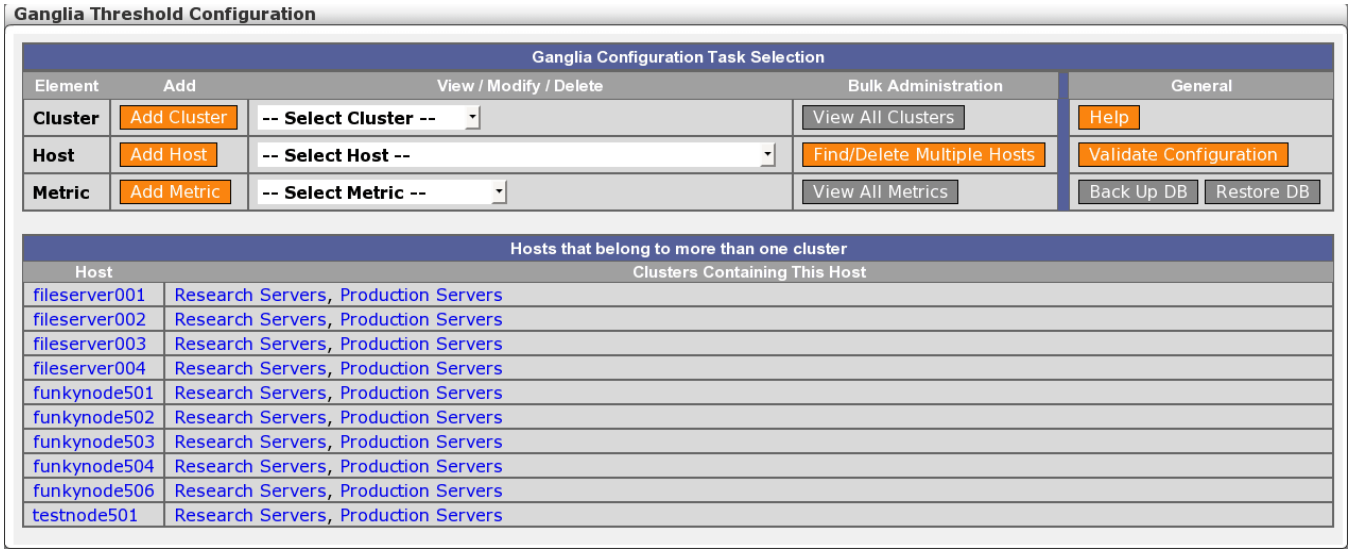
Once you have your thresholds defined, you will begin to receive passive service check results for the services on these hosts in Nagios. You next need to define these hosts and services in Nagios so that you can set up the displays and notifications. The easiest way to do this is with the Auto-Import function, described in a later section.

9 Well, it kind of is, but in a different place. That's where the Actual Cluster displayed in the screen comes from. This distinction and the extra manual step involved will be reviewed in a future release.

4.2.2 Validating the Configuration

Certain combinations of settings make little sense, but can be hard to spot when the user interface is presenting only a small portion of the setup in any single screen. To help with this, the threshold configuration UI provides an automated mechanism for digging out certain types of misconfiguration and making them very evident. This facility can be accessed via the "Validate Configuration" button in the top section of the screen.

In the present release, validation runs just one type of sanity check, namely, looking for hosts that belong to more than one cluster, according to the `ganglia` database. This could cause confusion as to what cluster-level metric thresholds should be applied, so it is a situation to be avoided. If any such hosts are found, they are listed on-screen:

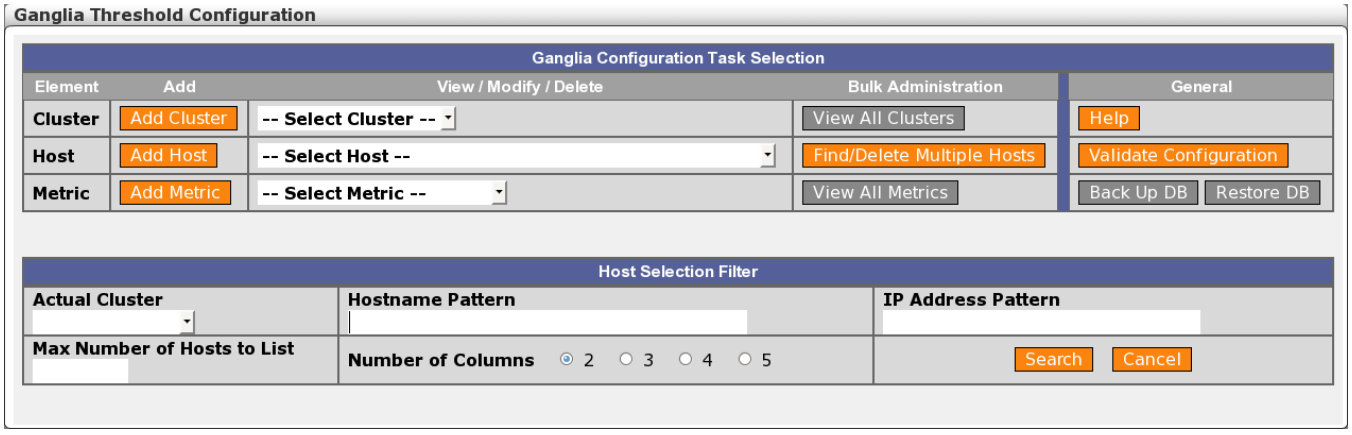


The host and cluster names are links to the respective pages for those hosts and clusters within the threshold configuration UI, so you can jump immediately to those areas to investigate and make adjustments.

4.2.3 Finding and Deleting Hosts

The threshold configuration tool is designed to make bulk administration of metric thresholds easy. But another aspect of bulk administration comes into play at other times — namely, when you need to find certain hosts, or delete groups of hosts. This is important, for instance, when you take a complete cluster permanently out of service.

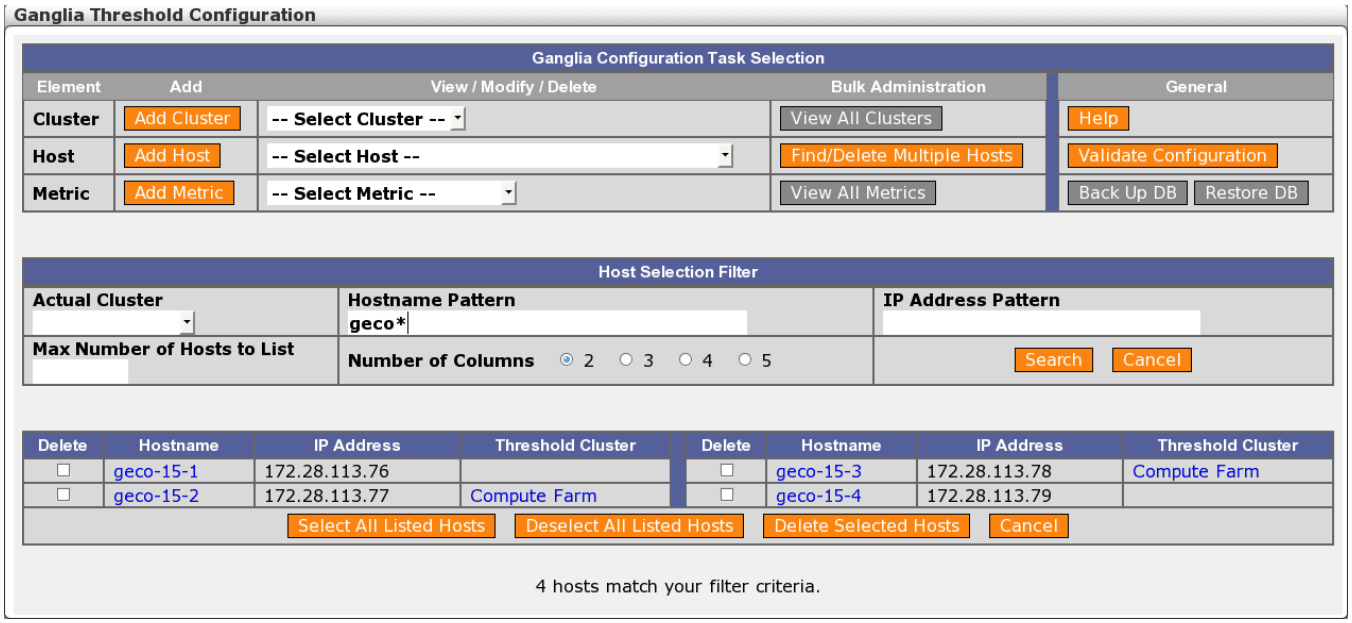
Identifying individual hosts or groups of similar hosts can be done via the "Find/Delete Multiple Hosts" capability, accessed via a button in the top section of the screen. It brings up a search template:



You can specify a number of criteria to search on, either singly or in combination. If you wave the mouse pointer over the respective heading for each search criterion, a pop-up tooltip will appear that describes acceptable

values. (The tooltip will remain steady for you to read its content until either some other tooltip appears, or you click somewhere in the screen to dismiss it.)

The search results look like this:



Here we see four hosts that matched our specified hostname pattern. Each of their names is a link to the respective host page within the threshold configuration tool. We also see that two of these hosts (geco-15-2 and geco-15-3) have a Threshold Cluster set, which is a strong indication that host-level metric thresholds are set for these hosts. These cluster names are also links to the respective cluster pages.

Once you have identified an interesting group of hosts this way, you can easily select some or all of them and delete them in bulk from the `ganglia` database. This is a maintenance step you would typically need to take before running auto-import, so the synchronization of the Monarch and Nagios views of the infrastructure with the Ganglia view will properly reflect the permanent removal of these hosts from your data center.

4.3 Auto-Import Configuration

There are several parameters that control the options in the auto-import script (see Section 3.5, Auto-Import, on page 25). These are found in the `autoimport.conf` file, stored in the `/usr/local/groundwork/config` directory. To configure auto-import, simply edit this file, and create associated objects within Monarch (see below). If the import runs under `cron`, you may wish to kick it off once by hand to ensure the results are what you expect, and that you did not make a mistake editing the file that would prevent the import from functioning. If you are running the import manually, then you will do this anyway.

As always, be sure to make a backup of your `monarch` database before running any kind of bulk update such as this import script. If it fails for any reason, you should take care not to lose any data.

We present below a listing of the initial configuration file. You should review this file and modify it to meet your needs, then set up the required services, profiles, and host groups in the Monarch GUI. In particular:

- Depending on your configuration of `process_ganglia_hosts` and `process_cacti_hosts`, create and customize services named according to your choices in the `autoimport.conf` file for:
  - `ganglia_svc_name`
  - `cacti_svc_name`

  If you are creating these services from scratch, the following setup is appropriate:
  - Check command:

    `check_msg`
  - Command line:

    `check_msg!3!"You actively checked a passive service, check your configuration"`
- If the `assign_deleted_hosts_to_hostgroup` option is enabled, create a hostgroup named `_DELETED_HOSTS` (or whatever name you have chosen for the `deleted_hostgroup` option).
- If the `assign_new_hosts_to_hostgroup` option is enabled, create hostgroups named according to your choices for:
  - `new_ganglia_hosts_hostgroup`
  - `new_cacti_hosts_hostgroup`

  depending on whether you have `process_ganglia_hosts` and/or `process_cacti_hosts` enabled. (In contrast, hostgroups assigned under the `process_wg_hostgroups` option will be created automatically as needed during auto-import processing.)
- If the `assign_host_profiles_by_ganglia_clusters` option is enabled, create and customize host profiles named after the Ganglia clusters in which your hosts reside.
- Depending on your configuration of `process_ganglia_hosts` and `process_cacti_hosts`, create and customize host and service profiles named according to your choices for:
  - `default_host_profile_ganglia`
  - `default_service_profile_ganglia`
  - `default_host_profile_cacti`
  - `default_service_profile_cacti`

  If you enabled `assign_host_profiles_by_ganglia_clusters` but failed to create a host profile named after a particular Ganglia cluster in which a host is found, these Ganglia-related profiles will be used as a fallback.

  You will probably want to assign the service you named as `ganglia_svc_name` to the `default_service_profile_ganglia` service profile, and the service you named as the `cacti_svc_name` to the `default_service_profile_cacti` service profile.

Then simply run the script from the command line:

```
/usr/local/groundwork/nagios/libexec/autoimport.pl
```

Look in the configured `logfile` (see below) to see whether any errors occurred, and to examine the operational statistics for each run.

If the script ran without errors, and you did not enable the `commit_changes` option, just open the Monarch (Configuration) GUI, review and adjust the imported hosts, and commit the changes. It's probably a good idea not to enable that option the first time you run the import, just so you can be sure of the results before you go live with the new setup.

You may also want to know which hosts are not being monitored by Ganglia, either because they are being monitored some other way, by Nagios, perhaps, or because they have dropped out of the Ganglia data stream. By default, these hosts will be placed in a new host group you created (e.g., `_DELETED_HOSTS`). Do not worry, the autoimport script will not actually delete the hosts it moves there. That is up to you to do on review.

Once you are done importing your hosts and committing your changes, you will be monitoring with Ganglia thresholds under Nagios in GroundWork Monitor. Congratulations!

```
# Configuration file for the autoimport.pl script.

#########################################################
#
#   General Program Execution Options
#
#########################################################

# Global Debug Level (controls the output of messages in the logfile)
# NONE    = 0; turn off all debug info
# FATAL   = 1; the application is about to die
# ERROR   = 2; the application has found a serious problem, but will attempt to recover
# WARNING = 3; the application has found an anomaly, but will try to handle it
# NOTICE  = 4; the application wants to inform you of a significant event
# STATS   = 5; the application wants to log statistical data for later analysis
# INFO    = 6; the application wants to log a potentially interesting event
# DEBUG   = 7; the application wants to log detailed debugging data
debug_level = 5

# Where to put all the log messages from autoimport processing.
logfile = "/usr/local/groundwork/nagios/var/log/autoimport.log"

# Whether or not to commit a new configuration to Nagios.
# Changes will be committed to the Monarch database regardless.
# [yes/no]
commit_changes = yes

# When defining a monarch host, use the host name instead of the IP address?
# [yes/no]
define_monarch_host_using_dns = yes

# Whether to process WesternGeco-style hostgroups.
# [yes/no]
process_wg_hostgroups = yes

# Whether to use hostgroup_program to classify hosts according to their function.
# If "no", use custom_hostgroup_package instead.
# Used only if process_wg_hostgroups = yes.
# [yes/no]
use_hostgroup_program = no

# A program to classify hosts into hostgroups according to their function.
# Used only if process_wg_hostgroups = yes and use_hostgroup_program = yes.
# The value specified can include initial options beyond just the program name;
# the hostname to be classified will be appended to this full command string.
hostgroup_program = "/usr/local/groundwork/jobs/westerngeco/bin/hosttype -c"

# What Perl package to call to classify hosts into hostgroups according to their function.
# Used only if process_wg_hostgroups = yes and use_hostgroup_program = no.
# For efficiency, the use of a package, if available, is preferred over an external program.
# Set this to an empty string if you have no such package.
custom_hostgroup_package = "WesternGecoHostgroupName"

# What options to initialize the custom_hostgroup_package with.
custom_hostgroup_package_options = "-c"

# Where to find the Nagios log file.
nagioslogfile = "/usr/local/groundwork/nagios/var/nagios.log"
```

```
# Ganglia service name to search for in Nagios log file.  Hosts with this service will be matched.
ganglia_svc_name = "ganglia"

# Cacti service name to search for in Nagios log file.  Hosts with this service will be matched.
cacti_svc_name = "cacti"

# Assign deleted hosts to the deleted_hostgroup specified below?
# [yes/no]
assign_deleted_hosts_to_hostgroup = yes

# The name of the hostgroup to which deleted hosts will be assigned.
# This hostgroup must already exist in the Monarch database.
deleted_hostgroup = "_DELETED_HOSTS"

# Assign new hosts to the single fixed new hostgroup for the type of node discovered,
# as specified below (new_ganglia_hosts_hostgroup or new_cacti_hosts_hostgroup)?
# [yes/no]
assign_new_hosts_to_hostgroup = no

# Names of hostgroups for newly discovered hosts.
# Used only if assign_new_hosts_to_hostgroup = yes.
new_ganglia_hosts_hostgroup = "New_Ganglia_Hosts"
new_cacti_hosts_hostgroup   = "New_Cacti_Hosts"

# For newly discovered Ganglia hosts, assign host profiles named by the Ganglia clusters
# in which the hosts reside?  "yes" is only possible if get_ganglia_host_from_ganglia_db
# (below) is "yes".
# If "no", just use the single fixed default_host_profile_ganglia specified below.
# If "yes", the default_host_profile_ganglia host profile will still be used if we find
# no host profile named after a given Ganglia cluster.
# [yes/no]
assign_host_profiles_by_ganglia_clusters = yes

# Note:  For newly discovered Cacti hosts, assuming you only use Cacti for network devices,
# using a single host profile (default_host_profile_cacti, specified below) makes sense.
# Within Cacti, you don't have something akin to "Host Groups", though you do have a 'tree'
# structure defined in the database for navigating the devices.  If we did want to allow
# alternate host profiles for Cacti devices, then the name of the branch of the tree the
# device is attached to would be the logical candidate.  We leave that sort of thing for
# possible future development.

# Default Monarch host and service profiles to be applied to newly discovered hosts.
default_host_profile_ganglia       = "ganglia_host"
default_service_profile_ganglia    = "Ganglia Hosts"
default_service_profile_ganglia_id = ""
default_host_profile_cacti         = "cacti_host"
default_service_profile_cacti      = "Cacti Hosts"
default_service_profile_cacti_id   = ""

# Process ganglia hosts?
# [yes/no]
process_ganglia_hosts = yes

# Read the Nagios log to pick up the list of Ganglia hosts from service check messages?
# [yes/no]
get_ganglia_host_from_nagios_log = no

# Get the list of ganglia hosts from the Ganglia database?
# Only effective if get_ganglia_host_from_nagios_log = no.
# [yes/no]
get_ganglia_host_from_ganglia_db = yes

# How to access the Ganglia database.
# ganglia_dbtype can be either "mysql" or "postgresql".
ganglia_dbtype = "postgresql"
ganglia_dbname = "ganglia"
ganglia_dbhost = "localhost"
ganglia_dbuser = "ganglia"
ganglia_dbpass = "gwrk"
```

```
# Process cacti hosts?
# [yes/no]
process_cacti_hosts = no

# How to access the Cacti database.
# cacti_dbtype can be either "mysql" or "postgresql".
cacti_dbtype = "postgresql"
cacti_dbname = "cacti"
cacti_dbhost = "localhost"
cacti_dbuser = "cacti"
cacti_dbpass = "cactipasswd"

# How to access the Monarch database.
monarch_user_acct = "super_user"
```

Appendix A: Revision History

This manual is expected to be a living document. Future versions may include detail and experience which is not available during the initial development.

The following versions of this document have been issued to date.

Version	Date	Description of Changes
2.0	October 3, 2007	First public release.
3.0	---	Interim internal release.
4.0.5	February 6, 2008	Draft-in-progress of changes to reflect repackaging as RPMs.
5.0.0	February 28, 2011	Revised to reflect installation and running in the GroundWork Monitor Enterprise Edition 6.4 environment. Also edited operational instructions for clarity and to describe new functionality.
5.1.0	March 24, 2011	Extended to: • Document the default view in the Ganglia Web Server Views screen. • Document additional manual steps needed during initial setup. • Highlight special features briefly mentioned in configuration files. • Provide critical cross-references within this document, for fast access to related info.
6.0.0	November 16, 2012	Software ported to support using a PostgreSQL database, and documentation upgraded to match. Special cross-database upgrade procedures are documented as well. This allows operation with GroundWork Monitor Enterprise Edition 6.6.1 and later releases.
6.0.1	May 10, 2013	No change to the doc, except to upgrade the version number and release date. The code was changed to prevent recognition of external entity references while parsing XML streams. This requires an updated `libxml2` library, as will be available in the GWMEE 7.0.0 release.
7.0.0	June 12, 2017	There are no significant functional changes in this release. The code and documentation has been modified to: • Work with the new portal structure that is used in GWMEE 7.0.0 and later. • Adopt the look and feel of Monarch and similar screens, as present in current base-product releases such as GWMEE 7.1.1. • Change the name of the GroundWork services directory for the service that supervises the daemon running of the `check_ganglia.pl` script, from `core/services/check_ganglia/` to `core/services/check-ganglia/`, to better fit with naming conventions used for other feeders. • Describe the fact that the Ganglia Integration Module 7.0.0 release only works when installed on GWMEE 7.1.1 or later, and that this has consequences for how migrations from a prior MySQL-based release can be carried out. As of this writing, the following documentation changes are not yet carried out: • GUI screenshots in this document have not yet been updated to reflect the revised look and feel of this release of the Ganglia Integration Module.