



# GMDAT – SENSOR TEST REPORT

## SOFTWARE TEST AND VALIDATION REPORT

### WP4 TASK4 - Verification and Quality Control

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Document Filename: **CG-4.4-REP-v1.1-DEMO001-gmdat-sensor\_TestReport.doc**

Work package: **WP4 TASK4 - Verification and Quality Control**

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Config ID: **CG-4.4-REP-v1.1-DEMO001-GMDAT\_SENSOR**

Document classification: **PUBLIC**

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**Abstract:** This report describes the validation performed on the package gmdat-sensor developed by CrossGrid WP 3 task 3.2. The tests were performed by Vangelis Floros on the behalf of the CrossGrid task 4.4 testbed verification and quality control. Gmdat-sensor provides a set of sensors for measurement of average data transfers and round-trip times between CrossGrid clusters. It also configures Ganglia Monitoring Toolkit, which is used as transport layer.

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### Document Log

Version	Date	Summary of changes	Author
1-0-DRAFT-A	19/03/2004	Draft version	Vangelis Floros
1-1-DRAFT-A	30/03/2004	Update after resolving the crontab and avg_rtt metrics issues	Vangelis Floros

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## 1. CONTEXT

Test and validation of the package GMDAT-SENSOR version 1.4-1 developed by CrossGrid WP 3, task 3.2. This package contains a set of sensors for measurement of average data transfers and round-trip times between Crossgrid clusters. It also configures Ganglia Monitoring Toolkit, which is used as a transport layer. Package comes in two flavors - CE and WN. CE is installed only on CEs, and WN on WNs and SEs.

### 1.1. TEST REQUEST

The package test request was assigned by Jorge Gomes ([Jorge@lip.pt](mailto:Jorge@lip.pt)) to Vangelis Floros ([floros@di.uoa.gr](mailto:floros@di.uoa.gr)) on 16 February 2004. The test requestor was Adam Padee ([apadee@icm.edu.pl](mailto:apadee@icm.edu.pl)) from ICM Warsaw. The request was submitted properly by a request form through the test and validation web form, and was assigned the Request ID 107693641150.3002856466086.

The software URL provided in the “Test Request” was correct containing the packaged GMDAT sensors. The request initially concerned version 1.1-1 but additional version were released and tested based on the issues found during the validation process. The package also required the download and installation of additional tools, namely *Ganglia* and *RRDtool*. Additional URLs were provided for the above packages but did not work properly so these packages had to be found manually elsewhere in the Internet.

The URL for the Installation, Developer’s and User’s Guide, points to a directory which contains draft versions of Deliverable 3.5 (in zipped format). To find the relevant information the tester had to go through all sub-documents of the Deliverable and locate the specific parts that concerned *gmdat-sensor* and post process monitoring. This information is provided in document CG3.0-D3.5-v1.0-PSNC010-Task3-2.doc.

### 1.2. TEST TEAM

The tests were performed by task 4.4 members from Demokritos.

- Vangelis Floros ([floros@di.uoa.gr](mailto:floros@di.uoa.gr))

### 1.3. RESOURCES INVOLVED

For the purposes of testing the following resources were used in the University of Athens cluster:

- 1 Computing Element ([cgnode00.di.uoa.gr](http://cgnode00.di.uoa.gr))
- 1 Worker Node ([cgnode01.di.uoa.gr](http://cgnode01.di.uoa.gr)) and
- 1 Storage Element ([cgnode04.di.uoa.gr](http://cgnode04.di.uoa.gr))

## 2. TEST AND VALIDATION

### 2.1. SOFTWARE INSTALLATION

The software was installed using LCFGng in the UoA site running *LCG-1.1.4*. All nodes use security patched kernel *2.4.20-30.7.legacysmp* and *iptables-1.2.5-3*. The packages were distributed as RPMs. The software is comprised by two packages:

- *cg-wp3.2-gmdat-sensor-CE-1.4-1.noarch.rpm* and
- *cg-wp3.2-gmdat-sensor-WN-1.4-1.noarch.rpm*

The former is installed in the CE and the later in all WNs and SEs. Both packages were copied in the LCFGng server, under directory */opt/local/linux/7.3/RPMS/cg/wp3*. The CE specific package was then included in file *CE-rpm* and the WN specific package was declared in *WN-rpm* and *SECLASSIC-rpm*.

GMDAT-SENSOR requires Ganglia monitoring tool in all nodes and RRDtool in the CE. For this reason the following packages were copied in the LCFGng server under */opt/local/linux/7.3/RPMS/cg/external*:

- *ganglia-monitor-core-gmetad-2.5.3-1.i386.rpm*
- *ganglia-monitor-core-gmond-2.5.3-1.i386.rpm*
- *rrdtool-1.0.38-1.i386.rpm*

All three packages were added in *CE-rpm*. Also *ganglia-monitor-core-gmond* was included in *WN-rpm* and *SECLASSIC-rpm*.

It is important to note that the above three packages have to be installed in the nodes before *gmdat-sensor* packages. The reason is that *gmdat-sensor* when it is installed it attempts to modify the ganglia configuration files. If the files do not exist the sensors will not function properly.

The installation of packages was completed with no problems in all nodes. The software is installed according to CrossGrid guidelines under */opt/cg/bin* (executables) and */opt/cg/etc* (configuration files). Man pages are also installed under */opt/cg/doc* for commands *exam* and *gtmt*. All files are owned by root.

During the installation the following existing files are automatically modified:

- */etc/gmond.conf* (Ganglia configuration file), all nodes
- */etc/gmetad.conf* (Ganglia configuration file), in CE
- */etc/crontab*, all nodes

### 2.2. ADDITIONAL TESTBED MODIFICATIONS

In order for some *gmdat-sensor* metrics to be calculated properly, a minimum *iptables* configuration had to be enabled in the Computing Element. Although *iptables* software is installed by default it is not activated since no filtering rules are provided by the setup. In order to start *iptables* filtering */etc/sysconfig/iptables* was modified to include the following lines:

```
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
COMMIT
```

### 2.3. TEST DEVELOPMENTS

No test developments were required.

### 2.4. USABILITY

As described the installation procedure is simple and automated. Gmdat-sensors are intended to operate continuously without supervision or user intervention. The sensors provide information to monitoring and post processing central services installed at the Central Monitoring Host (grid.fuw.edu.pl) in Warsaw. For this reason there are no issues regarding understanding and using the software.

The results of monitoring and performance prediction are provided by a Perl script that produces visual results on the Web at the following URL: <http://grid.fuw.edu.pl/cgi-bin/grid.pl> (does not include predictions) and also <http://grid.fuw.edu.pl/cgi-bin/grid2.pl> (experimental, provides metrics predictions).

The user interface for monitoring reporting is easy to use. It provides a list of hosts that are monitored and a set a metrics for each host regarding CPU usage, memory usage and Network Workload. The meaning of these metrics is straightforward in most cases, although an on-line help explaining them would be very helpful.

### 2.5. FUNCTIONALITY

According to the test request the following issues should be validated: installation of packages, clean de-installation and monitoring of results from the Central Monitoring Host (CMH). The functionality and the flawless operation of the sensors can only be tested through the Web interfaces providing the monitoring metrics.

#### 2.5.1. Unit tests

Unit tests are not required since the sensors utilization makes sense only when they operate as part of a distributed monitoring infrastructure.

#### 2.5.2. System tests

The Central Monitoring Host web page was consulted after the installation of the sensors to verify that the metrics were populated and that the values provide meaningful and valid results. The user can use the interface to acquire metrics that span over a period of time from 5 minutes to 1 month and get predictions for the next 5 minutes to 12 hours. The tests were carried out for a period of time of 5 weeks in order to validate that there was a continuous and consistent flow of information to the CMH. A view of the web pages is provided in Figure 1 and Figure 2 below:

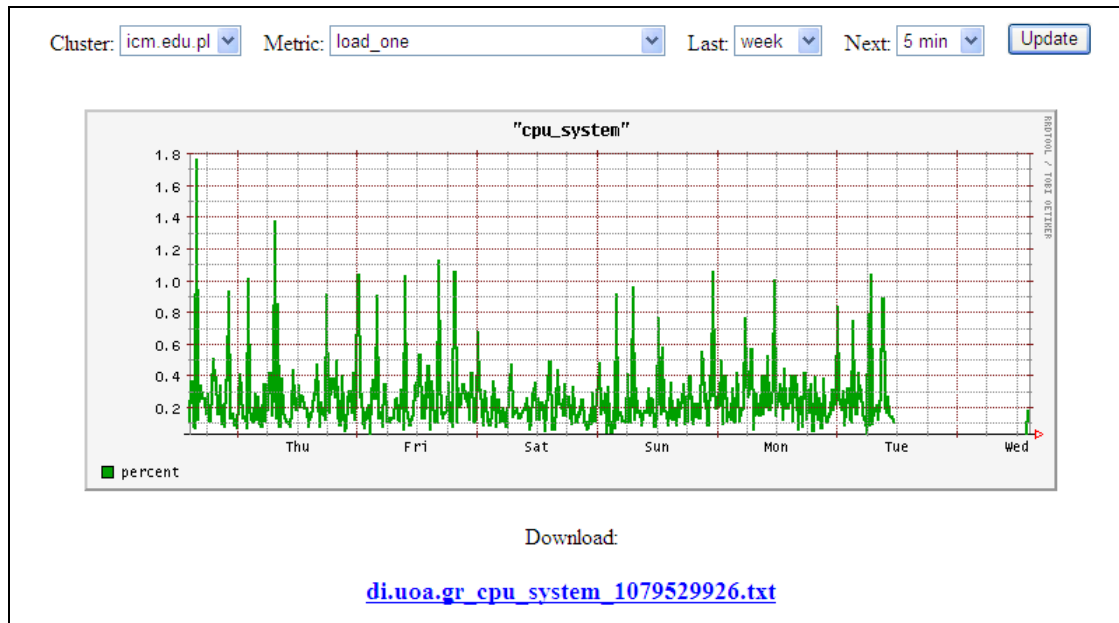


Figure 1 - CPU system metrics for di.uoa.gr

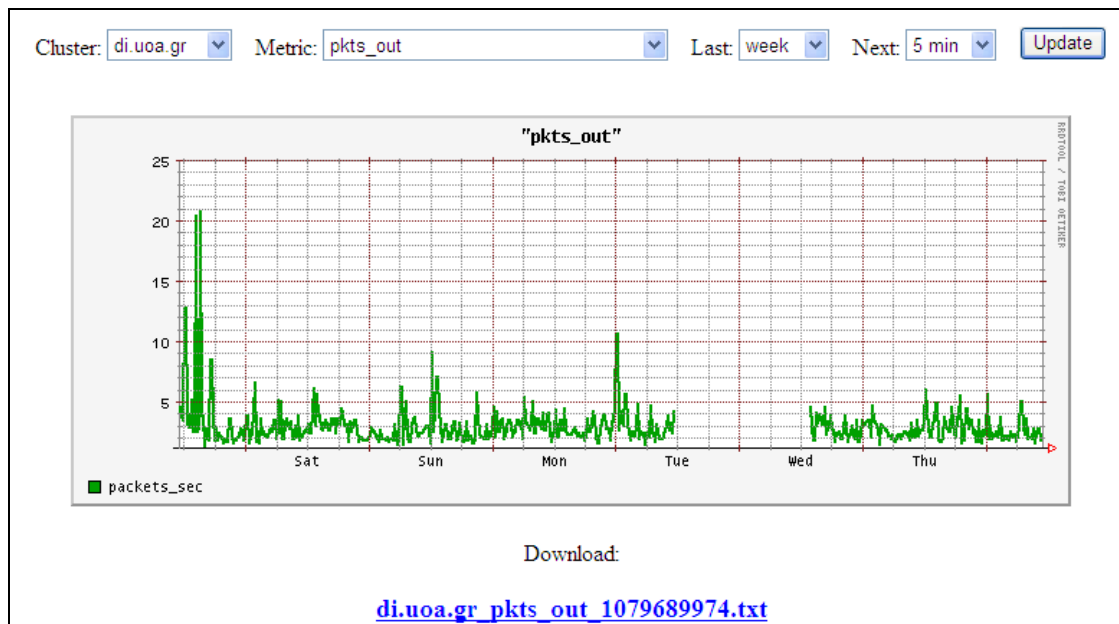


Figure 2 - Packets out for di.uoa.gr over a period of one week

### 2.5.3. Stress tests

As a form of stress test the `run_gmetrics` script was scheduled in the `crontab` to calculate metrics in shorter periods (every minute instead of every 5 minutes). No problems were detected.

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## 2.6. COMPATIBILITY

Since gmdat-sensors do not interfere, neither require, EDG middleware there are no issues of compatibility between them. The software is dependent on packages outside EDG distribution (*ganglia* and *rrdtool*) which in turn do not cause any compatibility problems.

## 2.7. SECURITY AND NETWORKING

For the sensors to report back to the CMH, TCP ports 8651 and 8649 have to be open in the CE, for outbound communication. Also all the relevant scripts and configuration files can be read and executed only by root.

There have been some reports on the Internet that claim Ganglia monitoring to be vulnerable to DoS attacks (see <http://xforce.iss.net/xforce/xfdb/13631> and <http://archives.neohapsis.com/archives/bugtraq/2003-11/0046.html> ). This vulnerability affects especially the version of Ganglia that gmdat-sensors use (2.5.3). This security issue should be taken into consideration.

## 2.8. PREVIOUSLY REPORTED ISSUES

Since the last report two major issues have been resolved:

**Issue 001:** The *avg\_rtt* metrics now report correct values. The problem appeared to be on the server side (unavailability of the central monitoring services that collect and analyze network metrics). Thus no modifications had to be applied on the gmdat-sensor sources.

**Issue 003:** The problem with the vanishing crontab entry was fixed. The problem was caused by a buggy post-install script inside the rpm that during the upgrade of the packages wouldn't re-insert the crontab line after it was deleted. The new versions of the gmdat-sensor packages (1.4-1) have solved the problem.

Also the low severity, low priority Issue 004 (“*When uninstalling gmdat-sensor packages from the CE, RPM prints a message that it couldn't remove files /tmp/setup\_gmetrics\_CE.sh and /tmp/ganglia\_cg\_setup\_SE.sh*”) was resolved

By resolving the above issues gmdat-sensors are rendered suitable for deployment in the CrossGrid testbed. The other issues previously reported are either minor or concern the structure of the testbed and thus require a collective solution (see Issue 001 in section 3).

The security issue regarding the DoS vulnerability of ganglia still remains but should be considered rather minor since it affects only the functionality of gmdat-sensors and does not threaten the stability of the rest of the testbed. This issue is still being reported in the following sections in order to be kept in mind and be resolved when fixed versions of ganglia are released.

### 3. ISSUES FOUND

#### 3.1. ISSUES FOUND IN THE SOFTWARE

##### 3.1.1. Issue 001

(Severity: high Priority: medium)

*Ganglia* and *RRDtool* packages should be installed before *gmdat-sensor* packages. This requirement should be enforced in the *rpmlists* provided by the common directory of GridPortal.

##### 3.1.2. Issue 002

(Severity: low Priority: low)

When uninstalling *cg-wp3.2-gmdat-sensor-WN-1.4-1* from the WN and SE RPM prints a warning: "Failed to detect tool. Please run *iptables* or *ipchains*". Since *iptables* is required only in the CE such test is not required by *uninstall*.

##### 3.1.3. Issue 003

(Severity: medium Priority: low)

There is an error in Ganglia's *gmond* daemon such that specially crafted packets will crash the service. The problem affects only the functionality of Ganglia and the operation of the services that rely upon like *gmdat-sensor*. Further details regarding the exploit can be found in the following link:

<http://archives.neohapsis.com/archives/bugtraq/2003-11/0046.html>.

This vulnerability has been identified in version 2.5.3 of Ganglia that *gmdat-sensor* uses thus it directly affects the security of the package.

#### 3.2. ISSUES FOUND IN THE DOCUMENTATION

##### 3.2.1. Issue 001

(Severity: medium Priority: medium)

There is a general issue regarding documentation and that is the fact that no stand-alone concise documentation is provided other than the deliverables of WP 3.2. As a result it is difficult for the reader to isolate the areas in the text that apply to *gmdat-sensor*. Although the installation and usage of the tool is simple a concise document describing these issues in brief should be provided.

#### 4. RECOMMENDATION

Apart from the issues reported previously the testers also would like to make the following recommendations:

- A detailed documentation regarding the functionality of the tool and the meaning of the metrics should be provided not only in the relevant documents but also in the web pages where the monitoring results are presented graphically.
- The developers should closely follow the DoS vulnerability issue of Ganglia and notify the rest of the Testbed when fixed or patched versions of the Ganglia packages have been released.

## 5. REFERENCES

- [1] <http://wp3.crossgrid.org/doc/d35-10-02-2004/CG3.0-D3.5-v1.0-PSNC010-Proto2Status.doc>
- [2] [http://wp3.crossgrid.org/doc/d35-10-02-2004/D3-5\\_2004-02-10.zip](http://wp3.crossgrid.org/doc/d35-10-02-2004/D3-5_2004-02-10.zip)
- [3] [http://www.lip.pt/computing/projects/crossgrid/task4/softvalidation/107693641150.3002856466086/request\\_form.html](http://www.lip.pt/computing/projects/crossgrid/task4/softvalidation/107693641150.3002856466086/request_form.html)

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## 6. INTEGRATION/VALIDATION REQUEST

Request id: 107693641150.3002856466086

**Component name:** cg-wp3.2-gmdat-sensor

**Version (CVS tag):** v1\_1

**Request priority:**

2

### Package brief description:

This package contains a set of sensors for measurement of average data transfers and round-trip times between Crossgrid clusters. It also configures Ganglia Monitoring Toolkit, which is used as a transport layer. Package comes in two flavors - CE and WN. CE should be installed only on CEs, and WN on WNs and SEs.

### Code:

**Source code in X# CVS ? (Y/N):** Y

**Autobuild generates RPMs ? (Y/N):** Y

**Software download URL:** <https://savannah.fzk.de/distribution/crossgrid/autobuilt/i386-rh7.3-gcc2.95.2/wp3/RPMS/>

### List of RPMs produced:

cg-wp3.2-gmdat-sensor-CE-1.1-1.noarch.rpm  
cg-wp3.2-gmdat-sensor-WN-1.1-1.noarch.rpm

### Changes:

#### List of all bugs fixed by this release:

This is initial release of the sensors package

#### List of backwards compatibility issues (installation, configuration or run-time):

### Documentation:

**Installation manual URL:** <http://wp3.crossgrid.org/pages/intranet/d35-10-02-2004.html>

**Users manual URL:** <http://wp3.crossgrid.org/pages/intranet/d35-10-02-2004.html>

**Development manual URL:** <http://wp3.crossgrid.org/pages/intranet/d35-10-02-2004.html>

**Software requirements URL:** <http://wp3.crossgrid.org/doc/srs-03-06-2002/3.3.zip>

**Software design URL:** <http://wp3.crossgrid.org/doc/dd-12-08-2002/3.3/CG-3.3.4-SDD-0100.doc>

**Files:****List of all configuration files (with full path):**

/opt/cg/etc/ip\_classes  
 /opt/cg/etc/pinger\_hosts.cf (only on CE)  
 /etc/gmond.conf (Ganglia configuration file)  
 /etc/gmetad.conf (Ganglia configuration file)

**List of all log files (with full path):****List of LCFG configuration objects (and versions):****List of daemons provided:**

gmond (Ganglia monitoring daemon, installed on all machines)  
 gmetad (Ganglia Meta-daemon, installed on CEs)

**List of init.d scripts and supported directives (start, stop, restart, etc.):**

gmond {start|stop|restart|status}  
 gmetad {start|stop|restart|status}

**Deployment:****Affected machine types (UI, WN, CE, SE, etc) and packages to be deployed on each:**

CE - cg-wp3.2-gmdat-sensor-CE-1.1-1.noarch.rpm  
 WN,SE - cg-wp3.2-gmdat-sensor-WN-1.1-1.noarch.rpm

**Component dependencies (required libraries, packages, etc.):**

ganglia-monitor-core-gmond-2.5.3-1  
 ganglia-monitor-core-gmeta-2.5.3-1 (only on CE)  
 iptables  
 rrdtool (only on CE)

**Credentials (if any) used by the service:****List of service ports (inbound,outbound):**

8651,8649 (tcp, both outbound, both only on CE)

**Who communicates with the service and from where:**

Central Monitoring Host (grid.fuw.edu.pl)

**Range of temporary ports used by the service (inbound,outbound):****Testing and Validation:**

**Unit tests that have been performed on the package:**

The package has been installed and tested on two clusters in Warsaw (ICM and INS)

**Features to be tested:**

- installation of the RPMS (after installation the name of the CE must be reported to [nawrocki@fuw.edu.pl](mailto:nawrocki@fuw.edu.pl) or [apadee@fuw.edu.pl](mailto:apadee@fuw.edu.pl))
- After addition to the Central Monitoring Host the metrics available on the CMH test page should be checked
- clean deinstallation of the RPMS

**Features not to be tested:**

Test programs  
download URL: <http://grid.fuw.edu.pl/cgi-bin/grid.pl>

**Other considerations:**

Ganglia packages should be installed before installation of sensors. Their proper versions can be found at <ftp://ftp.sourceforge.net/pub/sourceforge/ganglia/>  
Rrdtool can be downloaded from <http://atrpms.physik.fu-berlin.de/dist/rh73/rrdtool/>

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