Exporting GANESHA's statistics with SNMP

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GANESHA is able to export its internal statistics so that an administrator can browse them using the SNMP protocol. It also provides a client for easily broswing its SNMP tree in a convivial and human understandable way.

This document describes the requirements for this feature (libraries needed, SNMPd configuration...) and how to enable and configure it in GANESHA NFSD.

1 Requirements

SNMP support in GANESHA is based on the Net-SNMP library. This is a free implementation of SNMP that comes with most Linux distributions. It can also be retrieved from `http://net-snmp.sourceforge.net`.

GANESHA's SNMP support has been validated with Net-SNMP v5.1.4. However, Net-SNMP v5.4 or higher is recommended.

Install the following packages on the machine where you are compiling and running GANESHA NFSD:

- *net-snmp* contains the snmpd and snmptrapd daemons ;
- *net-snmp-utils* contains various utilities for snmp ;
- *net-snmp-perl* contains the perl API ;
- *net-snmp-devel* contains the development libraries and header files.

Note that the net-snmp library needs symbols defined in *lm-sensors* and *openssl* libraries, so you will also need to install *lm-sensors-devel* and *openssl-devel* packages on your system.

For using the SNMP client tool `snmp_adm` provided with GANESHA, you will also need the following perl modules:

- *SNMP*[1] provided by the *net-snmp-perl* RedHat's package
- *XML::DOM*[2] for XML outputs.

[1] `http://search.cpan.org/ gsm/SNMP-5.0400001/SNMP.pm`
[2] `http://search.cpan.org/ tjmather/XML-DOM-1.44/lib/XML/DOM.pm`

- *Getopt::Std*[3] to parse command line options.
- *Config::General*[4] to parse config file
- *SNMP::Trapinfo*[5] to manage SNMP traps.

2 SNMPd setup

GANESHA does not handle SNMP requests directly. Actually, it registers its SNMP sub-tree on a SNMPd daemon, using an extention of the SNMP protocol called *AgentX*.

The SNMPd daemon that exports GANESHA's SNMP tree can be located on the same host, but it can also run on a remote management station.

For activating agentX extension, add the following line to your SNMPd configuration file (default location is `/etc/snmp/snmpd.conf`):

```
master agentx
```

You must then specify a way to communicate with GANESHA:

- if it runs on the same host, you can use a socket file. In this case, add the following line to SNMPd configuration file `/etc/snmp/snmpd.conf`:

  ```
  AgentXSocket <path to the socket file>

  E.g:
  AgentXSocket /var/tmp/agentx/sock_file
  ```

- In any case (local or remote SNMPd), you can also use a standard socket connection:

  ```
  AgentXSocket <protocol>[:<network interface address>]:<port number>

  E.g:
  # listening on a single network interface
  AgentXSocket tcp:192.168.0.42:761

  # listening on all network interfaces
  AgentXSocket tcp:761
  ```

  Note that the AgentX default port number is 705.

[3] `http://search.cpan.org/ nwclark/perl-5.8.8/lib/Getopt/Std.pm`
[4] `http://search.cpan.org/ tlinden/Config-General-2.33/General.pm`
[5] `http://search.cpan.org/ tonvoon/SNMP-Trapinfo-1.0/lib/SNMP/Trapinfo.pm`

Your SNMPd is now ready for exporting GANESHA statistics. Restart it after you changed its configuration file.

Note: if you want to restrict the access of GANESHA's SNMP subtree, refer to the snmpd documentation about *views*, *groups*, *SNMPv2 communities*, and *SNMPv3 authentication*.

3 Enabling SNMP support in GANESHA

3.1 Compilation

By default, GANESHA is compiled without SNMP support. To enable this feature, add `-enable-snmp-adm` argument to the `configure` command line.

E.g:
```
./configure --with-fsal=FUSE --enable-snmp-adm
```

3.2 Configuration

A specific section of GANESHA's configuration file is dedicated to SNMP options. This block must be labelized with the `SNMP_ADM` tag.

It must include the following parameters:

- **snmp_agentx_socket**: the socket file or the network interface for communicating with SNMPd (as it appears in the SNMPd configuration file).
- **product_id**: this number must be unique for each instance of GANESHA you are exporting with the same SNMPd.
- **snmp_adm_log**: The log file for SNMP related logs.
- **export_cache_stats**: indicates if cache stats are exported.
- **export_requests_stats**: indicates if NFS requests stats are exported.
- **export_maps_stats**: indicates if UID/GID map stats are exported.
- **export_buddy_stats**: indicates if memory usage stats are exported.
- **export_nfs_calls_detail**: indicates if detailled stats about NFS calls are exported.
- **export_cache_inode_calls_detail**: indicates if detailled stats about metadata cache calls are exported.
- **export_fsal_calls_detail**: indicates if detailled stats about filesystem calls are exported.

E.g:

```
SNMP_ADM
{
    snmp_agentx_socket = "tcp:localhost:761";
    product_id = 2;
    snmp_adm_log = "/var/log/ganesha/snmp_adm.log";

    export_cache_stats    = TRUE;
    export_requests_stats = TRUE;
    export_maps_stats     = FALSE;
    export_buddy_stats    = TRUE;

    export_nfs_calls_detail = FALSE;
    export_cache_inode_calls_detail = FALSE;
    export_fsal_calls_detail = FALSE;
}
```

4 Browsing GANESHA's SNMP tree

4.1 Tree description

The SNMP tree of GANESHA is located under this OID:

`.iso.org.dod.internet.private.enterprise.cea.snmp-admin.<product_id>`

where `product_id` is the value you specified in GANESHA's config file. If some MIBs are missing, you can however access the tree with the numeric OID:

`.1.3.6.1.4.1.12384.999.<product_id>`

The product subtree is planned to be divided in tree parts:

- `<product_root>.0` contains dynamic statistics of the NFSD;
- `<product_root>.1` contains configuration values;
- `<product_root>.2` contains special OIDs for executing administrative actions on the daemon (flushing cache, ...).

At this time, only the first subtree (`<product_root>.0`) is exported.

GANESHA's SNMP tree is self-descriptive and it can be understood without any specific MIB installed on your system.

Thus, each exported value `<i>` is described by the following OIDs:

- `<product_root>.0.<i>.0` contains the name of the variable
- `<product_root>.0.<i>.1` contains the description of it

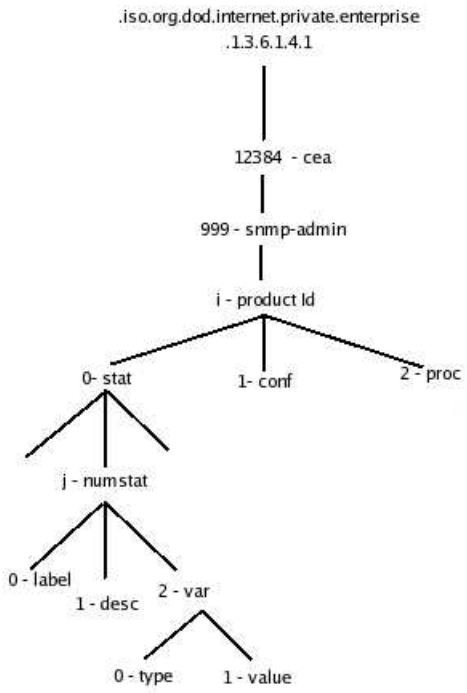

Figure 1: GANESHA's SNMP tree

- `<product_root>.0.<i>.2.0` is the type of the variable[6].
- `<product_root>.0.<i>.2.1` contains the value.

This tree is represented in the figure 1.

Example of `snmp_walk` on a GANESHA variable:

```
> snmpwalk -v 2c -c public localhost  .1.3.6.1.4.1.12384.999.2.0.4
SNMPv2-SMI::enterprises.12384.999.2.0.4.0 = STRING: "cache_nb_entries"
SNMPv2-SMI::enterprises.12384.999.2.0.4.1 = STRING: "number of entries in cache"
SNMPv2-SMI::enterprises.12384.999.2.0.4.2.0 = STRING: "INTEGER"
SNMPv2-SMI::enterprises.12384.999.2.0.4.2.1 = INTEGER: 51
```

4.2 Using the SNMP client provided with GANESHA

Even if GANESHA statistics can be browsed using standard SNMP commands (`snmp_get`, `snmp_walk`...), GANESHA comes with a SNMP client tool (`snmp_adm`)

[6]This is mainly unsed for handling 64 bits integers. Indeed, as SNMP doesn't support them, we return them as a string but this field will indicate they must be interpreted as integers.

for easily browsing those stats in a convivial way, without having to handle OIDs, and all SNMP relative stuff.

It is located in the 'snmp_adm/client' directory of GANESHA's distribution, and is also available in GANESHA RPMs that include SNMP support.

4.2.1 snmp_adm client configuration file

If you're bored of typing OIDs, SNMP version, community name and all that stuff, just create a .snmp_adm.conf file in your home (with mode 600) with the following lines inside:

```
host       <snmpd_address>[:<snmpd_port>]
product_id <the product id of your favorite NFS server>

#if you are using SNMPv3 protocol, also specify the following information:
# password for authentication
auth_pass "password"
# password for encoding
enc_pass "password"
# user name
sec_name "snmpadm"
```

4.2.2 SNMP relative options

If you don't want to use a configuration file, or if you want to overwrite the values it specifies, you can indicate them on snmp_adm command line:

```
SNMP relative options:

  -s <host>[:port] : the host where SNMP server is running
      (default is localhost)
  -p <product_id|product_name> : the deamon to be queried
      (default is the first product of server's admin tree)
  -C <community>: Community name for SNMPv2c (default is public).
  -A <auth>: authentication for SNMPv3.
  -X <pass>: password for SNMPv3.
  -u <secname>: security name for SNMPv3.
  -f <path>: path to the configuration file.
```

4.2.3 snmp_adm commands

The main command you will use is 'snmp_adm liststat'. When used without options, it only displays the list of available variables. When used with '-d' it displays the description of each variable. When used with '-v' it displays the values of variables. You can also specify an expression, so only the variables whose name contains this expression will be displayed.

E.g:

```
> ./snmp_adm -v liststat cache

Statistics for product_id=2:
name                          type       value

cache_nb_gc_lru_active         INTEGER    176
cache_nb_gc_lru_total          INTEGER    432
cache_nb_call_total            INTEGER    25323
cache_nb_entries               INTEGER    5176
cache_min_rbt_num_node         INTEGER    32
cache_max_rbt_num_node         INTEGER    37
cache_avg_rbt_num_node         INTEGER    34
cache_nbset                    INTEGER    5465
cache_nbtest                   INTEGER    0
cache_nbget                    INTEGER    6243
cache_nbdel                    INTEGER    132
```