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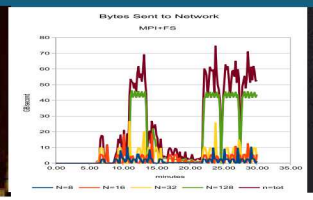
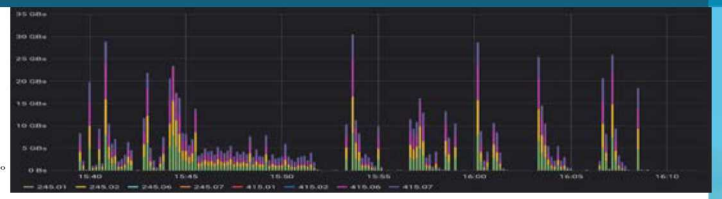
Production LDMS, genders, systemd, and the future





LDMSCON 2020

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Outline

- A little background
- What it takes to run ldmsd in production
- Goals of the genders-based systemd implementation
- What is genders?
- Example of samplers configuration
- Examples of aggregators
- How to do the hard things: trap doors
- What it doesn’t do yet
- What shall we do about these?

A detailed LDMS v3 systemd/genders case

- https://github.com/baallan/distribution/blob/master/gendersTutorial.md
- Only the highlights today
- The genders configuration for LDMS has not been demonstrated in CLE6/7 yet because until recently, genders library packages were not readily available from Cray. (Kevin Stroup resolved this for Sandia machines)
- LDMSD must be built with “--enable-libgenders --enable-genderssystemd”

Running LDMSD in production

- It is a system service supporting multiple instances
  - ldmsd (sampling daemon)
  - ldmsd@agg (aggregator daemon, level one)
  - ldmsd@$CLUSTER (aggregator per cluster on level two host(s))

- Should be easy to find out how it was last started (even after dead)
  - Capture in/var/run/ldmsd files:
    - daemon configuration file.
    - daemon environment.
    - daemon command line.

- Changing the configuration to enable/disable basic features should be simple i.e. ***declarative***: add a feature to a list, defaults do the rest.

Goals for the genders-based systemd scripts

- Provide automatically:
  - Default behavior for stores, samplers, transport, aggregation.
  - All information possible for diagnosis (whether live or dead).
  - Escape hatches: BYO LDMSD configuration scripting if you do not use genders.
    - We still need ldmsd@.service to handle multiple instances.
  - DRY configuration (don't repeat yourself).
    - Defining an aggregator or storage daemon should not require repeating what was written for upstream sampler daemons (unless exceptions to defaults are needed).
  - Valgrind support in production (as root)
- For administrators:
  - minimize learning of the "ldmsd programming language".
  - minimize configuration changes across across updates.
  - Everything should "just work" in common cases.

What is genders?

- It’s a file format and a library for defining and querying two-level hash tables
  - Typically, the first level of the hash table is unqualified hostname, eg. chama3
  - The second level is attribute/value pairs with specific syntax: values cannot contain whitespace or comma.
  - The attribute syntax can be mapped to ldmsd plugin configuration language “key1=value1 key2=value2,value3,value4” (though it is not beautiful)
  - Attribute meaning is entirely up to application
- e.g.

  ch[1-1232],chgw[1-24] ldmsd,ldmsd_port=411,ldmsd_xprt=sock

  chgw[1-24] ldmsd_metric_plugins=meminfo:vmstat:lnet_stat

  chadmin7 ldmsd_dbg=DEBUG,ldmsd_log=//localdisk/ldmsd/log

Sampler configuration example

```
/etc/sysconfig/ldms.d/ldmsd.local.conf                  # environment: ldmsd
/etc/sysconfig/ldms.d/ClusterGenders/genders.local      # genders
```

```
h1 ldmsd                                                # enable ldms
h1 ldmsd_metric_plugins=meminfo:vmstat:procstat         # list wanted
h1 ldmsd_host=%n-ib0,ldmsd_xprt=rdma                    # net link
```

Defaulted:

interval (10 second), offset (0), producer name logged ($host), schema name (plugin name), instance name ($host/$schema), port(411), component_id(from $host), log, auth method.

Sampler node ldmsd.local.conf

```
LDMS_AUTH_FILE=/etc/sysconfig/ldms.d/ClusterSecrets/ldmsauth.conf
LDMS_GENDERS=/etc/sysconfig/ldms.d/ClusterGenders/genders.local
```

Defines pointers to the files for this systemd instance of ldmsd

- ldmsd.service is in code exactly as ldmsd@local.service

L1 Aggregator configuration example

/etc/sysconfig/ldms.d/ldmsd.L1.conf # environment: ldmsd@L1
/etc/sysconfig/ldms.d/ClusterGenders/genders.L1 # genders for L1

ser[1-187],sergw[1-3],serln1 ldmsd_clientof=seradmin1
ser[188-374],sergw[4-6],serln2 ldmsd_clientof=seradmin2
seradmin[1-2] ldmsaggd=CLIENTOFLIST

Defaulted:

updater policy(all), connection retry interval(2s), agg. interval (10s), agg. offset (0.2 sec), port(411), log, connection definitions, thread count, memory reservation.

Looked up in genders.local (DRY):

transport types, hostnames and ports (374 times).

Aggregator node ldmsd.L1.conf

```
LDMS_AUTH_FILE=/etc/sysconfig/ldms.d/ClusterSecrets/ldmsauth.conf
LDMS_GENDERS=/etc/sysconfig/ldms.d/ClusterGenders/genders.L1
LDMS_GENDERS_1=/etc/sysconfig/ldms.d/ClusterGenders/genders.local
```

Defines pointers to the files for this systemd instance of ldmsd@L1

- Information lookups on genders in $LDMS_GENDERS_1 tell are used to determine connection details for the producer list.

L2 Store configuration example

/etc/sysconfig/ldms.d/ldmsd.L2.conf # environment: ldmsd@L2

/etc/sysconfig/ldms.d/ClusterGenders/genders.L2 # genders for L2

```
mon1 ldmsaggd_offset_default=4200000
mon1 ldmsd_store_plugins=store_csv
mon1 ldmsd_store_csv=altheader/1:rolltype/2:rollover/0:path//scratch_A/${LDMSCLUSTER}_csv:
create_gid/1000000039:create_perm/644:typeheader/2
mon1 ldmsd_schemas_store_csv=meminfo:procstat:vmstat
```

Defaulted:

updater policy(all), connection retry interval(2s), agg. interval (10s), port(411), log, connection definitions, storage policies.

Looked up in genders.L1: transport types, hostnames, and ports.

L2 storage node ldmsd.L2.conf

```
LDMS_AUTH_FILE=/etc/sysconfig/ldms.d/ClusterSecrets/ldmsauth.conf
LDMS_GENDERS=/etc/sysconfig/ldms.d/ClusterGenders/genders.L2
LDMS_GENDERS_1=/etc/sysconfig/ldms.d/ClusterGenders/genders.L1
```

Defines pointers to the files for this systemd instance of ldmsd@L2

- Information lookups on genders in $LDMS_GENDERS_1 tell are used to determine connection details for the producer list.

Doing hard things (1): Scaling & Redundancy

- Redundancy
  - Milly (monitoring host) defines same ldmsd instances as mon1

- Scaling to a supercomputing center with many clusters
  - Mon1 (monitoring host) defines several service instances
    - ldmsd@chama, ldmsd@uno, ldmsd@skybridge, ldmsd@eclipse,... CSV feeds
    - ldmsd@eclipse_Grafana GUI feed

Doing hard things (2): no-genders trap door

- Not using genders database at all?
- ldmsd.local.conf becomes:

```
LDMS_USE_GENDERS=0
LDMSD_PLUGIN_CONFIG_FILE=/etc/ldmsd/ldmsd.local.conf
```

Doing hard things (3): avoid long attributes

- One plugin is just too complex to configure using only genders syntax?
- Use the genders trap door for the plugins:

```
mon1 ldmsd_config_text_store_csv=/etc/ldmsd/csv_config
```

The file csv_config has your ldms plugin special options code:

```
altheader=1 rolltype=2 rollover=0 \
path=/scratch_A/${LDMSCLUSTER}_csv \
create_gid=1000000039 create_perm=644 \
typeheader=2
```

which gets added to the configuration.

Doing hard things (4): complex plugin trap door

- One plugin is just too complex to configure using only genders syntax?
- Use the genders trap door for a configuration generator:

mon1 ldmsd_config_gen_mysampler=mysampler_gen.sh

Program /etc/sysconfig/ldms.d/plugins-conf/mysampler_gen.sh is called with arguments:

$plugin $producer $host $interval $offset

and the output gets added to the configuration.

Dealing with change (v4)

The genders interpreter ***does*** have support for new plugins

- New options and new store/sampler plugins are handled transparently.
- Environment expansion ${VAR} in attributes is handled transparently.
- Plugins all act as singletons, which makes attribute naming easy.

But ***does not yet*** support

- Failover definitions.
- Transport set group definitions.
- Multiple updaters.
- Automatic interval and offset management.
- Push behavior
- Passive mode connections

Dealing with change (v5)

- All plugins changing from singleton objects to potentially many similar instances of “C classes”.
  - Some might still restrict themselves to singleton behavior.
  - Some might have ‘plugins within plugins’ depending on the instance API.
  - Two-layer hash table is likely not a good match for this.

- Still developing what new ldmsd features we will get.
  - Maybe include ***hostlist expansion*** in the ldmsd configuration language to provide for compact expression of aggregation, update, failover.

What shall we do about unsupported v4 features?

- Extending genders processing is a ‘mere matter of scripting’.
  - It requires sensible answers to:

    What should the default behavior be for feature X?
  - Naming the attributes can get a bit messy, however. E.g. now have:
    - ldmsd_strgp_exclude_metrics_meminfo
- Should we refactor the gender interpreter to do less (nothing?), and lean more on a directory full of files that look like .INI/YAML/TOML?
  - This would break compatibility with v2/v3 genders support.
  - This would break the “single file for tuning ldmsd” approach.

Thoughts?

- Share them here
- Post them on the ovis issue tracker
- See also: Chris Morrone's Lively Discussion
  - https://github.com/ovis-hpc/ovis/issues/67

  and
  - https://github.com/ovis-hpc/ovis/wiki/Proposal-2