altair Ellexus Mistral Live system Telemetry monitoring User Manual

Ellexus Mistral Live system Telemetry monitoring User Manual

Contents

Introduction

Mistral is a tool used to report on and resolve I/O performance issues when running complex Linux applications on high-performance compute clusters.
Mistral allows you to monitor application I/O patterns in real-time, and log undesirable behavior using rules defined in a configuration file called a contract.

Installation

Extract the Mistral product archive that has been provided to you somewhere sensible. Please make sure that you use the appropriate version of Mistral (32 or 64bit) for the machine you want to run it on.
Mistral requires a license, please contact Altair if you do not already have a valid Mistral license.
The environment variable MISTRAL_LICENSE must be set to the location of your license, which can be one of:

1. <server>:<port> for your network Altair license server.
2. The pathname of a specific license file, for a legacy Ellexus license file.
3. The pathname of a directory that contains one or more legacy Ellexus license files.

Mistral will attempt to detect the installation directory correctly on start up however some job schedulers, e.g. Univa Grid Engine, use a spool directory that can break this detection. In this case, the environment variable MISTRAL_INSTALL_DIRECTORY must be set to the directory used for installation.
There are two flavors of Mistral, designed to be used with either /bin/bash or /bin/[t]csh as interpreter.
If Mistral is intended to be used with a job scheduler all required environment variables must be available in all interactive and non-interactive shells. It is recommended that global environment variable settings be added to /etc/bashrc or /etc/cshrc and individual user settings to the user's .bashrc or .cshrc file.

Configuring Mistral

Configuring contract and log locations

Mistral determines what events to log and/or throttle by using contract files. Mistral uses two types of contracts, local and global.
This enables administrators to define global settings for the entire system while also allowing for the creation of tuned settings for specific workloads. The following environment variables configure the locations Mistral uses for contract and log files.
It is not necessary to configure both global and local contracts but at least one valid contract/log pair must be defined. When testing it may be preferable to just use one contract, either local or global, for simplicity.

MISTRAL_CONTRACT_MONITOR_GLOBAL	The path of the global monitoring contract file.
MISTRAL_CONTRACT_MONITOR_LOCAL	The path of the local monitoring contract file.
MISTRAL_CONTRACT_THROTTLE_GLOBAL	The path of the global throttling contract file.
MISTRAL_CONTRACT_THROTTLE_LOCAL	The path of the local throttling contract file.
MISTRAL_LOG_MONITOR_GLOBAL	The path of the file in which Mistral will log violations of global contract rules.
MISTRAL_LOG_MONITOR_LOCAL	The path of the file in which Mistral will log violations of local contract rules.
MISTRAL_LOG_THROTTLE_GLOBAL	The path of the file in which Mistral will log throttling events triggered by a violation of a global contract rule.
MISTRAL_LOG_THROTTLE_LOCAL	The path of the file in which Mistral will log throttling events triggered by a violation of a local contract rule.
MISTRAL_TRAFFIC_LIGHT_LOG	The path of the file in which Mistral will log traffic light numbers at the end of a run.
MISTRAL_TRAFFIC_LIGHT_PER_PROCESS	1: Log per-process traffic light entries. Unset – don't log per-process traffic light entries (default).

Contract specification

Contracts are configuration files that specify I/O limits for a process. This section describes the syntax and semantics of contract files.
If any monitoring rule limit is exceeded a log message is output indicating which process broke the limit and by how much.
If a throttling rule limit is exceeded a log message is output indicating the process that contributed most to breaking the limit and all job processes are rate limited until the job falls within the defined rule.

Contract Header

The first line of the file specifies the contract type and the time frame in the format <VERSION>,<CONTRACT-

TYPE>,<TIMEFRAME-PERIOD>,<TIMEFRAME- UNIT> where:
VERSION is the contract format version number which must be 2 for this release of Mistral;
CONTRACT-TYPE is either monitor timeframes or throttle time frame;
TIMEFRAME-PERIOD is the length of the time frame for all rules in this contract, specified as an integer, followed by; TIMEFRAME-UNIT which must be ms for milliseconds or s for seconds.
For example:
2, monitor timeframes, 15s 3.2.2 Comment Lines and Whitespace Blank lines and lines starting with # are ignored and can be used for adding comments to a contract file.
Whitespace is permitted before or after any item in a contract file.

Contract Rules
Each remaining line specifies a rule in the format
<LABEL>, <PATH>, <CALL-TYPE>, <SIZE-RANGE>, <MEASUREMENT>, <THRESHOLD>, <UNIT> where:
LABEL is the name of this rule. It appears in log entries related to this rule. It is an arbitrary string of the letters a-z (in lower or upper case), the digits 0-9, the underline character ("_"), or a hyphen ("-").
PATH is an absolute file system path representing a file system mount point. The rule applies to function calls that do I/O on the device mounted on this path. Mistral de- references all relative paths and symbolic links therefore this path must be fully resolved. If the path is not a mount point, the rule will use the mount point which contains the path. So if /home is a mount point then a rule using /home/Lexus would be treated as if /home had been specified.
A path that starts with a mount: can match a number of mount points. For example mount:/* matches all mount points, while mount:/home/* would match /home and any mount points "under" home. (Some mount points, such as those within /proc and /sys, are excluded from the mount: matching process, but can still be specified as absolute file system paths. I/O within a "bind mount" is reported as I/O on the original file system.)
Mistral can be configured to treat an arbitrary directory as a mount point by creating a text file with a series of absolute paths, one per line, and setting the environment variable MISTRAL_VOLUMES to point to this file.
CALL-TYPE is the set of call types to which the rule applies. It must specify one or more of these call types:

access	Calls that access file system metadata (stat, reading, etc.).
create	Calls that create new files (open, create, media, etc.).
delete	Calls that delete files (remove, rmdir, unlink, etc.).
change	Calls that update file system metadata (Richmond, rename, etc.).
open	Calls that open existing files (open, open, opendir, etc.).
read	Calls that read data from the file system (read, fgets, map, readdir, recv, scanf, etc.).
seek	Calls that update the current position within a file (seek, seek, rewind, etc.).
write	Calls that write data to the file system (write, error, print, put, send, warn, etc.).

When a rule applies to multiple call types, join them with + signs. For example, read+write matches calls that either read or write data.
SIZE-RANGE specifies the range of sizes that match this rule. A size range may only be specified for rules with any combination of the call types read, write, and seek (other types of call have no associated size). A size range is specified in the format: <SIZE-MIN><SIZE-MIN-UNIT>-<SIZE-LIMIT><SIZE-LIMIT-UNIT> meaning that a matching size must be at least SIZE-MIN but lower than SIZE-LIMIT. The SIZE-MIN-UNIT and SIZELIMIT-UNIT are the corresponding units, and must be one of the following:

- B Bytes
- kB Kilobytes (1,000 bytes)
- kiB Kibibytes (1,024 bytes)
- MB Megabytes (1,000,000 bytes)

- MiB Mebibytes (1,048,576 bytes)
- GB Gigabytes (1,000,000,000 bytes)
- GB Gibibytes (1,073,741,824 bytes)

For example, a size range of 1kB-4kB matches reads (or writes) with a size greater than or equal to 1000 and less than 4000.
(Note the asymmetric bounds: these make it easier to specify non-overlapping ranges.)
<SIZE-MIN><SIZE-MIN-UNIT> may be omitted, in which case the value 0 is used.
<SIZE-LIMIT><SIZE-LIMIT-UNIT> may be omitted, in which case there is no upper limit.

If a rule is to apply to all of the specified operations regardless of size, or size is not applicable to one or more of the call types specified in the rule this field must be set to all.
MEASUREMENT is the type of data being measured. The list of valid measurement types differs between monitoring throttling rules. For monitoring rules it must be one of:

bandwidth	Amount of data processed by calls of the specified type in the time frame. This applies only to r ead and write calls.
count	The number of calls of the specified type in the time frame.
max-latency	The maximum duration of any call of the specified type in the time frame. See the Latency Sam pling section.
mean-latency	The mean duration of any call of the specified type in the time frame, provided the number of calls is higher than the value of MISTRAL_MONITOR_LATENCY_MIN_IO. See the Latency Sa mpling section.
total-latency	The total duration of time spent in calls of the specified type in the time frame, provided the nu mber of calls is higher than the value of MISTRAL_MONITOR_LATENCY_MIN_IO. See the Lat ency Sampling section.
memory	The amount of memory used by the job. This is the total of the Resident Set Size (RSS) of the i ndividual processes. Note that if the application uses shared memory then the actual memory consumption could be much less than the sum of the RSS for each process.
memory-RSS	Same as memory.
memory-size	The amount of memory used by the job. This is the total of the Virtual Memory Size (VM Size) o f the individual processes. Note that if the application uses shared memory then the actual memory consumption could be much less than the sum of the VM Size for each process.
user-time	The amount of CPU time used by the job while executing user code.
system-time	The amount of CPU time used by the job while executing system code.
CPU-time	The amount of CPU time used by the job while executing either user or system code.
host-cpu-use r-time	The amount of CPU time used by the host while executing user code.
host-CPU-sy stem-time	The amount of CPU time used by the host while executing system code.
host-CPU-wa it-time	The amount of CPU time used by the host while waiting for I/O oprations to complete.

For processing the following resource rules: memory, memory-loss, memory size, user-time, system-time, and CPU time, Mistral takes measurements once per second, so if the time frame is shorter than this, then results for these rules will not be logged in every time frame. For processing the following resource rules: host-CPU-user-time, host-CPU- system time, and host-CPU-wait-time, Mistral takes measurements at the end of every timeframe and at the end of Mistral execution.
For all resource rules, the PATH, CALL-TYPE, and SIZE-RANGE fields should be left blank. For example memory-size-rule,,,, memory-size, 0MB user-time-rule,,,,user- time,0ms host-CPU-system-time rule,,,,host-CPU-system-time,0ms
For the following CPU time rules: user-time, system-time, and cpu-time, the time measurements are accumulated across all cores for the job under monitoring, so the reported measurements may be longer than the time frame if you are running on a multi-core host.
For the host CPU time rules: host-cpu-user-time, host-cpu-system-time, and host-CPU-wait-time, the time measurements include all the processes running on the host, whether or not they are monitored by Mistral.
For throttling rules, the only valid measurements are bandwidth, count, total latency, user time, system time, and CPU time as described above.
THRESHOLD is the limit for this rule. If the measured data exceeds THRESHOLD in TIMEFRAME, then the violation is logged.
Monitoring contracts allow 0 and throttling contracts allow 1 as the lowest limit.
UNIT is the unit for THRESHOLD. When MEASUREMENT is bandwidth, memory, memory-loss, or memory size this must be one of:

- B Bytes
- kB Kilobytes (1,000 bytes)
- kiB Kibibytes (1,024 bytes)
- MB Megabytes (1,000,000 bytes)
- MiB Mebibytes (1,048,576 bytes)
- GB Gigabytes (1,000,000,000 bytes)
- GB Gibibytes (1,073,741,824 bytes)

When MEASUREMENT ends with -latency or -time, this must be one of:

- us Microseconds
- ms Milliseconds
- s Seconds

When MEASUREMENT is counted, this must be one of:

- blank Exact number of calls
- k Thousands of calls
- M Millions of calls

For example:
red, /mnt/net/abc, write, all, bandwidth, 100MB

Monitoring rules
Monitoring rules within the same contract are grouped by PATH, CALL-TYPE, and MEASUREMENT. If multiple rules in a group have been violated simultaneously, only the rule with the highest THRESHOLD is logged.
For example, consider the contract:

monitor timeframes, 1s

#LABEL,	PATH,	CALL-TYPE,	SIZE-RANGE,	MEASUREMENT,	THRESHOLD
Red,	/mnt/net/abc,	write,	all,	bandwidth,	1MB
Yellow,	/mnt/net/abc,	write,	all,	bandwidth,	10MB
Green,	/mnt/net/abc,	write,	all,	bandwidth,	10kB
#Black,	/mnt/net/abc,	write,	all,	bandwidth,	1kB

If the application writes more than 10 kB/s to the device mounted at /mnt/net/abc the Green rule is violated and logged. If it writes more than 1 MB/s the Green and Red rules are violated but only the Red rule is logged. If it writes more than 10 MB/s to the device the Red, Yellow, and Green rule all match, but only the Yellow rule is logged. The Black rule is never logged because it has been commented out with "#".

Latency Sampling

Latency measurements incur a larger processing overhead than simple count or bandwidth operations. Such measurements are also subject to greater variability in value. To limit the impact of these problems Mistral implements measurement sampling on any latency rules defined in a monitoring contract.
Latency sampling is controlled by two environment variables.

MISTRAL_MONITOR_LATENCY_SAMPLE MISTRAL_MONITOR_LATENCY_MAX_IO	The sampling factor. If set to n, Mistral will randomly choose whether to measure the latency of a particular I/O operation with probability 1/n. If set to 1 then the latency of all I/O operations will be measured. Defaults to 10. The maximum number of I/O operations of a particular type that will have their latency measured in a single time frame. Defaults to 1000.

The MISTRAL_MONITOR_LATENCY_MAX_IO is applied individually to each CALL-TYPE class. For example, assuming the default configuration, if a program makes 20000 reads and 3000 writes in a single time frame, Mistral will measure the latency of 1000 of the reads and about 300 of the writes.
Note that total-latency rules estimate the total latency based on the latency of the sampled I/O operations. So if there were 20000 read operations in a single time frame of which 1000 were sampled, a total-latency rule would report a value that is twenty times the sum of the measured latencies.

Adjusting contracts

It is possible to update contracts for running jobs. It can be particularly useful to increase thresholds to prevent excessive logging. How this is done differs between global and local contracts.
Global contracts are assumed to be configured with high "system threatening" rules that should not be frequently changed.
These contracts are intended to be maintained by system administrators and will be polled approximately once a minute for changes on disk.
Local contracts can be updated dynamically during a job execution run by the use of an updated plug-in. Using an updated plug-in is the only way to modify the local contracts in use by a running job. If an update plug-in configuration is not defined Mistral will use the same local configuration contracts throughout the life of the job.
Please see the Plug-ins section for details on the configuration and use of plug-ins.

Log Entries

Log entries are output in the following format:
<TIME-STAMP>,<LABEL>,<PATH>,<FS-TYPE>,<FS-NAME>,<FS-HOST>,<CALL-TYPE>,<SIZE-RANGE>, <MEASUREMENT>,<MEASURED- DATA>/<TIMEFRAME>,<THRESHOLD>/<TIMEFRAME>, <HOSTNAME>, <PID>,<CPU>,<COMMAND-LINE>,<EMPTY>, <JOB-GROUP-ID>,<JOB-ID>, <MPI-WORLD-RANK>,<ZERO>
Where the field definitions are as follows:
<TIME-STAMP> is either the end of the time frame where the violation occurred (monitoring contract) or when the first rule was violated in the current time frame (throttling contract). The time-stamp is in ISO 8601 format with microsecond precision (YYYY-MM-DDThh:mm: ss. ffffff).

<LABEL> is copied from the violated rule.
<PATH> is the mount point that contains the path that caused <MEASURED-DATA> to exceed <THRESHOLD>. For process resource rules (memory, memory-rss, memory-size, user-time, system-time, , cpu-time, host-cpu-user-time, host-cpu-user-time, and host-cpu-wait-time) this is not relevant and is given as /.
<FS-TYPE> is the filesystem type of <PATH>. It is empty for resource rules. <FS-NAME> is the so-called filesystem “name” of <PATH>, typically a device name or an NFS HOST: PATH specification. This is empty for resource rules.
<FS-HOST> is the hostname part of <FS-NAME>, if present. It is empty for resource rules.
<CALL-TYPE> is copied from the violated rule. This field is not relevant for process resource rules but is given as none.
<SIZE-RANGE> is copied from the violated rule. This field is not relevant for process resource rules, but if such a rule is violated the size range will be given as all.
<MEASUREMENT> is copied from the violated rule.
<MEASURED-DATA> is the data rate of the job that exceeded the limit.
<THRESHOLD> is copied from the violated rule.
<TIMEFRAME> is copied from the violated rule.
<HOSTNAME> is the name of the host on which the rule was violated. The hostname includes the domain name.
<PID> is the id of the process in the job that performed the most I/O that contributed to violating the rule.

<CPU> is the number of the CPU on which the process (PID) was running. If the process was multi-threaded, this is the CPU on which the thread that violated the rule was running. If a process resource rule is violated then this field will be given as 0.
<COMMAND-LINE> is the full path name and arguments of the program that performed the most I/O that contributed to violating the rule. It includes the parameters for the execution.
‘’ is a field that is always empty. In earlier versions of Mistral, this contained an affected filename, which is now omitted for efficiency.
<JOB-GROUP-ID> is the job group identifier for the job group that violated the rule.
<JOB-ID> is the job identifier for the job that violated the rule.
The <MPI-WORLD-RANK> field is always zero.
The <ZERO> field is always zero. In earlier versions of Mistral, backtraces could be recorded, and this field could contain the index of a backtrace. That feature was dropped for efficiency.

Example Log Entries
The following is an example of a rule violation log entry: 2020-01-30T14:30.108355,red,/mnt/net/abc,nfs4,server17.local:/nfs/abc,
server17.local,write,all,bandwidth,102MB/15s,1MB/15s,foo.bar.com,1234, 1,/mnt/tool/bin/abc -d -e,,5,5,,0
Although violated throttling rules will cause Mistral to slow the I/O operation of all processes within a job, any I/O operation that is already in progress when throttling is applied will complete without any modification by Mistral.
As a result, the I/O rate measured may still exceed the defined limit even under throttling. The actual I/O rate that was achieved when applying the throttle is output in the MEASURED-DATA field.

Traffic Light Log
Traffic light mode is disabled by default under Mistral. It can be enabled by setting MISTRAL_TRAFFIC_LIGHT_LOG. Mistral will collect aggregated statistics about the type of I/O that was performed. This has been split into three categories, good (green), medium (yellow), and bad (red).
By default, only per-job entries are logged. Per-process entries are logged if MISTRAL_TRAFFIC_LIGHT_PER_PROCESS=1 environment variable has been set.

Traffic Light Log format
Log entries are output in the following format with one entry per job:
<TIME-STAMP>,<RUN-TIME>,<IO-TIME>,<%IO-TIME>,<IO-CALLS>, <RED-TIME>,<%RED-TIME>,<RED-CALLS>,<%RED-CALLS>, <YELLOW- TIME>,<%YELLOW-TIME>,<YELLOW-CALLS>,<%YELLOW-CALLS>, <GREEN-TIME>,<%GREEN-TIME>,<GREEN-CALLS>,<%GREEN-CALLS>, <JOB- GROUP-ID>,<JOB-ID>
Where the field definitions are as follows:
<TIME-STAMP>Time when this log entry was created. We use ISO 8601 format with microsecond precision: YYYY-MMDDThh:mm:ss. ffffff <RUN-TIME>
Wallclock runtime of this job (μs).

<IO-TIME> Time spent doing I/O calls (µs).
<%IO-TIME> % of runtime that was spent on I/O.
<IO-CALLS> Total number of I/O calls.
<RED-TIME> Time spent doing bad I/O (µs).
<%RED-TIME> % of total I/O time that is bad I/O.
<RED-CALLS> Number of bad I/O calls.
<%RED-CALLS> % of total I/O calls that are bad I/O.
<YELLOW-TIME> Time spend doing medium I/O (µs).
<%YELLOW-TIME> % of total I/O time that is medium I/O.
<YELLOW-CALLS> Number of medium I/O calls.
<%YELLOW-CALLS> % of total I/O calls that are medium I/O.
<GREEN-TIME> Time spent doing good I/O (µs).
<%GREEN-TIME> % of total I/O time that is good I/O.
<GREEN-CALLS> Number of good I/O calls.
<%GREEN-CALLS> % of total I/O calls that are good I/O.
<JOB-GROUP-ID> Job group identifier.
<JOB-ID> Job identifier.

How red, yellow, and green percentages are calculated
Each I/O call has a duration measured in microseconds. Once the call is categorized under bad, medium, or good I/O, we accumulate the call duration to get the time spent in red, yellow, and green I/O operations. In addition, we need to measure the total time the application spent doing I/O. The percentages are then simply calculated as:

- % Red time = (Time spent in bad I/O ops) / (Total time spent in I/O ops)
- % Yellow time = (Time spent in medium I/O ops) / (Total time spent in I/O ops)
- % Green time = (Time spent in good I/O ops) / (Total time spent in I/O ops)

We don't calculate the percentages against the total wallclock runtime, because the application spends time also doing CPU-intensive tasks, memory I/O, synchronization (locks), sleeping, etc.
In a similar fashion, we calculate the percentages using call counts:

- % Red calls = (Number of bad I/O calls) / (Total I/O calls)
- % Yellow calls = (Number of medium I/O calls) / (Total I/O calls)
- % Green calls = (Number of good I/O calls) / (Total I/O calls)

We log the total time spent in I/O ops, which is:

- Total time spent in I/O ops = Red time + Yellow time + Green time and similarly for the total number of I/O calls:
- Total number of I/O calls = Red calls + Yellow calls + Green calls
- We also log how much of the total running time was spent in I/O:
- % I/O Time = (Total time spent in I/O ops) / (Total wallclock runtime)
  For multi-threaded processes, the times and call counts are accumulated from each thread. Therefore the total time spent in I/O may be greater than the total wallclock runtime, and equally % I/O Time may be greater than 100%.

Rules for Bad I/O
Definition of bad I/O:

- Small reads or writes.

- Opens for files where nothing was written or read.
- Stats that succeeded on files that were not used.
- Failed I/O.
- Backward seeks.
- Trawls of failed I/O where we include the whole time from the first fail to the last fail or the first success of the same type.
- Zero seeks, reads, and writes.
- Failed network I/O.

Rules for medium I/O
Definition of medium I/O:

- Opens for files from which less than N bytes were read or written.
- Stats of files that were used later.
- Forward seeks.

Rules for good I/O
Definition of good I/O:

- Reads and writes greater than MISTRAL_PROFILE_SMALL_IO
- Opens for files from which at least MISTRAL_PROFILE_SMALL_IO bytes were read or written.
- Successful network I/O.

Monitoring an application

Once Mistral has been configured it can be run using the mistral script available at the top level of the installation. To monitor an application you just type mistral followed by your command and arguments. For example:
$ ./mistral ls -l $HOME
By default, any error messages produced by Mistral will be written to a file named mistral.log in the current working directory.
Any errors that prevent the job from running as expected, such as a malformed command line, will also be output to stderr.
This behaviour can be changed by the following command line options.
–log= < filename >
-l= < filename >
Record Mistral error messages in the specified file. If this option is not set, errors will be written to a file named mistral.log in the current working directory. -q Quiet mode. Send all error messages, regardless of severity, to the error log. Command line options are processed in order, therefore this option must be specified first to ensure any errors parsing command line options are sent to the error log.

Example contracts

Monitoring Contract
Consider the following contract:

#LABEL,	PATH,	CALL-TYPE,	SIZE-RANGE,	MEASUREMENT,	THRESHOLD
High_reads,	/usr/,	read,	all,	bandwidth,	1MB
Higher_reads,	/usr/,	read,	all,	bandwidth,	5MB
Even_higher_reads,/usr/,	usr/,	read,	all,	bandwidth,	50MB
High_create_lat,	/tmp/,	create,	all,	mean-latency,	mean-latency, 10ms
High_num_w,	/home/,	write,	all,	count,	750

2, monitortimeframe, 1s
This line identifies the contract as containing monitoring rules that are applied over a time frame of 1 second.
High_reads, /usr/, read, all, bandwidth, 1MB
Assuming that /usr/ is a mount point, this line defines a rule named " High_reads" and tells Mistral to generate an alert when the total amount of data read from /usr/ exceeds 1 MB within the one-second time frame.
If a monitored process were to read a 2 MB file in /usr/share/doc/ in less than a second, for example, this rule would be violated and a log message of the following form would be output:
2020-07-30T14:30.108355,High_reads,/usr,ext4,/dev/nvme0n1p5,,read,all,
bandwidth,2MB/1s,1MB/1s,foo.bar.com,15392,0,/mnt/tool/bin/python script.py, ,3,6,,0

Higher_reads, /usr/, read, all, bandwidth, 5MB
Even_higher_reads, /usr/, read, all, bandwidth, 50MB
These two lines define two additional rules named Higher_reads and Even_higher_reads respectively.
All reads in /usr/ will be tested against all three rules.
If a process read 60MB of data in less than 1 second all three currently defined rules would be violated, but only the third rule would be logged. This is because Mistral only logs the largest threshold violated when multiple rules are defined on the same path, call-type, and measurement as is the case with the High_reads and Higher_reads_bin rules: 2020-07-30T14:30.108529,Even_higher_reads,/usr,ext4,/dev/nvme0n1p5,,read,all, bandwidth,60MB/1s,50MB/1s,foo.bar.com,15392,0,/bin/bash script.sh, ,3,6,,0

High_create_lat, /tmp/, create, all, mean-latency, 10ms
The rule labeled High_create_lat is only concerned with function calls that create file system objects (create) under /tmp/, which is assumed to be a mount point. In this case the latency of each call made during the time frame is accumulated and averaged over the total number of these calls, provided the number of calls within the time frame is higher than the value of MISTRAL_MONITOR_LATENCY_MIN_IO.

If at the end of the time frame this mean-latency is higher than 10ms then a log message will be output, for example:
2020-07-30T15:10.108650,High_create_lat,/tmp,,,,create,all,mean-latency,
22ms,10ms,foo.bar.com,15537,1,/bin/bash script.sh,,3,6,,0
High_num_w, /home/, write, all, count, 750

The rule labeled High_num_w is violated if the number of write calls in a time frame exceeds 750.
2020-07-30T15:10.108669,High_num_w,/home,nfs4,server25.local:/nfs/home,
server25.local,read,all,,write,all,count,863,750,foo.bar.com,15537,1, /bin/bash script.sh,,3,6,,0

Throttling Contract

Consider the following contract:
2, throttletimeframe, 1s

#LABEL,	PATH,	CALL-TYPE,	SIZE-RANGE,	MEASUREMENT,	ALLOWED
High_reads,	/usr/,	read,	all,	bandwidth,	5MB
Moderate_reads,	Moderate_reads, /usr/,	read,	all,	bandwidth,	1MB
High_num_r,	/home/,	read,	all,	count,	750

Examining each line individually:
2, throttle time frame, 1s
This line identifies the contract as containing throttling rules that are applied over a time frame of 1 second.
High_reads, /usr/, read, all, bandwidth, 5MB
If a monitored job were to try and read a 6MB file in /usr/share/doc/ in less than a second, for example, this rule would be violated. When Mistral identifies an I/O operation that would violate a throttling rule it will introduce a sleep long enough to bring the observed I/O back down to the configured limit and a log message of the following form will be output: 2020-07-30T14:30.108355, High_reads,/usr,ext4,/dev/nvme0n1p5,, read, all, bandwidth, 1MB/1s,1MB/1s, foo.bar.com,15392,0,/mnt/tool/bin/python script.py, 3,6,,0

Moderate_reads, /usr/, read, all, bandwidth, 1MB
The second rule in this contract is very similar to the first. Again it is monitoring read bandwidth but this time will allow up to 1MB of data to be read before the rule is violated.
In this case, all reads in /usr/ will be tested against both the " High_reads and Moderate_reads rules.
If the process attempted to read 6MB of data in less than 1 second both the currently defined rules would be violated. In this case, the most restrictive rule applies and the process will be throttled to 1MB/1s, and up to 6 log messages generated by violations of the Moderate_reads rule will be logged.

High_num_r, /home/, read, all, count, 750
The third rule does not care about how large each operation is, it is simply interested in the total number of times a call is made to a read operation. If a total of more than 750 read operations are performed within the time frame of 1 second on the device mounted at /home/ then on the 751st read Mistral would introduce a sleep long enough to bring the data rate under 750/1s and a log message of the following form would be logged:
2020-07-30T16:45.108469,High_num_r,/home,nfs4,server25.local:/nfs/home,
750/1s,750/1s,foo.bar.com,16601,1,/usr/lib64/firefox/firefox, ,1,1,,0

Plug-ins
Currently, two different plug-ins are supported.

Update Plug-in
The updated plug-in is used to modify local Mistral configuration contracts dynamically during a job execution run according to conditions on the node and/or cluster. Using an updated plug-in is the only way to modify the local contracts in use by a running job.
Global contracts are assumed to be configured with high "system threatening" rules that should not be frequently changed.
hese contracts are intended to be maintained by system administrators and will be polled periodically for changes on disk as described above. Global contracts cannot be modified by the update plug-in in any way.
If an update plug-in configuration is not defined Mistral will use the same local configuration contracts throughout the life of the job.

Output Plug-in
The output plug-in is used to record alerts generated by the Mistral application. All event alerts raised against any contract (local or global, monitoring or throttling) are sent to the output plug-in.
If an output plug-in configuration is not defined Mistral will default to recording alerts to disk as described above. In addition, if an output plug-in performs an unclean exit during a job Mistral will revert to recording alerts to a log file. This log file will use the log record format expected by the plug-in to allow for simpler recovery of the data at a

later date.

Data rate

When setting up an output plug-in it makes sense to consider the rate at which Mistral can be configured to output data. The amount of data output is dependent on your configuration, for sizing the database we recommend the following calculation:

Each record has a maximum size of 4kB – this can be reduced by excluding fields.

Most rules are applied per mount point and can output data once per time frame.

(4kB * Active Mount Points * Number of Rules) / Time frame = Data per Second

Plug-in Configuration

On start up Mistral will check the environment variable MISTRAL_PLUGIN_CONFIG. If this environment variable is defined it must point to a file that the user running the application can read. If the environment variable is not defined Mistral will assume that no plug-ins are required and will use the default behaviors as described above.

When using plug-ins, at the end of a job Mistral will wait for a short time, by default 30 seconds, for all plug-ins in use to exit in order to help prevent data loss. If any plug-in processes are still active at the end of this timeout they will be killed. The timeout can be altered by setting the environment variable MISTRAL_PLUGIN_EXIT_TIMEOUT to an integer value between 0 and 86400 that specifies the required time in seconds.

The expected format of the configuration file consists of one block of configuration lines for each configured plug-in. Each line is a comma-separated pair of a single configuration option directive and its value. Whitespace is treated as significant in this file. The full specification for a plug-in configuration block is as follows:

PLUGIN,<OUTPUT|UPDATE>INTERVAL,<Calling interval in seconds> PLUGIN_PATH,<Fully specified path to plug-in> [PLUGIN_OPTION,<Option to pass to plug-in>] …END

PLUGIN directive

The PLUGIN directive can take one of only two values, UPDATE or OUTPUT which indicates the type of plug-in being configured.

If multiple configuration blocks are defined for the same plug-in the values specified in the later block will take precedence.

INTERVAL directive

The INTERVAL directive takes a single integer value parameter. This value represents the time in seconds the Mistral application will wait between calls to the specified plug-in.

PLUGIN_PATH directive

The PLUGIN_PATH directive value must be the fully qualified path to the plug-in to be run e.g. /home/ellexus/bin/output_plugin.sh.

This plug-in must be executable by the user that starts the Mistral application. The plug-in must also be available in the same location on all possible execution host nodes where Mistral is expected to run.

The PLUGIN_PATH value will be passed to /bin/sh for environment variable expansion at the start of each execution host job.

PLUGIN_OPTION directive

The PLUGIN_OPTION directive is optional and can occur multiple times. Each PLUGIN_OPTION directive is treated as a separate command line argument to the plug-in. Whitespace is respected in these values.

As whitespace is respected command line options that take parameters must be specified as separate PLUGIN_OPTION values.

For example, if the plug-in uses the option “–output /dir/name/” to specify where to store its output then this must be specified in the plug-in configuration file as: PLUGIN_OPTION,–output

PLUGIN_OPTION,/dir/name/Options will be passed to the plug-in in the order in which they are defined.

Each PLUGIN_OPTION value will be passed to /bin/sh for environment variable expansion at the start of each execution host job.

END Directive

The END directive indicates the end of a configuration block and does not take any values.

Invalid Configuration
Blank lines and lines starting with "#" are silently ignored. All other lines that do not begin with one of the configuration directives defined above cause a warning to be raised.

Example Configuration
Consider the following configuration file; line numbers have been added for clarity:

 # File version: 2.9.3.2, modification date: 2016-06-17 2
PLUGIN,OUTPUT
INTERVAL,300
PLUGIN_PATH,/home/ellexus/bin/output_plugin.sh
PLUGIN_OPTION,–output
PLUGIN_OPTION,/home/ellexus/log files
END 9
PLUGIN,UPDATE
INTERVAL,60
PLUGIN_PATH, $HOME /bin/update_plugin
END
The configuration file above sets up both update and output plug-ins.
Lines 1-2 are ignored as comments. The first configuration block (lines 3-8) defines an output plug-in (line 3) that will be called every 300 seconds (line 4) using the command line /home/ellexus/bin/output_plugin.sh –output "/home/ellexus/log files" (lines 5-7). The configuration block is terminated on line 8.
The blank line is ignored (line 9).
The second configuration block (lines 10-13) defines an updated plug-in (line 10) that will be called every 60 seconds (line 11) using the command line /home/ellexus/bin/update_plugin, (line 12), assuming $HOME is set to /home/ellexus. The configuration block is terminated on line 13.

Scheduler Integration

IBM Spectrum LSF
Launcher script
Create a script that defines the required environment variables and any default settings, for example #!/bin/bash INSTALL= /apps/ellexus export MISTRAL_INSTALL_DIRECTORY=${INSTALL} /mistral_latest_x86_64 export MISTRAL_LICENSE=${ALTAIR_LICENSE_SERVER} :6200
This script hard codes a simple global contract but the
following lines can be replaced with whatever business
logic is required to set up an appropriate contract for
the submitted job.
export MISTRAL_CONTRACT_MONITOR_GLOBAL=${INSTALL} /global.contract export MISTRAL_LOG_MONITOR_GLOBAL=${INSTALL} /global- ${HOSTNAME} .log # Set up the Mistral environment. As we are doing this # automatically on LSF queues set Mistral to only manually # insert itself in is and ssh commands to other nodes. source ${MISTRAL_INSTALL_DIRECTORY} /mistral –remote=rsh, ssh This script should be saved in an area accessible to all execution nodes.

Define a Job Starter
For each queue that is required to automatically wrap jobs with Mistral add a JOB_STARTER setting that re-writes the command to launch the submitted job using the script created above. For example, if the script above has been saved in /apps/ellexus/mistral_launcher.sh the following code defines a simple queue that will use it to wrap all jobs with Mistral:

 # Mistral job starter queue
Begin Queue
QUEUE_NAME = mistral
PRIORITY = 30
INTERACTIVE = NO
TASKLIMIT = 5

JOB_STARTER = . /apps/ellexus/mistral_launcher.sh ; %USRCMD
DESCRIPTION = For mistral demo
End Queue

Once the job starter configuration has been added the queues must be reconfigured by running the command: $ admin config
To check if the configuration has been successfully applied to the queue the queues command can be used with the " -l" long format option which will list any job starter configured, e.g. $ queues -l mistral

QUEUE: mistral
— For mistral demo
PARAMETERS/STATISTICS
PRIO NICE STATUS MAX JL/U JL/P JL/H NJOBS PEND RUN SSUSP USURP RSV 30 0 Open:Active – – – – 0 0 0 0 0 0
Interval for a host to accept two jobs is 0 seconds TASKLIMIT 5
SCHEDULING PARAMETERS
r15s r1m r15m ut pg io ls it tmp swp mem loadSched – – – – – – – – – – – loadStop – – – – – – – – – – –
SCHEDULING
POLICIES: NO_INTERACTIVE
USERS: all
HOSTS: all
JOB_STARTER: . /apps/ellexus/mistral_launcher.sh ; %USRCMD

OpenLava
Launcher script
Create a script that defines the required environment variables and any default settings, for example: #!/bin/bash INSTALL= /apps/ellexus
export MISTRAL_INSTALL_DIRECTORY=${INSTALL} /mistral_latest_x86_64 export MISTRAL_LICENSE=${ALTAIR_LICENSE_SERVER} :6200
This script hard codes a simple global contract but the
following lines can be replaced with whatever business
logic is required to set up an appropriate contract for
the submitted job.
export MISTRAL_CONTRACT_MONITOR_GLOBAL=${INSTALL} /global.contract export MISTRAL_LOG_MONITOR_GLOBAL=${INSTALL} /global- ${HOSTNAME} .log # Set up the Mistral environment. As we are doing this automatically
on OpenLava queues set Mistral to only manually insert itself
in rsh and ssh commands to other nodes. source ${MISTRAL_INSTALL_DIRECTORY} /mistral –remote=rsh,ssh
This script should be saved in an area accessible to all execution nodes.

Define a Job Starter
For each queue that is required to automatically wrap jobs with Mistral add a JOB_STARTER setting that re-writes the command to launch the submitted job using the script created above.
For example, if the script above has been saved in /apps/ellexus/mistral_launcher.sh the following code defines a simple queue that will use it to wrap all jobs with Mistral:

 # Mistral job starter queue
Begin Queue
QUEUE_NAME = mistral
PRIORITY = 30
INTERACTIVE = NO
JOB_STARTER = . /apps/ellexus/mistral_launcher.sh ; %USRCMD
DESCRIPTION = For mistral demo
End Queue

Once the job starter configuration has been added the queues must be reconfigured by running the command: $

badmin reconfig
To check if the configuration has been successfully applied to the queue the queues command can be used with the " -l" long format option which will list any job starter configured, e.g. $ queues -l mistral
QUEUE: mistral
— For mistral demo
PARAMETERS/STATISTICS
PRIO NICE STATUS MAX JL/U JL/P JL/H NJOBS PEND RUN SSUSP USUSP RSV
30 0 Open:Active – – – – 0 0 0 0 0 0
Interval for a host to accept two jobs is 0 seconds
SCHEDULING PARAMETERS
r15s r1m r15m ut pg io ls it tmp swp mem loadSched – – – – – – – – – – loadStop – – – – – – – – – – SCHEDULING
POLICIES: NO_INTERACTIVE
USERS: all users
HOSTS: all hosts used by the OpenLava system
JOB_STARTER: . /apps/ellexus/mistral_launcher.sh ; %USRCMD

Univa Grid Engine
Launcher script
Create a script that defines the required environment variables and any default settings, for example: #!/bin/bash
# This script should be saved in an area accessible to all
# execution nodes and added as a starter_method to each
# queue that requires Mistral.
INSTALL= /apps/ellexus
export MISTRAL_INSTALL_DIRECTORY=${INSTALL} /mistral_latest_x86_64 export MISTRAL_LICENSE=${ALTAIR_LICENSE_SERVER} :6200
This script hard codes a simple global contract but the
following lines can be replaced with whatever business
logic is required to set up an appropriate contract
for the submitted job.
export MISTRAL_CONTRACT_MONITOR_GLOBAL=${INSTALL} /global.contract export MISTRAL_LOG_MONITOR_GLOBAL=${INSTALL} /global-%h.log # Set the shell we need to use to invoke the submitted command shell=${SGE_STARTER_SHELL_PATH:- /bin/sh } if [! -x $shell]; then
Assume that if the check failed $shell was not
set to /bin/sh shell= /bin/sh fi shell_name=$(basename $shell) if [" ${shell_name: -3} " = "csh"]; then suffix= .csh fi
Check if a login shell is required if [" $SGE_STARTER_USE_LOGIN_SHELL " = "true"]; then logopt= "-l" else logopt= "" fi
Wrap the job with Mistral. As we are doing this automatically
on UGE queues set Mistral to only manually insert itself in
rsh and ssh commands to other nodes. exec ${logopt} ${shell} " ${MISTRAL_INSTALL_DIRECTORY} /mistral $suffix " –remote=rsh,ssh " $@ "

This will launch the default editor (either vi or the editor indicated by the EDITOR environment variable). Find the setting for starter_method and replace the current value, typically " NONE", with the path to the launcher script. Save the configuration and exit the editor. For example, the following snippet of queue configuration shows the appropriate setting to use the file described above.

epilog NONE
shell_start_mode unix_behavior
starter_method /home/ellexus/ugedemo/launch.sh
suspend_method NONE
resume_method NONE

It is important to note that a starter_method will not be invoked for qsh, login, or qrsh acting as login, and as a result, these jobs will not be wrapped by Mistral.
To check if the configuration has been successfully applied to the conf command can be used with the -sq option

to show the full queue configuration which will list any starter method configured, e.g.

$ qconf -sq mistral.q qname mistral.q hostlist @allhosts seq_no 0 load_thresholds np_load_av g=1.75 suspend_thresholds NONE nsuspend 1 suspend_interval 00:05:00 priority 0 min_cpu_interval 00:05:00 qtype BATCH INTERACTIV E ckpt_list NONE pe_list make jc_list NO_JC,ANY_JC rerun FALSE slots 1 tmpdir /tmp shell /bin/bash prolog NONE epilog NONE shell_start_mode unix_beha vior starter_method /home/ellexus/ugedemo/laun ch.sh suspend_method NONE resume_method NONE terminate_method NONE notify 00:00:60	owner_list NONE user_lists NONE xuser_lists NONE subordinate_list NONE complex_values NONE projects NONE xprojects NONE calendar NONE initial_state default s_rt INFINITY h_rt INFINITY d_rt INFINITY s_cpu INFINITY h_cpu INFINITY s_fsize INFINITY h_fsize INFINITY s_data INFINITY h_data INFINITY s_stack INFINITY h_stack INFINITY s_core INFINITY h_core INFINITY s_rss INFINITY h_rss INFINITY s_vmem INFINITY h_vmem INFINITY

Slurm

TaskProlog script

Create a Slurm TaskProlog script that prints out the required environment variables and any default settings, for example: #!/bin/bash

INSTALL= /apps/ellexus
MISTRAL_INSTALL_DIRECTORY=${INSTALL} /mistral_latest_x86_64
echo “export MISTRAL_INSTALL_DIRECTORY= $MISTRAL_INSTALL_DIRECTORY ”
Setup the license echo “export MISTRAL_LICENSE= ${ALTAIR_LICENSE_SERVER} :6200”
Disable remote tracing; Singularity is always monitored echo “export ELLEXUS_REMOTE=singularity”
Slurm has a mechanism which sends the environment variables from

the submission node to the execution nodes. We want Mistral to have
a fresh start on each execution node.
echo “unset ELLEXUS_ONETIME_SETUP_DONE”
echo “unset ELLEXUS_OUTPUT_DIRECTORY”
echo “unset ELLEXUS_ROOT_OUTPUT_DIRECTORY”
This script hard codes a simple global contract but the following
lines can be replaced with whatever business logic is required to
set up an appropriate contract for the submitted job.
echo “export MISTRAL_CONTRACT_MONITOR_GLOBAL= ${INSTALL} /global.contract”
echo “export MISTRAL_LOG_MONITOR_GLOBAL= ${INSTALL} /global-%h.log”
# This script sets the Mistral temporary directory. This only needs
# to be set if the slurm installation uses cgroups.
# This should be the same path as in the TaskEpilog script.
ELLEXUS_OUTPUT_DIRECTORY= “/tmp/mistral. ${USER} . ${SLURM_JOB_ID} ” if [[-n ” ${SLURM_ARRAY_TASK_ID} ”]] ; then
ELLEXUS_OUTPUT_DIRECTORY= ” ${ELLEXUS_OUTPUT_DIRECTORY} . ${SLURM_ARRAY_TASK_ID} ” fi if [[-n ” ${SLURM_STEP_ID} ”]] ; then
ELLEXUS_OUTPUT_DIRECTORY= ” ${ELLEXUS_OUTPUT_DIRECTORY} _ ${SLURM_STEP_ID} ” fi mkdir ” ${ELLEXUS_OUTPUT_DIRECTORY} ” echo “export ELLEXUS_OUTPUT_DIRECTORY= ${ELLEXUS_OUTPUT_DIRECTORY} ” # Finally, set LD_PRELOAD echo “export LD_PRELOAD= ${MISTRAL_INSTALL_DIRECTORY} /dryrun/ \$ LIB/libdryrun.so” This script should be saved in an area accessible to all execution nodes.

TaskEpilog Script

If Islam is set to use groups, it is necessary to create a Slurm TaskEpilog script that signals to Mistral that the job is finished before the cgroup kills the task. For example:

#!/bin/bash
# This script should be saved in an area accessible to all
# execution nodes and set as the TaskEpilog script in the
# slurm.conf file. This is only needed if slurm is configured
# to use cgroups to track processes.
# If Mistral is still running there will be a PID identifier file
# This path must match ELLEXUS_OUTPUT_DIRECTORY set in the TaskProlog
ELLEXUS_OUTPUT_DIRECTORY= “/tmp/mistral. ${USER} . ${SLURM_JOB_ID} ”
if [[-n ” ${SLURM_ARRAY_TASK_ID} ”]] ; then
ELLEXUS_OUTPUT_DIRECTORY= ” ${ELLEXUS_OUTPUT_DIRECTORY} . ${SLURM_ARRAY_TASK_ID} ” fi if [[-n ” ${SLURM_STEP_ID} ”]] ; then
ELLEXUS_OUTPUT_DIRECTORY= ” ${ELLEXUS_OUTPUT_DIRECTORY} _ ${SLURM_STEP_ID} ” fi
MONITOR_PID_FILE= ` ls ” ${ELLEXUS_OUTPUT_DIRECTORY} ” /tmp/monitor_pid_* 2> /dev/null ` if [[-f ” $MONITOR_PID_FILE ”]] ; then
# File exists get PID from the end of the file name MONITOR_PID=${MONITOR_PID_FILE## *_ }
# Send SIGTERM to Mistral, so that the final timeframe of data
# is writen before the cgroup is Killed by SIGKILL kill -TERM $MONITOR_PID 2> /dev/null while kill -0 $MONITOR_PID 2> /dev/null ; do
# Wait unil the monitor has actually finished sleep 0.3 done fi

Update Slurm configuration

Configure Slurm to use the above TaskProlog and TaskEpilog scripts by adding the following lines in your slurm. conf file: TaskProlog=/path/to/mistral/task prolog.sh TaskEpilog=/path/to/mistral/taskepilog.sh, Each execution host requires the same TaskProlog setting. Finally, instruct all Slurm daemons to re-read the configuration file: $ control reconfigure Now all jobs submitted with batch, run, and allow commands use Mistral.

Running Mistral on a Specific Partition

Rather than running Mistral on all jobs, Mistral can be configured to run only on specific Partitions. Simply surround the examples in task prolog script and task epilog script with an if statement comparing the $SLURM_JOB_PARTITION variable, for example:

#!/bin/bash
if [" $SLURM_JOB_PARTITION " == “mistral”]; then INSTALL= /apps/ellexus
MISTRAL_INSTALL_DIRECTORY=${INSTALL} /mistral_latest_x86_64 …
The Slurm configuration should then be updated as in the Update Slurm configuration.
Any jobs submitted on the ‘mistral’ partition will now run under mistral.

PBS Professional

Hook script

Create a PBS hook script (python) that inserts the required environment variables and any default settings into the job’s environment.
For example create a script called hook.py that contains:

```
import socket
import PBS
pbsevent = pbs.event()
jobname = pbsevent.job.queue.name
if jobname == “demo” ;
install_dir = “/home/users/ellexus/mistral_latest_x86_64/”
config_dir = “/home/users/ellexus/pbsconfig/”
pbsevent.env[ “MISTRAL_INSTALL_DIRECTORY” ] = install_dir
pbsevent.env[ “MISTRAL_LICENSE” ] = < server > : < port >
pbsevent.env[ “MISTRAL_CONTRACT_MONITOR_GLOBAL” ] = config_dir + “global.contract”
host = socket.gethostname()
pbsevent.env[ “MISTRAL_LOG_MONITOR_GLOBAL” ] = config_dir + “global-” + host + “.log”
pbsevent.env[ “MISTRAL_PLUGIN_CONFIG” ] = config_dir + “output_plugin.conf”
pbsevent.env[ “LD_PRELOAD” ] = install_dir + “dryrun/$LIB/libdryrun.so”
```

This script should be saved in an area accessible to all execution nodes.
Now the hook needs to be setup. Create a hook named “job_starter” (can use any name) and import it:

```
$ qmgr -c “create hook job_starter event=execjob_launch”
$ qmgr -c “import hook job_starter application/x-python default /path/to/hook.py”
```

Now all jobs submitted with qsub use Mistral.
Note: Every time the hook script is modified, it needs to be “imported” again using the
$ qmgr -c “import hook …” command above.

Altair Accelerator & Flowtracer

The MISTRAL_BYPASS_PROGRAMS environment variable can be used to avoid tracing I/O which originates in Altair Accelerator & Flowtracer while still recording I/O caused by Accelerator & Flowtracer jobs.
If the MISTRAL_BYPASS_PROGRAMS environment variable is set to list of programs and directories, then any program which matches an entry in the list will be run in bypass mode. For example, export MISTRAL_BYPASS_PROGRAMS=”emacs,/usr/local/”, would run emacs and any program in /usr/local/, or a sub-directory such as /usr/local/bin, in bypass mode. If MISTRAL_BYPASS_PROGRAMS is set to the parent directory of VOVDIR, all programs in the Accelerator or Flowtracer installation will run in bypass mode.
If more control over the process is needed, you can take advantage of the fact that both Accelerator and Flowtracer can set user-specified environment variables when they run jobs. Since Breeze and Mistral can be started by setting appropriate environment variables, this provides a basic mechanism for tracing such jobs without having to trace the accelerator or flow tracer infrastructure.

Accelerator

Following a similar approach to the PBS hook, you can create an environment for mistral which just sets the version. Then create another special environment file called MISTRAL.pre.TCL actually sets all the relevant variables for the job.

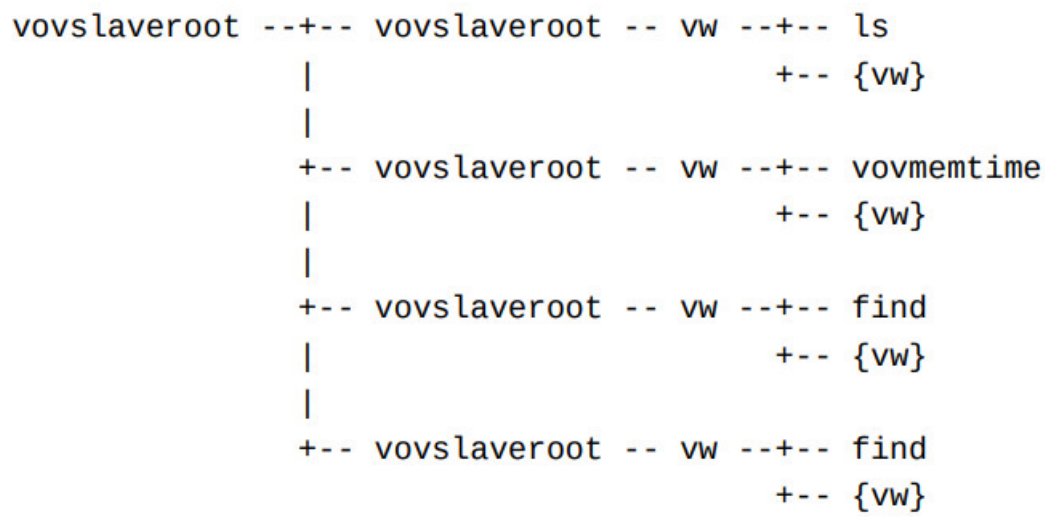
```
$ cat MISTRAL.pre.tcl
setenv MISTRAL_LICENSE <server>:<port>
setenv MISTRAL_PLUGIN_CONFIG /path/to/mistral_tests/elastic_plugin.conf
setenv MISTRAL_CONTRACT_MONITOR_GLOBAL /path/to/ellexus/pbsconfig/monitoring.kitchensink.contract
setenv MISTRAL_LOG_MONITOR_GLOBAL /path/to/ellexus/pbsconfig/monitoring.kitchensink.contract%h.log
setenv
LD_PRELOAD /path/to/ellexus/ellexus/mistral_2.13.6_x86_64/dryrun/\$LIB/libdryrun.so $
```

To use this, you submit the job with a command such as… nc run -e SNAPSHOT+MISTRAL — myJob

You could put all the mistral environment variables in SNAPSHOT.pre.tcl, but having a separate environment is slightly clearer.

Flowtracer

If the variable VOV_ENV directory is set to $VOVDIR/local/mistral/environments then any SNAPSHOT/SNAPPROP, the noninteractive job can automatically activate Mistral monitoring.
This can be done at job submission or by the administrator by setting the variable dynamically in a compute host (vovslavemgr config -setenv VOV_ENV_DIR=…).
Host-based enablement is likely to be the lowest impact. It can also be done centrally (**setup.TCL**). It also takes effect immediately whereas anything that is job submission based will on impact new jobs and conversely roll back is difficult because of queued jobs carrying the variable.
A typical calling sequence for a single compute host, here running 4 jobs, looks something like this:



The first vovslaveroot runs as root. The second is the forked version that has setuid to the user and can be thought of as the entry point to the user's job. Vw is a binary wrapper that does many magic things.
The triggering script is called in the first 'vw' – it runs a tcl intpreter on the code below and then captures the results environment array. This environ is then used in the exec of the job. This approach requires 'vw', which means that interactive jobs cannot be monitored in this way
The triggering script should be something like: if [info exists env(VOV_JOBID)] { if { [info exists env(ELLEXUS_ONETIME_SETUP_DONE)] == 0} { setenv ELLEXUS_JOB_ID $env(VOV_JOBID) catch {setenv ELLEXUS_JOB_GROUP_ID [exec vovselect jobclass from $env(VOV_JOBID)]} # add/change this list for alternative locations foreach d [list $env(VOVDIR)/local/mistral/current] { if {[file isfile $d/mistral] == 1} { setenv MISTRAL_HAVE $d/mistral setenv MISTRAL_INSTALL_DIRECTORY [file normalize $d] # arbitrary but the way we have it for the evaluation setenv MISTRAL_LICENSE "<server>:<port>" set INSTALL "[file dirname $env(MISTRAL_INSTALL_DIRECTORY)]" vovenvDebug "Mistral is in $env(MISTRAL_INSTALL_DIRECTORY)"

possibly from the user's environment or passed in as argument to MISTRAL env
if [info exists MISTRAL_CONTRACT] {setenv MISTRAL_CONTRACT_MONITOR_GLOBAL env(MISTRAL_INSTALL_DIRECTORY)/monitoring.${MISTRAL_CONTRACT}.contract } else { setenv MISTRAL_CONTRACT_MONITOR_GLOBAL $env(MISTRAL_INSTALL_DIRECTORY)/samples/monitoring.kitchensink.contract } setenv MISTRAL_LOG_MONITOR_GLOBAL $env(VNCSWD)/$env(VOV_PROJECT_NAME).swd/logs/mistral/global%h.log setenv MISTRAL_PLUGIN_CONFIG ${INSTALL}/**elastic_plugin.config** vovenvDebug "MISTRAL: Contract: $env(MISTRAL_CONTRACT_MONITOR_GLOBAL) with plugin $env(MISTRAL_PLUGIN_CONFIG)" # Finally, set LD_PRELOAD
setenv LD_PRELOAD $env(MISTRAL_INSTALL_DIRECTORY)/dryrun/\$LIB/libdryrun.so vovenvDebug "MISTRAL: LD preloader: $env(LD_PRELOAD)" } else { vovenvDebug "MISTRAL: Already have Mistral monitoring"

Container Support

Singularity
Mistral will monitor workloads in Singularity containers by default. This will add a number of bind paths to each singularity container so that Mistral is able to read the configuration files and run the executables that it normally would. If these files are all in one area of your filesystem you can minimize the number of paths that are bound by setting the following environment variable to that path:
MISTRAL_SINGULARITY_BIND_PATH
Docker
Mistral does not currently monitor workloads in Docker containers by default – this feature is planned for a future release.

Mistral Healthcheck

If you are running Mistral on a small scale, for instance, to test the functionality, it can sometimes be useful to log data to disk and then process the log file(s) that it produces.
There are scripts and tools for doing this in the tools directory. There is a master script in this directory mistral_report.sh, which creates separate CSV files for the different rules, GNUplot graphs, and an HTML report.

mistral_report.sh
This script expects the path (or paths) to Mistral log files. Optionally you can also specify an output directory with the -o argument.
e.g. $ tools/mistral_report.sh -o /tmp/mistral.out /tmp/job1.mistral.log
This will generate the HTML report, CSV files and GNUPlot graphs. To omit the CSV files and GNUPlot graphs supply the -n option.
Mistral Healthcheck Reports
The Mistral Healthcheck report works best with the supplied monitoring. kitchen sink. contract, as this contains rules that populate specific sections of the report.
When the tools/mistral_report.the sh script is run it will create the Healthcheck HTML file mistral_report.html and output the location of the file. This is the main report file and has links to all the other data. The other data is split by rule type into different HTML files.

Documents / Resources

	altair Ellexus Mistral Live system Telemetry monitoring [pdf] User Manual Ellexus Mistral Live system Telemetry monitoring, Live system Telemetry monitoring, Telemetry monitoring

References

- launch.sh
- Loading...
- 8086