Moira

Release 2.3

Dec 26, 2018

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CHAPTER 1

Contents

1.1 Overview

Moira is a real-time alerting tool, based on Graphite data.

1.1.1 Key Features

- **Graphite storage independence**

  Some Graphite queries are *very* ineffective. Tools like Seyren multiply this effect every minute making lots of ineffective queries and overloading your cluster. Moira relies on the incoming metric stream, and has its own fast cache for recent data.

- **Support for (almost) all Graphite functions**

  Graphite function library (carbonapi) is embedded directly into Moira source code. You can use any function and get predictable results, like in your Graphite or Grafana dashboards.

- **Support for custom expressions**

  If simple warning/error threshold is not enough, you can write flexible govaluate expressions to calculate trigger state based on metric data.

- **Tags for triggers and subscriptions**

  When several teams/services share one monitoring tool, it is essential to provide some way of filtering triggers and subscriptions in the UI. Moira has a flexible tag system.

- **Extendable notification channels**

  Moira supports email, Slack, Pushover and many other channels of notification out-of-the-box. But you can always write your own plugin in Go and rebuild Moira Notifier microservice.

- **Alarm fatigue protection**

  Sometimes one of your triggers goes mad and switches back and forth between states, sending you hundreds of notifications. Sometimes you just ignore and delete all messages, accidentally also deleting one that is actually important. Moira tries to protect you with a feature called *throttling*. It's simple: if one of your triggers starts to send over 10 messages per an hour, Moira limits this trigger to one message per 30 minutes. Alerts from this trigger are combined, and not lost - just packaged into a single message.

1.1.2 Limitations

By default, Moira stores metric history for one hour. This ensures performance under heavy load. You can tweak this in config file, but note that performance will degrade.

In order to reduce database load, Moira checks every single trigger at most once every 5 seconds. Probably, your metrics arrive once every minute, so you really won't notice this limitation. You can also tweak this in config file.

1.1.3 Microservices

In spirit of Graphite architecture, Moira consists of several loosely coupled microservices. You are welcome to replace or to add new ones.

Filter

Filter is a lightweight service responsible for receiving lots of metric data in Graphite format. It filters received data and saves only metrics that match any of user triggers. This reduces load on all other parts of Moira.

Checker

Checker is an application with embedded Graphite functions. Checker watches for incoming metric values and performs checks according to saved trigger settings. When state of any trigger changes, Checker generates an event.

Notifier

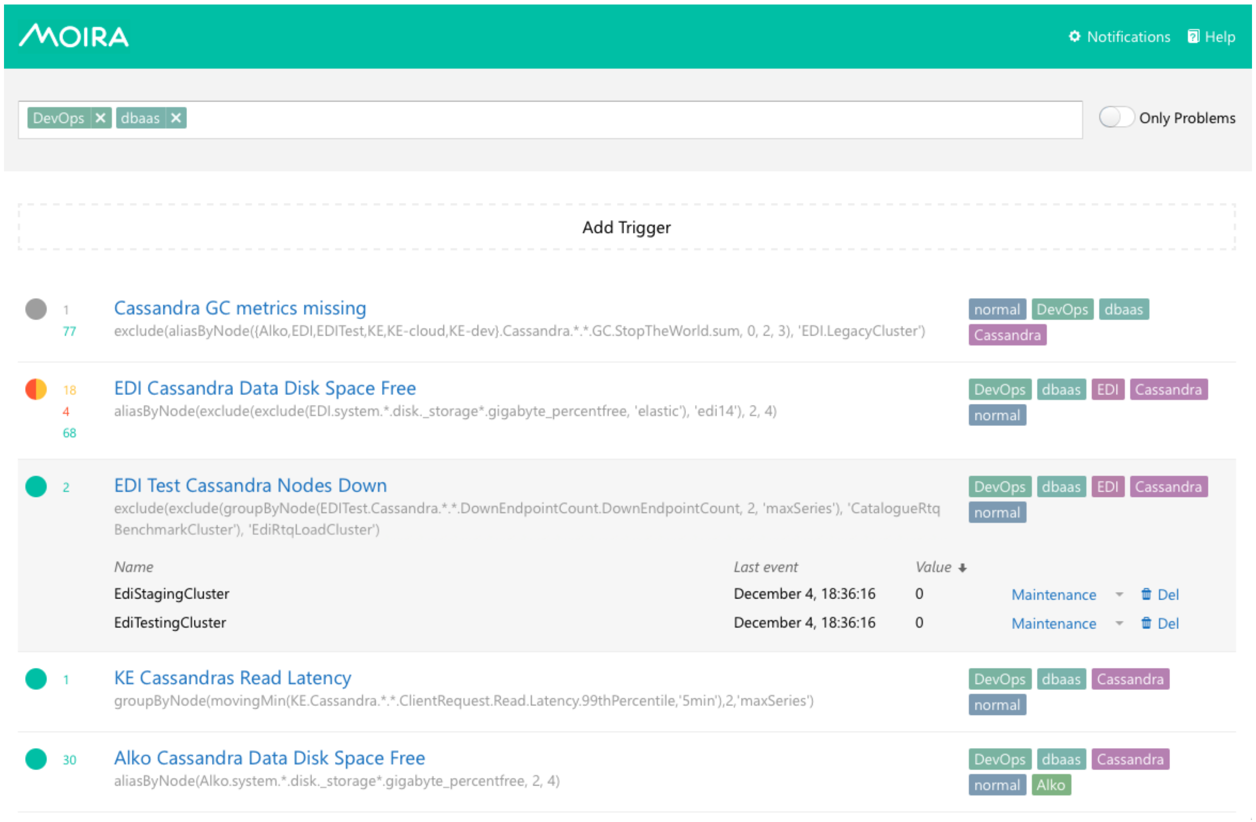
Notifier is an application that watches for generated events. Notifier is responsible for scheduling and sending notifications, observing quiet hours, retrying failed notifications, etc.

API

API is an application that serves as a backend for UI.

Web 2.0

Web 2.0 is a frontend React application, it looks like this:



1 77	Cassandra GC metrics missing exclude(aliasByNode({Alko,EDI,EDITest,KE,KE-cloud,KE-dev}.Cassandra.*.*.GC.StopTheWorld.sum, 0, 2, 3), 'EDI.LegacyCluster')	normal DevOps dbaas Cassandra
18 4 68	EDI Cassandra Data Disk Space Free aliasByNode(exclude(exclude(EDI.system.*.disk._storage*.gigabyte_percentfree, 'elastic'), 'edi14'), 2, 4)	DevOps dbaas EDI Cassandra normal
2	EDI Test Cassandra Nodes Down exclude(exclude(groupByNode(EDITest.Cassandra.*.*.DownEndpointCount.DownEndpointCount, 2, 'maxSeries'), 'CatalogueRtq BenchmarkCluster'), 'EdiRtqLoadCluster')	DevOps dbaas EDI Cassandra normal
1	KE Cassandras Read Latency groupByNode(movingMin(KE.Cassandra.*.*.ClientRequest.Read.Latency.99thPercentile,'5min'),2,'maxSeries')	DevOps dbaas Cassandra normal
30	Alko Cassandra Data Disk Space Free aliasByNode(Alko.system.*.disk._storage*.gigabyte_percentfree, 2, 4)	DevOps dbaas Cassandra normal Alko

Name	Last event	Value		
EdiStagingCluster	December 4, 18:36:16	0	Maintenance	Del
EdiTestingCluster	December 4, 18:36:16	0	Maintenance	Del

1.2 Changelog

1.2.1 2.3

- Add API methods: `DELETE /notification/all` and `DELETE /event/all` moira-alert/moira#73.
- Add notifier config option: DateTime format for email sender moira-alert/moira#74.
- Add Graphite-API support for remote triggers moira-alert/moira#75. See more: *Remote Triggers Checker*. Thanks to @errx.
- Fix newlines in trigger description body for web and email sender moira-alert/moira#76.
- Add option to enable runtime metrics in Graphite-section of configuration moira-alert/moira#79.
- Add new fancy email template moira-alert/moira#82.
- Change default trigger state to TTLState option instead of NODATA moira-alert/moira#83.
- Refactor maintenance logic moira-alert/moira#87. See more: *Maintenance*.
- Add basic false NODATA protection moira-alert/moira#90. See more: *Self State Monitor*.
- Prohibit removal of contact with assigned subscriptions found moira-alert/moira#91.
- Make trigger exception messages more descriptive moira-alert/moira#92.
- Make filter cache capacity configurable moira-alert/moira#93. See more *Filter Configuration*.
- Fix incorrect behavior in which the trigger did not return from the `EXCEPTION` state moira-alert/moira#94.

- Remove deprecated pseudo-tags, use checkboxes instead moira-alert/moira#95. See more: *Ignore specific states transitions*.
- Allow to use single-valued thresholds (ex. only `WARN` or only `ERROR`) moira-alert/moira#96.
- Reduce the useless CPU usage in Moira-Filter moira-alert/moira#98. Thanks to @errx.
- Add concurrent matching workers in Moira-Filter moira-alert/moira#99. Thanks to @errx.
- Update Carbonapi to 1.0.0-rc.0 moira-alert/moira#101.
- Improve checker performance moira-alert/moira#103.
- Add Markdown support in contact edit modal view moira-alert/web2.0#138.
- Fix default timezone in trigger moira-alert/web2.0#173.
- Add ability to type negative numbers in simple trigger edit mode moira-alert/web2.0#169.
- Fix trailing whitespaces in tag search bar moira-alert/web2.0#139.
- Update Moira Client 2.3.4.
- Update Moira Trigger Role 2.3.

Important: Redis DB conversion is desirable.

Moira 2.3 has some structure changes in Redis DB. It will work fluently out of the box, but we recommend you to run converter once Moira is updated.

```
moira-cli -update --config=/etc/moira/cli.yml
```

Listing 1.1: /etc/moira/cli.yml

```
redis:
  host: localhost
  port: "6379"
  dbid: 0
log_file: stdout
log_level: debug
```

If you would like to downgrade back to Moira 2.2, you should run CLI-converter.

```
moira-cli -downgrade --config=/etc/moira/cli.yml
```

Both cases imply usage of Moira-Cli v.2.3, you can find it on Release Page.

1.2.2 2.2

- Add Redis Sentinel support.
- Increase new metric event processing speed by adding a cache on metric patterns.
- Update carbonapi (new functions: map, reduce, delay; updated: asPercent).
- Optimize reading metrics while checking trigger (removed unnecessary Redis transaction).
- Add domain autoresolving for self-metrics sending to Graphite.
- Fix concurrent read/write from expression cache.
- Re-enable Markdown in Slack sender.

- Optimize internal metric collection.
- Replace pseudotags with ordinary checkboxes in Web UI (but not on backend yet).
- Fix bug that allowed to create pseudotags (ERROR, etc.) as ordinary tags.
- Add metrics for each trigger handling time.
- Translate pagination.
- Make sorting by status the default option on trigger page.
- Hide tag list on trigger edit page.
- Sort tags alphabetically everywhere.
- Highlight metric row on mouse hover.
- Automatically add tags from search bar when creating new trigger.
- Add metric name to "Trigger has same timeseries names" error message.
- Update event names in case trigger name had changed.
- Fix bug in triggers with multiple targets. Metrics from targets T2, T3, . . . were not deleted properly.
- Fix old-style configuration files in platform-specific packages.
- Fix bug that prevented non-integer timestamps from processing.
- Fix logo image background.
- Fix sorting on -s and 0s.
- Fix UI glitch while setting maintenance time.
- Fix retention scheme parsing for some rare cases with comments.

1.2.3 2.1

- Throw an exception if any target except the first one resolves in more than one metric.
- Fix Moira version detection in CI builds.
- Add user login information to API request logs.
- Fix long interval between creating a new trigger and getting data into that trigger.

1.2.4 2.0

Version 2.0 is fully rewritten in Go instead of Python. This implies lower CPU load in Checker and API microservices, but also changes the list of supported Graphite functions.

We also introduce new UI based on React. It is not backwards-compatible with old API, but new API supports both old and new UI.

Breaking Changes

- New structure of *Configuration* files.
- New Advanced mode expression format. Moira 2.0 supports govaluate expressions instead of Python expressions. Use `moira-cli -convert-expressions` to convert.

- API methods URLs do not have trailing slashes anymore.
- API `/notification` method returns valid JSON list instead of plain text.
- `ttl` parameter in API calls is always a number instead of string.
- API `PUT` methods strictly separate create and update operations.
- There is no `tag maintenance` entity anymore.
- Error messages return valid JSON instead of plain text.
- Support for Graphite functions changed. See carbonapi compatibility list for details.

Other Improvements

- Internal Graphite metric names changed.
- Numerous bugs fixed. Some new were created :)

1.3 Installation

1.3.1 Manual Installation

Tip: To get Moira running quickly, try *Docker* version

There are following components you need to install before running Moira microservices:

1. golang version 1.9 or higher
2. redis database version 2.8 or higher
3. web server e.g. nginx

Build Moira Microservices

```
go get -u github.com/moira-alert/moira
cd $GOPATH/src/github.com/moira-alert/moira
make build
```

You will find binaries in `$GOPATH/src/github.com/moira-alert/moira/build`.

Download Web UI Application

https://github.com/moira-alert/web2.0/releases/latest

Download and unpack `.tar.gz` file into Nginx static files directory (e.g. `/var/local/www/moira`).

Configure

1. If you need to override default settings, place configuration files somewhere on your disk (e.g. `/etc/moira/`). You can dive into *Configuration* syntax on a separate page.
2. Place nginx configuration file to proper location (e.g. `/etc/nginx/conf.d/moira.conf`):

```
server {
    listen 127.0.0.1:80;
    location / {
        root /var/local/www/moira;
        index index.html;
        try_files $uri $uri/ /index.html;
    }
    location /api/ {
        proxy_pass http://127.0.0.1:8081;
    }
}
```

3. If you need to override UI settings, edit web.json file. You can find its location in API configuration.

Run

1. Run nginx and redis-server
2. Run microservices

```
$GOPATH/src/github.com/moira-alert/moira/build/cache
$GOPATH/src/github.com/moira-alert/moira/build/checker
$GOPATH/src/github.com/moira-alert/moira/build/notifier
$GOPATH/src/github.com/moira-alert/moira/build/api
```

Now you need to feed your metrics to Moira (see *Feeding Metrics to Moira*) on port 2003 and to create alerts in UI (see *User Guide*).

1.3.2 Docker

You can quickly test a local Moira installation using Docker containers from Docker Hub and docker-compose file in documentation repository.

```
git clone https://github.com/moira-alert/doc.git
cd doc
docker-compose up
```

Containers are preconfigured to serve Web UI at `localhost:8080` and accept graphite metrics at `localhost:2003`.

1.3.3 RPM and DEB Packages

All stable versions of Moira components are tagged on GitHub. For every tag, we automatically build RPM and DEB packages. You can download these packages on each repository release page:

1. https://github.com/moira-alert/web2.0/releases
2. https://github.com/moira-alert/moira/releases

1.3.4 Configuration

By default, microservices will look for `/etc/moira/<servicename>.yml`, but you can change this location by passing your path as a command-line parameter `--config`.

On this page you can find examples of configuration files for Moira microservices.

Filter

```
# Use fields MasterName and SentinelAddrs to enable Redis Sentinel support,
# use Host and Port fields otherwise.
redis:
  # Sentinel cluster name
  master_name: ""
  # Sentinel address list, format: {host1_name:port};{ip:port}
  sentinel_addrs: ""
  # Node ip-address or host name
  host: "moira-redis"
  # Node port
  port: "6379"
  # Database id
  dbid: 0
graphite:
  # If true, graphite sender will be enabled.
  enabled: true
  # If true, runtime stats will be captured and sent to graphite. Note: It takes to␣
↪call stoptheworld() with configured "graphite.interval" to capture runtime stats␣
↪(https://golang.org/src/runtime/mstats.go)
  runtime_stats: false
  # Graphite relay URI, format: ip:port
  uri: "graphite-relay:2003"
  # Moira metrics prefix. Use 'prefix: {hostname}' to use hostname autoresolver.
  prefix: DevOps.moira
  # Metrics sending interval
  interval: 60s
filter:
  # Metrics listener uri
  listen: ":2003"
  # Retentions config file path. Simply use your original storage-schemas.conf or␣
↪create new if you're using Moira without existing Graphite installation.
  retention_config: /etc/moira/storage-schemas.conf
  # Number of metrics to cache before checking them.
  # Note: As this value increases, Redis CPU usage decreases.
  # Normally, this value must be an order of magnitude less than graphite.prefix.
↪filter.recevied.matching.count | nonNegativeDerivative() | scaleToSeconds(1)
  # For example: with 100 matching metrics, set cache_capacity to 10. With 1000␣
↪matching metrics, increase cache_capacity up to 100.
  cache_capacity: 10
  # Defines number of threads to match incoming graphite-metrics.
  # Equals to the number of processor cores found on Moira host by default or when␣
↪variable is defined as 0.
  max_parallel_matches: 0
log:
  log_file: stdout
  log_level: info
```

storage-schemas.conf is graphite carbon configuration file that should match similarly-named file in your Graphite installation.

Checker

```
# Use fields MasterName and SentinelAddrs to enable Redis Sentinel support,
# use Host and Port fields otherwise.
redis:
  # Sentinel cluster name
  master_name: ""
  # Sentinel address list, format: {host1_name:port};{ip:port}
  sentinel_addrs: ""
  # Node ip-address or host name
  host: "moira-redis"
  # Node port
  port: "6379"
  # Database id
  dbid: 0
graphite:
  # If true, graphite sender will be enabled.
  enabled: true
  # If true, runtime stats will be captured and sent to graphite. Note: It takes to␣
↪call stoptheworld() with configured "graphite.interval" to capture runtime stats␣
↪(https://golang.org/src/runtime/mstats.go)
  runtime_stats: false
  # Graphite relay URI, format: ip:port
  uri: "graphite-relay:2003"
  # Moira metrics prefix. Use 'prefix: {hostname}' to use hostname autoresolver.
  prefix: DevOps.moira
  # Metrics sending interval
  interval: 60s
checker:
  # Period for every trigger to perform forced check on
  nodata_check_interval: 60s
  # Min period to perform triggers re-check. Note: Reducing of this value leads to␣
↪increasing of CPU and memory usage values
  check_interval: 10s
  # Time interval to store metrics. Note: Increasing of this value leads to␣
↪increasing of Redis memory consumption value
  metrics_ttl: 3h
  # Period for every trigger to cancel forced check (greater than 'NoDataCheckInterval
↪') if no metrics were received
  stop_checking_interval: 30s
  # Equals to the number of processor cores found on Moira host by default or when␣
↪variable is defined as 0.
  max_parallel_checks: 0
  # Is related with remote triggers (see remote section)
  # Equals to the number of processor cores found on Moira host by default or when␣
↪variable is defined as 0.
  max_parallel_remote_checks: 0
# This section configures remote triggers Checker.
# See https://moira.readthedocs.io/en/latest/installation/configuration.html#remote-
↪triggers-checker for futher information
remote:
  enabled: false
  # URL of Graphite HTTP API: graphite-web, carbonapi, etc.
  # Specify full URL including '/render'
  url: "http://graphite.example.com/render"
  # Auth username. Only Basic-auth supported
  user: devops
  # Auth password. Only Basic-auth supported
  password: verySecurePassword
  # Min period to perform triggers re-check.
  # Note: Reducing of this value leads to increasing of CPU and memory usage values␣
↪and extra load on Graphite HTTP API
  check_interval: 60s
  # Maximum timeout for HTTP-request made to Graphite HTTP API
  timeout: 60s
log:
  log_file: stdout
  log_level: info
```

Remote Triggers Checker

One of Moira key feature is Graphite independance. Some Graphite queries are *very* ineffective. Tools like Seyren multiply this effect every minute making lots of ineffective queries and overloading your cluster. Moira relies on the incoming metric stream, and has its own fast cache for recent data.

Enabling Remote triggers Checker allows user to create triggers that relies on Graphite Storage instead of Redis DB.

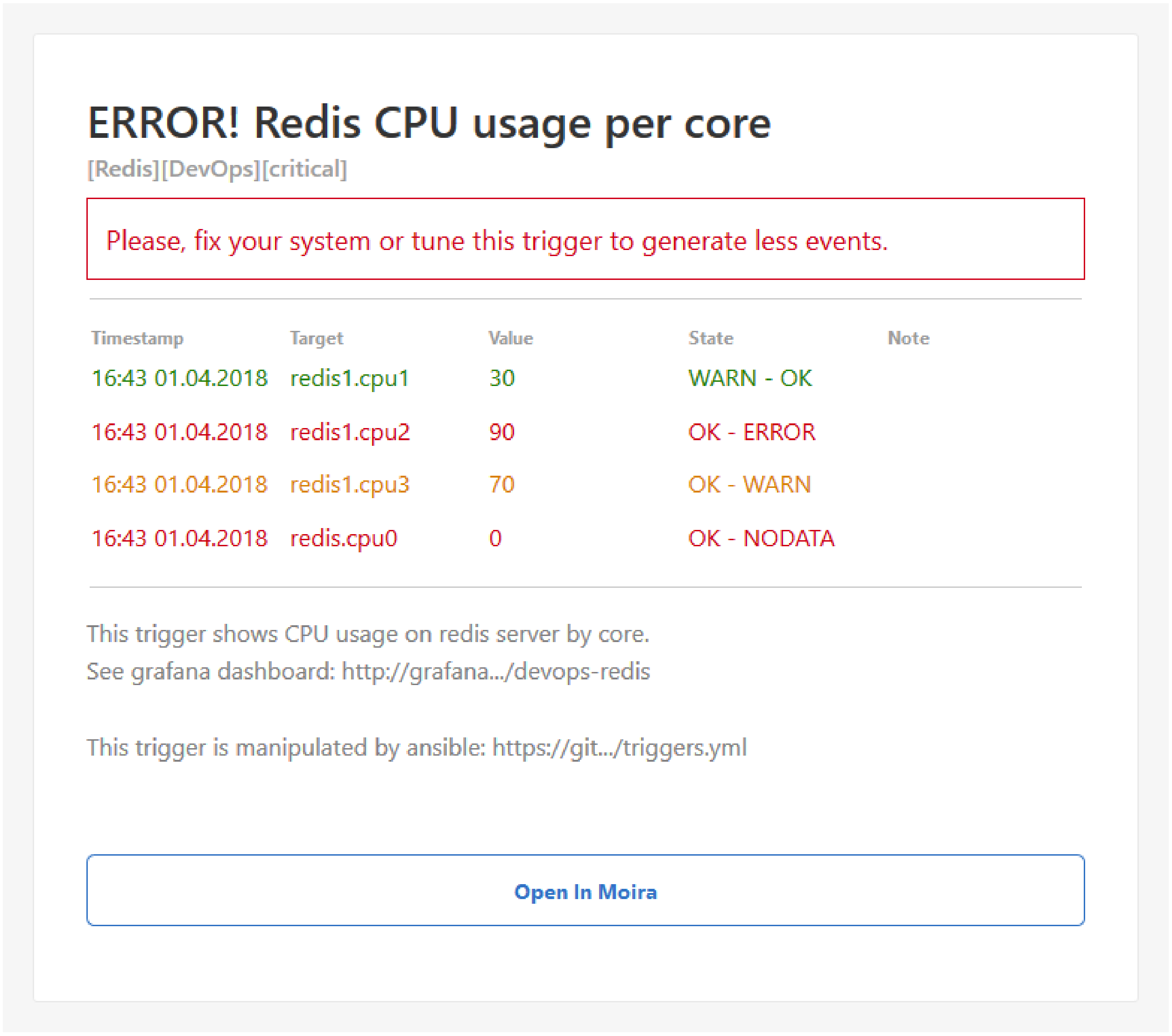
Warning: Use this feature with caution, because it can create an extra load on Graphite HTTP API.

Notifier

```
# Use fields MasterName and SentinelAddrs to enable Redis Sentinel support,
# use Host and Port fields otherwise.
redis:
  # Sentinel cluster name
  master_name: ""
  # Sentinel address list, format: {host1_name:port};{ip:port}
  sentinel_addrs: ""
  # Node ip-address or host name
  host: "moira-redis"
  # Node port
  port: "6379"
  # Database id
  dbid: 0
graphite:
  # If true, graphite sender will be enabled.
  enabled: true
  # If true, runtime stats will be captured and sent to graphite. Note: It takes to␣
↪call stoptheworld() with configured "graphite.interval" to capture runtime stats␣
↪(https://golang.org/src/runtime/mstats.go)
  runtime_stats: false
  # Graphite relay URI, format: ip:port
  uri: "graphite-relay:2003"
  # Moira metrics prefix. Use 'prefix: {hostname}' to use hostname autoresolver.
  prefix: DevOps.moira
  # Metrics sending interval
  interval: 60s
notifier:
  # Soft timeout to start retrying to send notification after single failed attempt
  sender_timeout: 10s
  # Hard timeout to stop retrying to send notification after multiple failed attempts
  resending_timeout: "1:00"
  # Web-UI uri prefix for trigger links in notifications. For example: with 'http://
↪localhost' every notification will contain link like 'http://localhost/trigger/
↪triggerId'
  front_uri: "https://moira.example.com"
  # Timezone to use to convert ticks. Default is UTC. See https://golang.org/pkg/time/
↪#LoadLocation for more details.
  timezone: Europe/Moscow
  # Format for email sender. Default is "15:04 02.01.2006". See https://golang.org/
↪pkg/time/#Time.Format for more details about golang time formatting.
  date_time_format: "15:04 02.01.2006"
  # List of senders, every element has "type" field (one of ["pushover", "slack",
↪"mail", "telegram", "twilio sms", "twilio voice", "script"])
  # Every type of sender has additional config fields
  senders:
    - type: pushover
      # Api token for your pushover channel, for more info see https://pushover.net/
↪api#registration
      api_token: ...
    - type: slack
      # Api token for your moira notifications slack user, for more info see https://
↪get.slack.help/hc/en-us/articles/215770388-Create-and-regenerate-API-tokens
      api_token: ...
    - type: telegram
      # Api token for your telegram bot, for more info about creating bot and get␣
↪token see https://core.telegram.org/bots#3-how-do-i-create-a-bot
      api_token: ...
    - type: mail
      mail_from: ...
      smtp_host: ...
      smtp_port: ...
      # Skip SMTP server certificate chain validation if false
      insecure_tls: false
      # Uses "mail_from" if empty
      smtp_user: ...
      smtp_pass: ...
      # Email template file path (standard Go templates). By default use 'Fancy'␣
↪template (see screenshot below). If empty, use build-in template with no markups␣
↪and styles.
      template_file: '/etc/moira/fancy-template.html'
    - type: twilio sms
      api_asid: ...
      api_authtoken: ...
      api_fromphone: ...
      # URL that responds with TwiML config for voice message generation, see https://
↪www.twilio.com/docs/api/twiml/voice-overview
      voiceurl: ...
      append_message: true
    - type: twilio voice
      api_asid: ...
      api_authtoken: ...
      api_fromphone: ...
    - type: script
      name: ...
      # Executable path. File must exist on all machines where notifier is running.
      # You can use ${trigger_name} and ${contact_value} in command-line parameters,
      # they will be replaced with trigger name and contact (as specified in web␣
↪interface).
      exec: ...
  # Self state monitor configuration section. Note: No inner subscriptions is␣
↪required. Moira will use its notification mechanism to send messages.
  moira_selfstate:
    enabled: true
    # If true, Moira selfstate will check remote triggers checker works properly and␣
↪notify admin if remote checker fails
    # See https://moira.readthedocs.io/en/latest/installation/configuration.html
↪#remote-triggers-checker for futher information
    remote_triggers_enabled: false
    # Max Redis disconnect delay to send alert when reached
    redis_disconect_delay: 60s
    # Max Filter metrics receive delay to send alert when reached
    last_metric_received_delay: 120s
    # Max Checker checks perform delay to send alert when reached
    last_check_delay: 120s
    # Max Remote triggers Checker checks perform delay to send alert when reached
    # See https://moira.readthedocs.io/en/latest/installation/configuration.html
↪#remote-triggers-checker for futher information
    last_remote_check_delay: 300s
    # Self state monitor alerting interval
    notice_interval: 300s
    # Contact list for Self state monitor alerts, use this like delivery channels in␣
↪web-ui
    contacts:
      - type: mail
        value: devopsteam@example.com
log:
  log_file: stdout
  log_level: info
```

Email template

By default mail sender will use ‘Fancy’ template:



ERROR! Redis CPU usage per core

[Redis][DevOps][critical]

Please, fix your system or tune this trigger to generate less events.

Timestamp	Target	Value	State	Note
16:43 01.04.2018	redis1.cpu1	30	WARN - OK	
16:43 01.04.2018	redis1.cpu2	90	OK - ERROR	
16:43 01.04.2018	redis1.cpu3	70	OK - WARN	
16:43 01.04.2018	redis.cpu0	0	OK - NODATA	

This trigger shows CPU usage on redis server by core.
See grafana dashboard: http://grafana.../devops-redis

This trigger is manipulated by ansible: https://git.../triggers.yml

Self state monitor

If self state monitor is enabled, Moira will periodically check the Redis connection, the number of incoming metrics in the Moira-Filter and the number of triggers to be checked by Moira-Checker.

See *Self State Monitor* for more details.

API

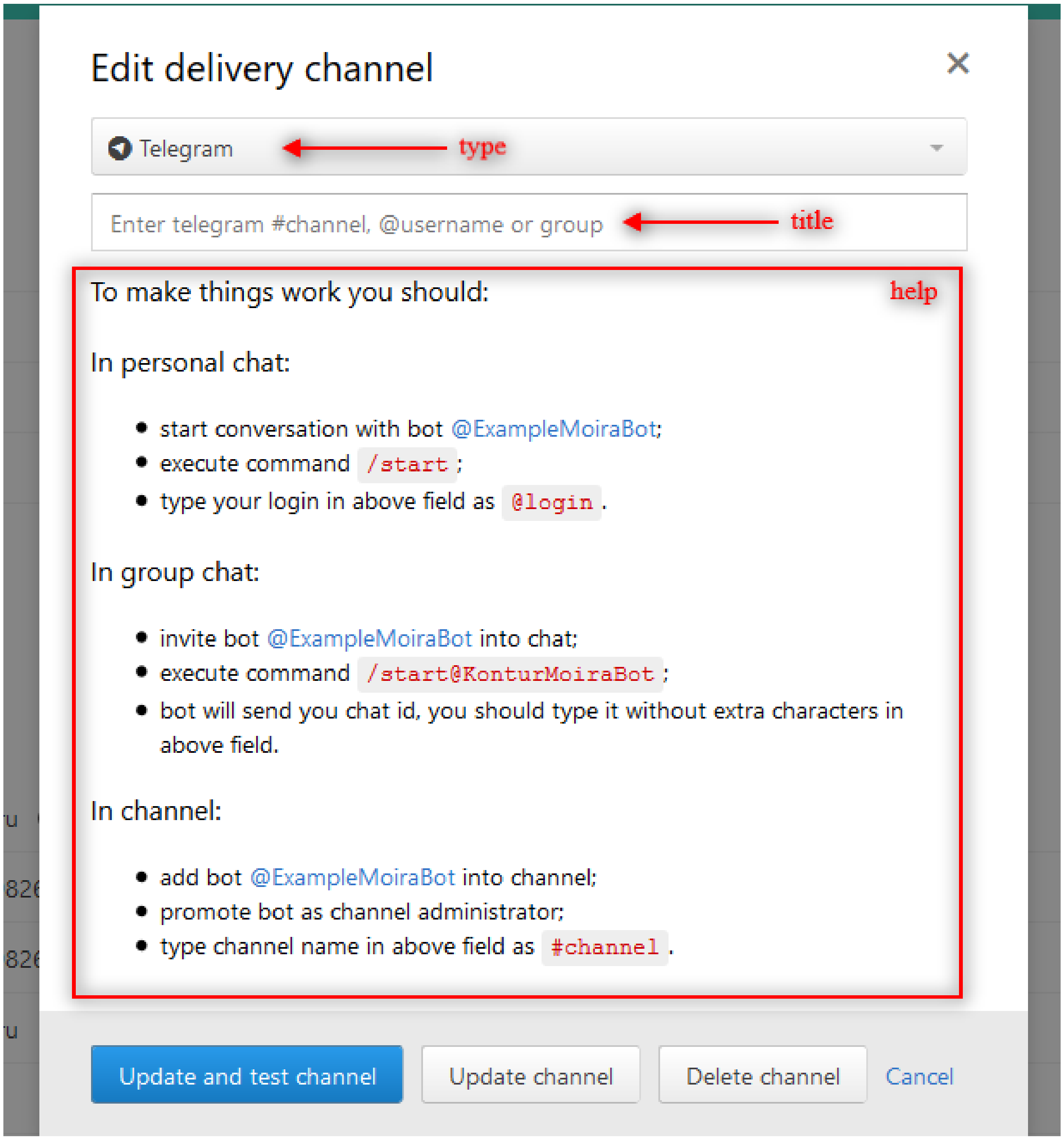
```
# Use fields MasterName and SentinelAddrs to enable Redis Sentinel support,
# use Host and Port fields otherwise.
redis:
  # Sentinel cluster name
  master_name: ""
  # Sentinel address list, format: {host1_name:port};{ip:port}
  sentinel_addrs: ""
  # Node ip-address or host name
  host: "moira-redis"
  # Node port
  port: "6379"
  # Database id
  dbid: 0
graphite:
  # If true, graphite sender will be enabled.
  enabled: true
  # If true, runtime stats will be captured and sent to graphite. Note: It takes to␣
↪call stoptheworld() with configured "graphite.interval" to capture runtime stats␣
↪(https://golang.org/src/runtime/mstats.go)
  runtime_stats: false
  # Graphite relay URI, format: ip:port
  uri: "graphite-relay:2003"
  # Moira metrics prefix. Use 'prefix: {hostname}' to use hostname autoresolver.
  prefix: DevOps.moira
  # Metrics sending interval
  interval: 60s
api:
  # Api local network address. Default is ':8081' so api will be available at http://
↪moira.company.com:8081/api
  listen: ":8081"
  # If true, CORS for cross-domain requests will be enabled. This option can be used␣
↪only for debugging purposes.
  enable_cors: false
  # Web_UI config file path. If file not found, api will return 404 in response to
↪"api/config"
  web_config_path: "/etc/moira/web.json"
log:
  log_file: stdout
  log_level: info
```

WEB UI

```
{
  "contacts": [
    {
      "type": "pushover",
      "validation": "",
      "title": "pushover user key"
    },
    {
      "type": "slack",
      "validation": "^[@#][a-zA-Z0-9-_]+",
      "title": "slack #channel / @user"
    },
    {
      "type": "telegram",
      "validation": "",
      "title": "Enter telegram #channel, @username or group",
      "help": "### To make things work you should:\n### In personal chat:\n - start␣
↪conversation with bot [@ExampleMoiraBot](https://t.me/ExampleMoiraBot);\n - execute␣
↪command `/start`;\n - type your login in above field as `@login`.\n\n### In group␣
↪chat:\n - invite bot [@ExampleMoiraBot](https://t.me/ExampleMoiraBot) into chat;\n -
↪ execute command `/start@ExampleMoiraBot`;\n - bot will send you chat id, you␣
↪should type it without extra characters in above field.\n\n### In channel:\n - add␣
↪bot [@ExampleMoiraBot](https://t.me/ExampleMoiraBot) into channel;\n - promote bot␣
↪as channel administrator;\n - type channel name in above field as `#channel`.\n"
```

```
    }
  ],
  "supportEmail": "devops@example.com",
  "remoteAllowed": false
}
```

- *type* — contact type: pushover, slack, mail, script, telegram, twilio sms, twilio voice;
- *validation* — regular expression for user contact;
- *title* — hint shown in input field;
- *help* — help text in Markdown markup .
- *remoteAllowed* — set to `true` if *Remote Triggers Checker* is enabled.



Enter telegram #channel, @username or group

To make things work you should:

In personal chat:

- start conversation with bot @ExampleMoiraBot;
- execute command `/start`;
- type your login in above field as `@login`.

In group chat:

- invite bot @ExampleMoiraBot into chat;
- execute command `/start@KonturMoiraBot`;
- bot will send you chat id, you should type it without extra characters in above field.

In channel:

- add bot @ExampleMoiraBot into channel;
- promote bot as channel administrator;
- type channel name in above field as `#channel`.

1.3.5 Feeding Metrics to Moira

Moira needs to keep its own local copy of your metric data to improve performance and reduce load on your existing graphite cluster. This means data needs to be duplicated from your existing stream and sent to your existing cluster and to your Moira installation.

Unfortunatly, the Carbon-Relay with Graphite does not support duplication of data to multiple backends, and so you need to use a more feature rich carbon relay such as carbon-c-relay.

The following is a basic example configuration which defines two clusters and sends all metrics to both at once. One cluster is Moira installation, and the other uses consistent hashing across a three node cluster of Carbon servers.

```
cluster moira
forward
    moira-host:2003
;

cluster graphite
 carbon_ch
     127.0.0.1:2006=a
     127.0.0.1:2007=b
     127.0.0.1:2008=c
 ;

match *
    send to
        moira
        graphite
;
```

1.3.6 Security

Typically, internal DevOps tools like Graphite are deployed in intranet without any external access, so you can skip authentication and leave everything accessible to everyone. But powerful Moira features, like separate subscriptions for tags, work best when you have some way to tell apart users.

Moira doesn't provide any authentication mechanism. It is hard to find one that fits all situations. Instead, Moira accepts `X-WebAuth-User` header with some user id, like login name. You are free to set up any reverse proxy and configure it to provide this header.

If you don't, Moira will assume that user id is "anonymous".

> **Warning:** Even if you do provide authentication header, please note that most parts of Moira are read and write accessible to every user, and there is no meaningful way of authorization in Moira. This is by design, because Moira is an internal DevOps tool. Separating users is a convenience, not protection feature.

Example of Nginx configuration

Assuming that Moira UI static files are in `/var/www/moira-web` and API is running on port 8081

```
server {
  auth_basic "Moira";
  auth_basic_user_file /etc/nginx/htpasswd;

  listen 0.0.0.0:80 default_server;

  location / {
    root /var/www/moira;
    index index.html;
    try_files $uri $uri/ /index.html;
  }

  location /api/ {
    proxy_pass http://127.0.0.1:8081;
    proxy_set_header X-WebAuth-User $remote_user;
    }
}
```

Look at auth_basic_module if you need more details of Nginx basic authentication.

1.4 User Guide

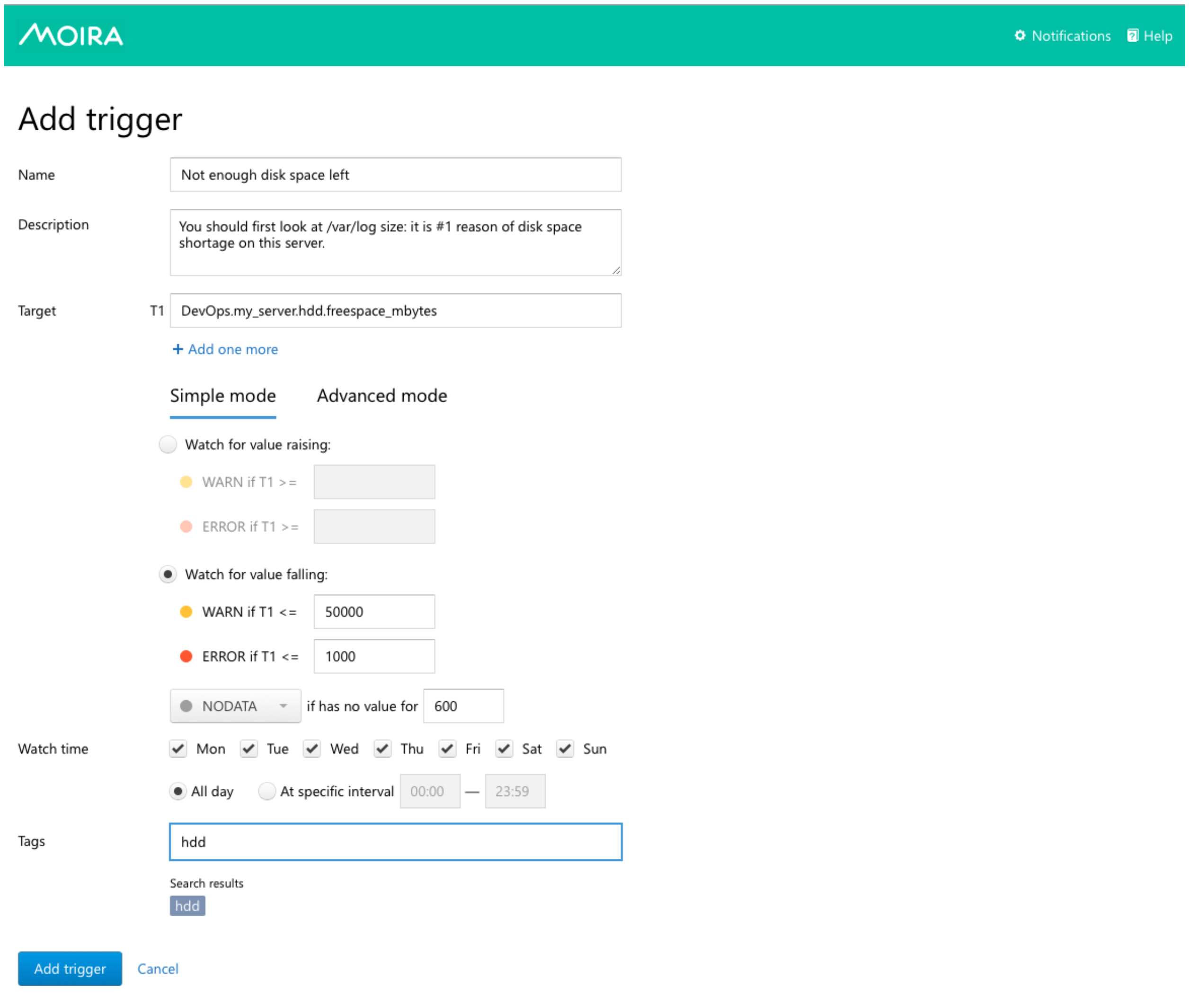
This user guide is based on a number of real-life scenarios, from simple and universal to complicated and specific. Also, we have screenshots.

Note: Click on any screenshot to see full-size version.

1.4.1 Simple Threshold Trigger

Let's say you measure how much free space is left on your HDD and store this value as `DevOps.my_server.hdd.freespace_mbytes` in Graphite. Maybe you want to get an email when you have less than 50 GB left (it's not a big problem), and a Pushover notification when you have less than 1 GB left (you really need to delete something asap).

You can easily accomplish this by adding a trigger in Moira's Simple Mode:


MOIRA

Add trigger

Name	Not enough disk space left
Description	You should first look at /var/log size: it is #1 reason of disk space shortage on this server.
Target	T1 DevOps.my_server.hdd.freespace_mbytes

( ) Watch for value raising:

WARN if T1 >=

ERROR if T1 >=

(●) Watch for value falling:

WARN if T1 <= 50000

ERROR if T1 <= 1000

NODATA if has no value for 600

Watch time ✓ Mon ✓ Tue ✓ Wed ✓ Thu ✓ Fri ✓ Sat ✓ Sun

(●) All day ( ) At specific interval 00:00 — 23:59

Tags hdd

Search results hdd

Graphite Target

You can specify a single metric like we did here: `DevOps.my_server.hdd.freespace_mbytes`.

You can also specify multiple metrics like `DevOps.*.hdd.freespace_mbytes`. All metrics will be monitored separately, and you will get separate notifications for each metric.

You can even use Graphite functions like `movingAverage(DevOps.my_server.hdd.freespace_mbytes, 10)`. Moira understands everything that Graphite itself understands. See appropriate documentation.

Thresholds

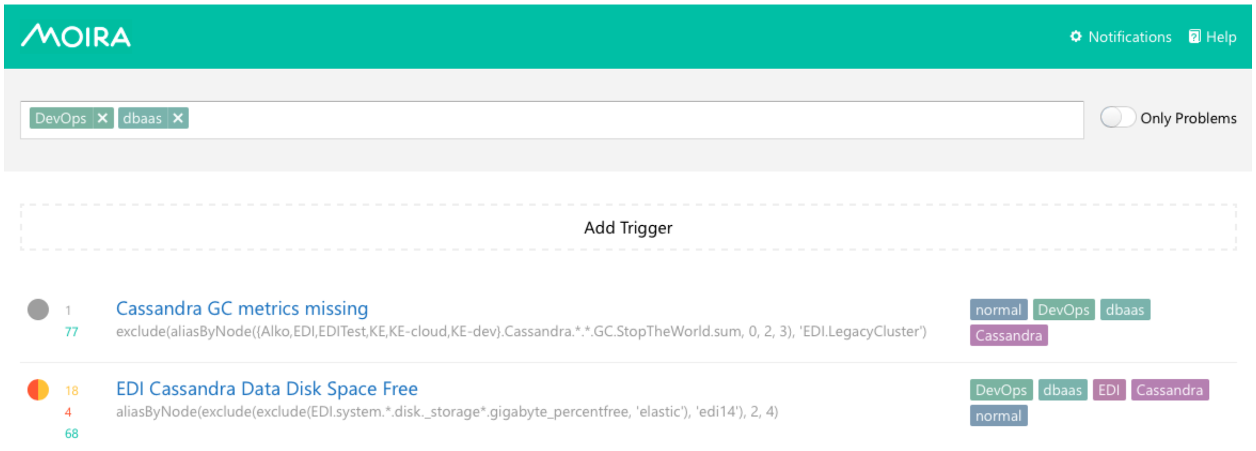
In simple mode you need to at least one threshold values: WARNING and ERROR. In our example we set both, lower values are bad, so we set warning threshold greater than error threshold. In this case, Moira will consider any value less than 50000 a warning and less than 1000 an error, which is what we want. In other cases, you may need to consider large values a problem - then you should make error threshold greater than warning and select `Watch for value rising` option.

See also:

You can set only one threshold. For example, you can set WARNING equal to 50000, omit ERROR and select `Watch for value falling`. In this case you will receive only WARNING messages when free space goes under 50GB and never receive ERROR messages. You can also do vise versa: set ERROR and omit WARNING.

Tags

In Moira, you cannot subscribe to a single trigger. Instead, you should categorize your triggers by tags and subscribe to a tag. It may look like an overkill here, but when you have dozens of triggers, you are much better off with tags, because you don't have to enter your contact information over and over again. Tags also help to filter information on main screen:



Cassandra GC metrics missing
exclude(aliasByNode({Alko,EDI,EDITest,KE,KE-cloud,KE-dev}.Cassandra.*.*.GC.StopTheWorld.sum, 0, 2, 3), 'EDI.LegacyCluster')
1 77 — normal DevOps dbaas Cassandra

EDI Cassandra Data Disk Space Free
aliasByNode(exclude(exclude(EDI.system.*.disk._storage*.gigabyte_percentfree, 'elastic'), 'edi14'), 2, 4)
18 4 68 — DevOps dbaas EDI Cassandra normal

You can add as many tags as you want.

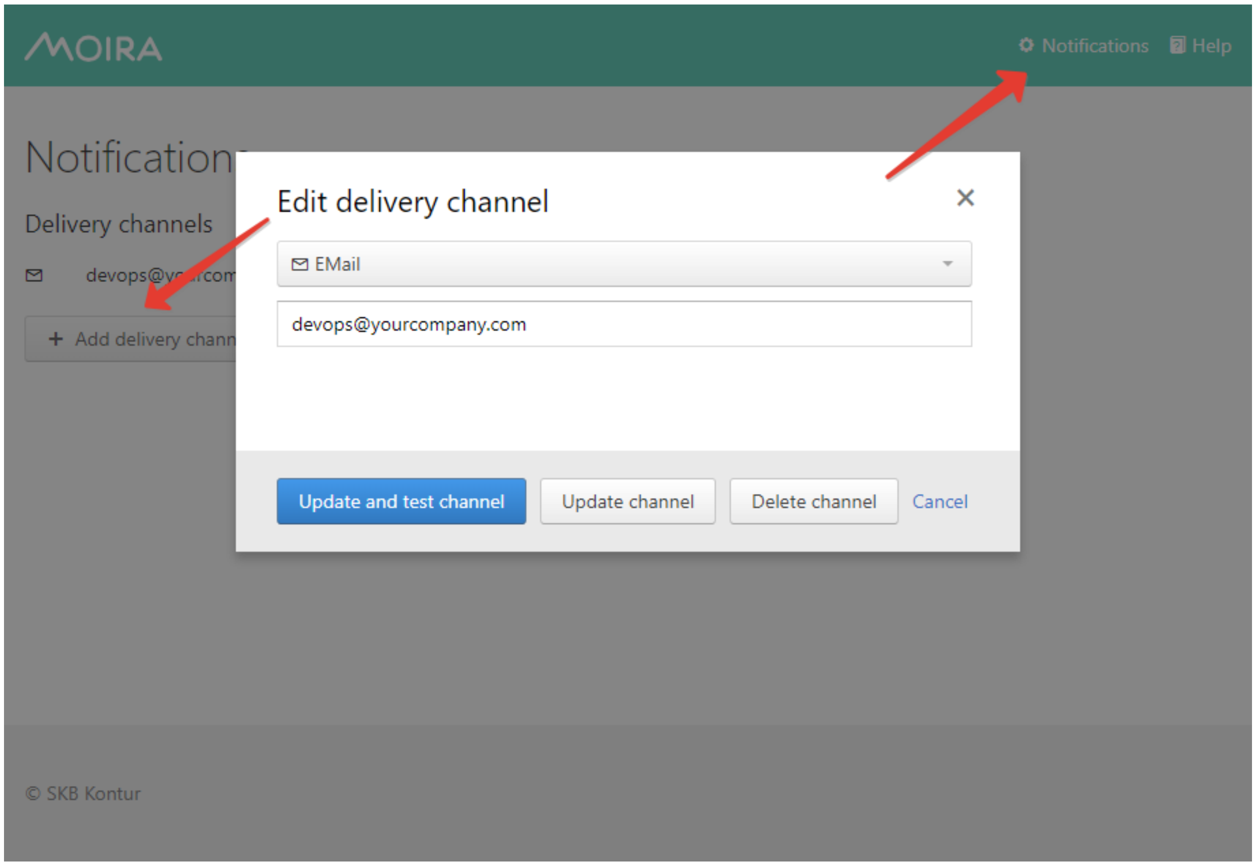
Subscriptions

Proceed to the *Setting Up Your Subscriptions* page to learn how to set up a subscription to your trigger.

1.4.2 Setting Up Your Subscriptions

By now you should have at least one trigger saved. If you don't, go back to the *Simple Threshold Trigger* page.

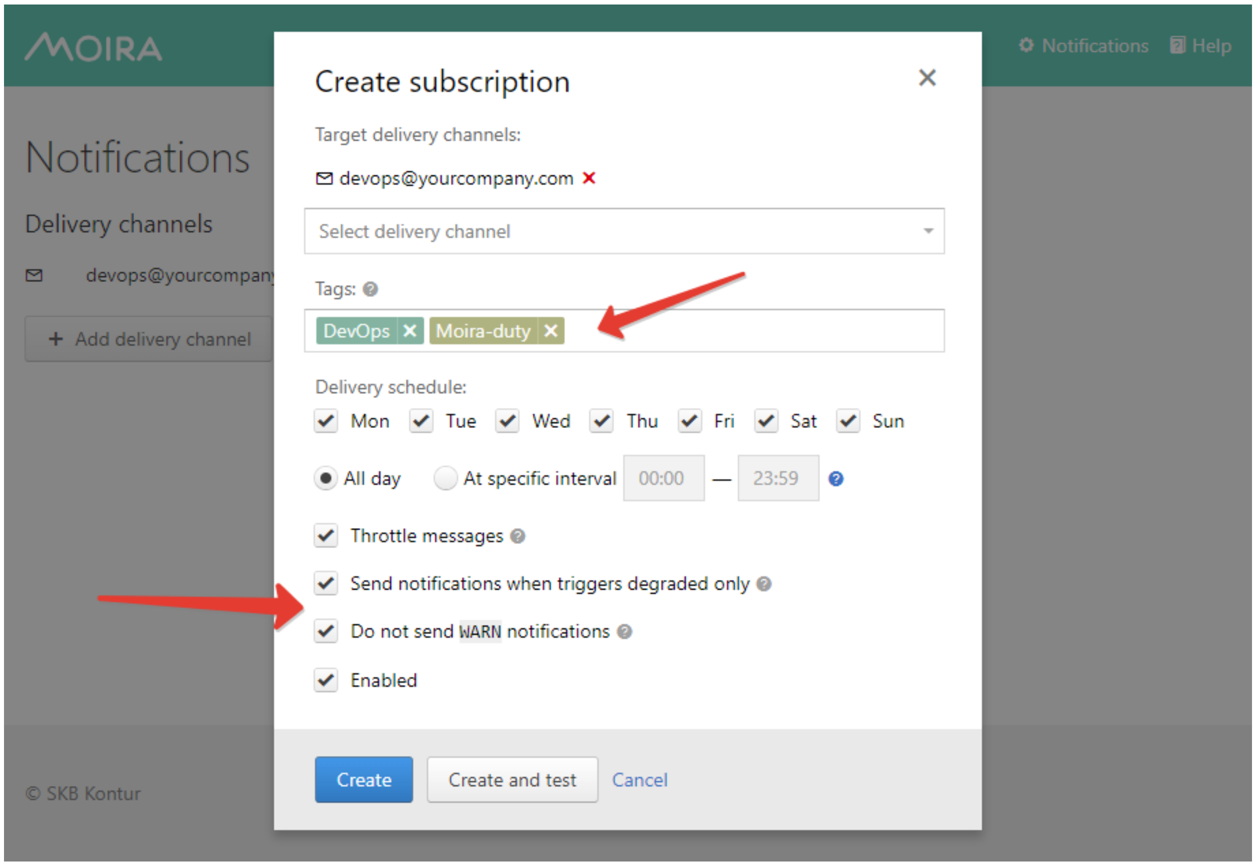
First, add some delivery channels:



If your Moira installation is configured with separate user accounts, you will see only your channels and subscriptions on this page. Otherwise, every user will see the same page with the same channels and subscriptions.

Consult *Security* page for instructions on separating user accounts.

Once you have at least one channel, you can create a subscription. Press `+ Add subscription` button:


Create subscription

Target delivery channels:

devops@yourcompany.com

Select delivery channel

Tags: DevOps, Moira-duty

Delivery schedule:

[✓ Mon] [✓ Tue] [✓ Wed] [✓ Thu] [✓ Fri] [✓ Sat] [✓ Sun]

[● All day] At specific interval 00:00 — 23:59

[✓] Throttle messages

[✓] Send notifications when triggers degraded only

[✓] Do not send WARN notifications

[✓] Enabled

Tags

Add required tags into subscription to receive notifications from triggers with these tags.

Matching rules are:

- If subscription has only one tag, you will receive notifications from any trigger with this tag.
  - Create Triggger1 with tags: `["DevOps", "Moira-duty"]`
  - Create Triggger2 with tags: `["DevOps"]`
  - Create Subscription1 with tags: `["DevOps"]`

    By using Subscription1 you will receive events for both Triggger1 and Triggger2
- If subscription has multiple tags, you will receive notifications only from triggers which include all these tags.
  - Create Subscription2 with tags: `["DevOps", "Moira-duty"]`

    By using Subscription2 you will receive events only for Trigger1

Ignore specific states transitions

You also can reduce number of notifications ignoring unnecessary event. For this purpose use following check boxes:

- Send notifications when triggers degraded only

  Only following states transitions will require notifications:

  - `OK` → `WARN`
  - `OK` → `ERROR`
  - `OK` → `NODATA`
  - `WARN` → `ERROR`
  - `WARN` → `NODATA`
  - `ERROR` → `NODATA`

- Do not send WARN notifications

  Following states transitions will be ignored:

  - `OK` → `WARN`
  - `WARN` → `OK`

Create and Test

You can just save your subscription, but if you want to be 100% sure it works, you should immediately test it. Dummy notification message will arrive shortly.

1.4.3 Efficient Triggers

To use Moira efficiently, you should understand its underlying design decisions.

We often notice that when new users create their first triggers, they set thresholds at random, or by intuition. It happens because when you configure your first 24/7/365 automated monitoring system, you don't really know how your system works. If you have at least hundreds of metrics, it's impossible to watch all of them with your eyes. What are the limits of your system? How often does your system reach critical resource consumption during a day? Should you immediately react when metric X reaches value N, or is it a fluctuation that passes by itself?

Later, when you learn to understand you system, you will need to adjust your triggers. And that's when you need to understand Moira.

States

Unlike many other tools providing several distinct level systems like "priority" and "severity", Moira supports a single set of states. Every state has a well-defined meaning, and you should use these states accordingly.

OK

This is a basic state, in which all your metrics must spend most of their time. Just like you keep your autotests green, you should keep your metrics green.

WARN

This state means that you should do something to prevent ERRORs in the future. Not immediately: maybe you should order more hardware from your vendor, or plan to optimize code in the next iteration. You can configure less intrusive delivery channels here, like email.

Metrics can be in this state for days or even weeks.

ERROR

This is a critical condition that requires immediate intervention. Your datacenter is on fire. All application processes shut down. There is no disk space left on your database server to process million-dollar transactions. These notifications are important enough to wake you up at night. You can still configure schedules to assign shifts to several engineers, though (see *Schedules*). You should configure more intrusive delivery channels here, like Pushover.

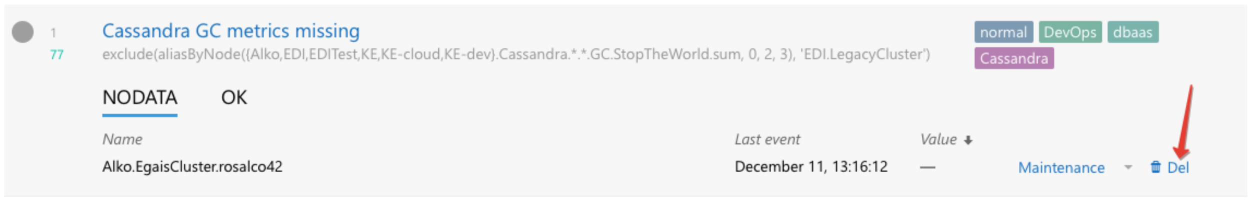
Metrics should not be in this state for more than several hours.

Moira will send you reminders every 24 hours if some of your metrics remain in this state.

If a delivery channel supports high-priority messages (like Pushover does), Moira will try to use them for ERRORs.

NODATA

This state means that Moira hasn't been receiving data points for a metric for some time. See *Dealing with NODATA* for details. This state is considered as bad as an ERROR in Moira (because it can actually be an ERROR - we don't receive any data, so we don't know for sure). It may be even worse than an ERROR, because users tend to ignore metrics in this state and leave them hanging in the web interface, greatly increasing the chance to miss something actually important. You should delete old unused metrics from Moira when they stop providing data points:



Cassandra GC metrics missing

exclude(aliasByNode({Alko,EDI,EDITest,KE,KE-cloud,KE-dev}.Cassandra.*.*.GC.StopTheWorld.sum, 0, 2, 3), 'EDI.LegacyCluster')

Name	Last event	Value
Alko.EgaisCluster.rosalco42	December 11, 13:16:12	—

In the beginning every metric is in this state. You will receive one NODATA → OK notification when the first data point arrives.

Moira will send you reminders every 24 hours if some of your metrics remain in this state.

Moira will set NODATA state only for known metrics - i.e. for metrics that have sent at least one data point to Moira.

EXCEPTION

This is an error inside Moira. Unless you have bad syntax in your *Advanced Mode Trigger* trigger, this has nothing to do with your metric state. You should try to fix or update Moira, or contact Moira developers (see *Contact Moira Developers*).

Dealing With False Positives

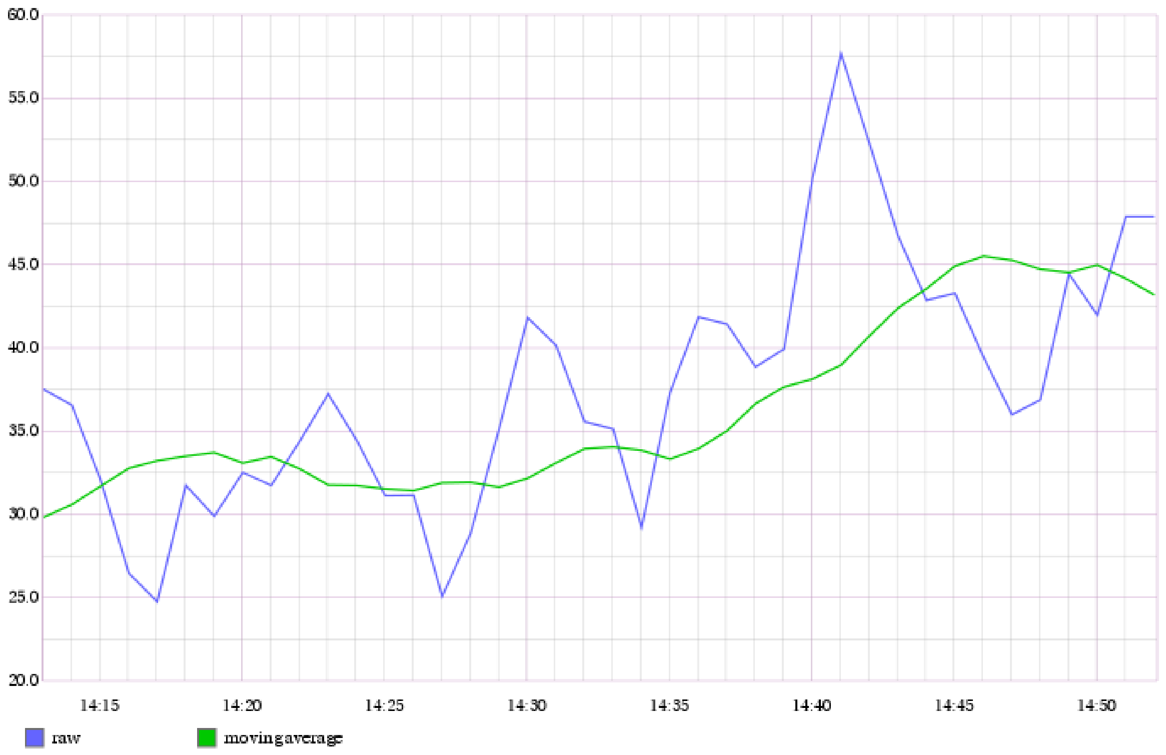
Sometimes it's hard to maintain strict rule of keeping your metrics green, if your triggers switch OK → ERROR → OK → ERROR for short periods of time several times a day. It can lead to alarm fatigue and missing actual failures.

There is no single recipe for eliminating false positives, but here are some tips.

Use Graphite Functions

Graphite provides tons of useful functions to process data, and Moira understands all of them. For example:

- If you are experiencing peaks on you graphs that lead to unnecessary state switches, you can alleviate these peaks with `movingAverage` or `movingMedian`.



- If you are interested in aggregate 10-minute values, not single minute values, use `summarize`.
- If you want zeros instead of missing data points, use `transformNull`. Also, `keepLastValue` is useful when dealing with missing points.
- Avoid functions that show and hide metrics, like `averageAbove`. Moira does not consider hidden metrics to be in NODATA state. Instead, Moira retains last state that the metric had when it was visible.

Draw First, Monitor Later

Always draw a graph of target(s) you are planning to monitor. Use generic Graphite web interface or something like Grafana. Look for minumum and maximum values. Notice, how often and for how long the graph crosses your planned thresholds. Try to correlate the graph with previous system failures. Then, copy and paste corrected target to Moira.

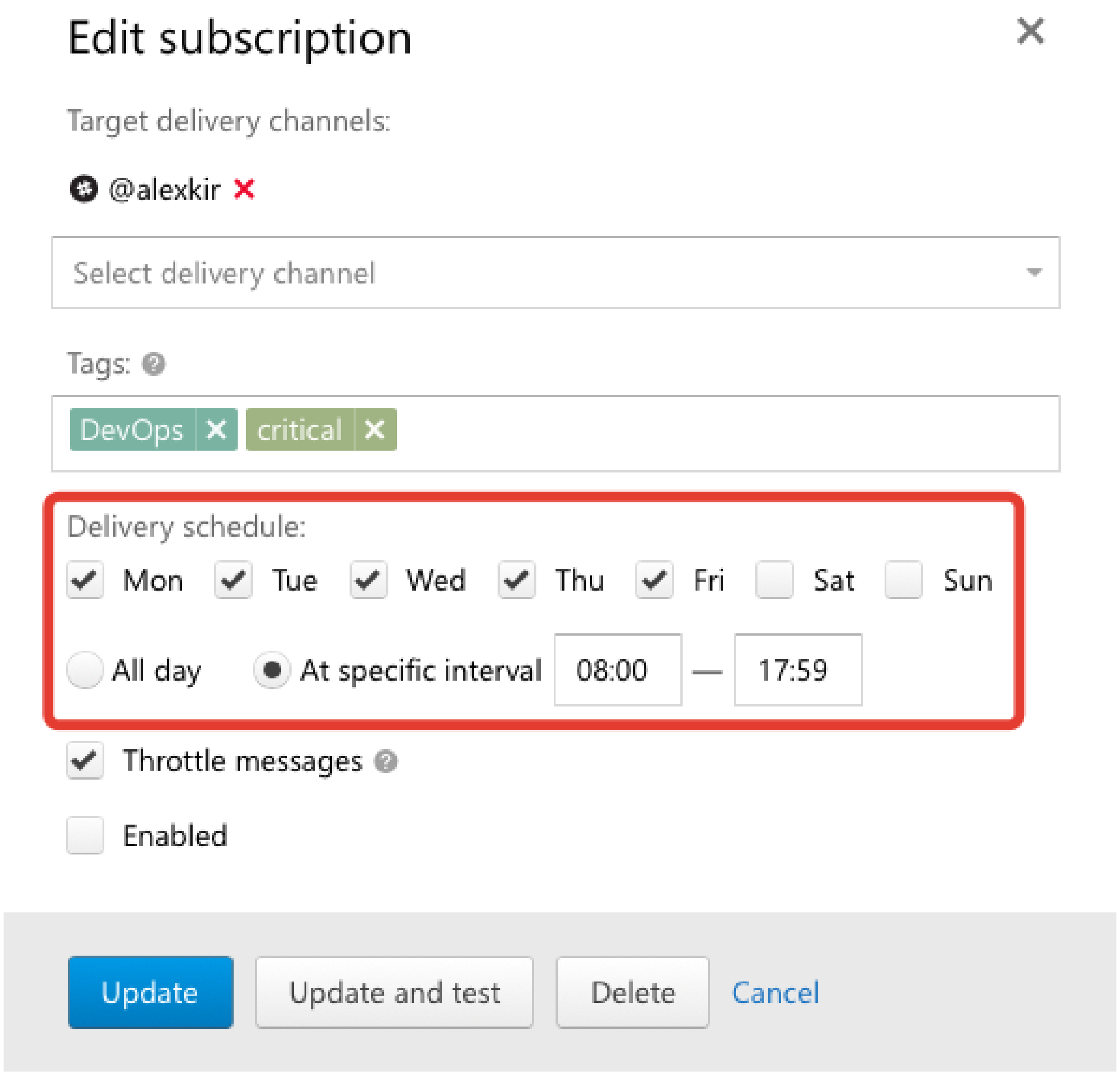
Of course, you may and should remove any functions that make no sense in Moira (like `sortByTotal`) and can generate unwanted side effects (like `averageAbove`).

1.4.4 Schedules

Moira provides two ways of defining allowed time intervals for notifications.

Subscription Schedule

If a metric is not that important to wake you up in the middle of the night, you can set a schedule for subscription:


Edit subscription

Target delivery channels:

@alexkir

Select delivery channel

Tags:

DevOps, critical

Delivery schedule:

[✓] Mon [✓] Tue [✓] Wed [✓] Thu [✓] Fri [ ] Sat [ ] Sun

All day [✓ At specific interval] 08:00 — 17:59

[✓] Throttle messages

[ ] Enabled

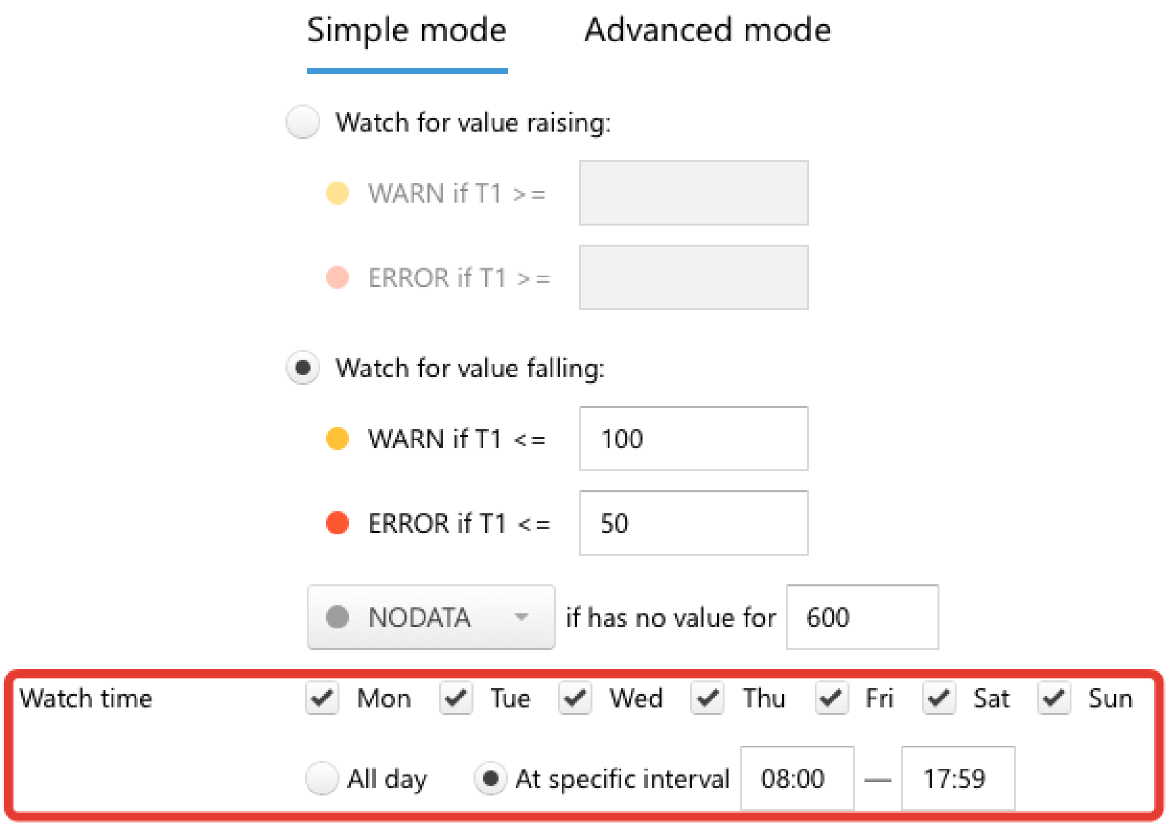
Notifications generated by this subscription will arrive only on weekdays, from 08:00 to 17:59 local time.

If an event happens on weekend, you will receive a notification at 08:00 on Monday. So notifications are not skipped, you just receive them later. Events will still appear on the event history page at the time when they happened (see *Current State and Event History*).

Trigger Watch Time

Let's say, you have a popular website, that serves over 1000 page views per second during a day. You can set up a trigger to notify you when you have less than 50 page views per second - obviously, something is wrong. You also need to disable this trigger for the night, because at night all of your users sleep, and this metric is irrelevant.

Of course, you can set up a subscription schedule - but your history will become riddled with false night "events", and you will still receive notifications in the morning. In this case, you need to set up a trigger watch time:



WARN if T1 <= 100

ERROR if T1 <= 50

NODATA if has no value for 600

Watch time ✓ Mon ✓ Tue ✓ Wed ✓ Thu ✓ Fri ✓ Sat ✓ Sun

All day [● At specific interval] 08:00 — 17:59

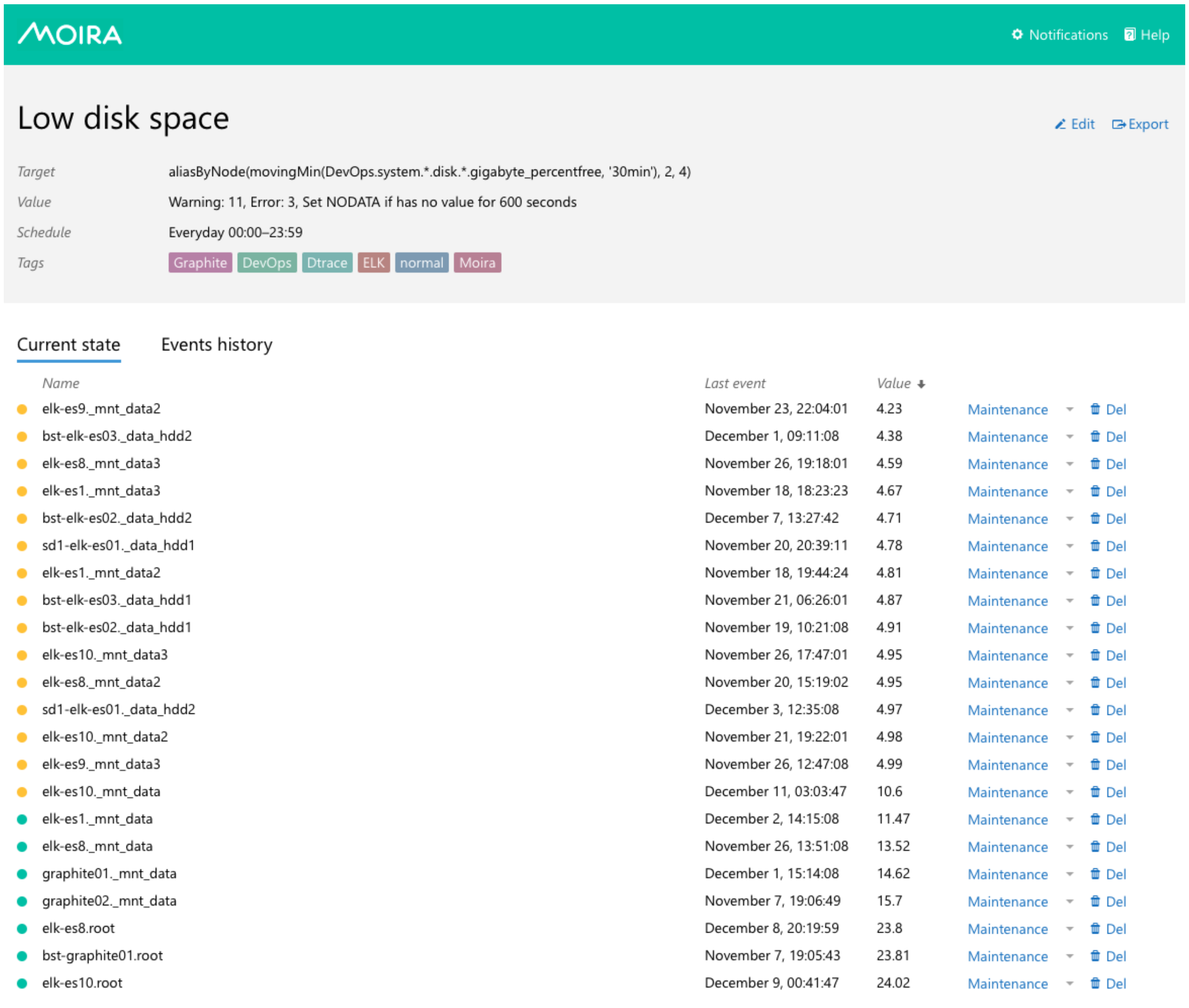
No events will be recorded for this trigger outside of watch time - you will receive no notifications, and the event history page will be empty (see *Current State and Event History*).

1.4.5 Current State and Event History

By clicking on a saved trigger, you can see current state and event history of this trigger.

Current State

Moira shows current state, current value and time of last event for every separate metric that matches the trigger.



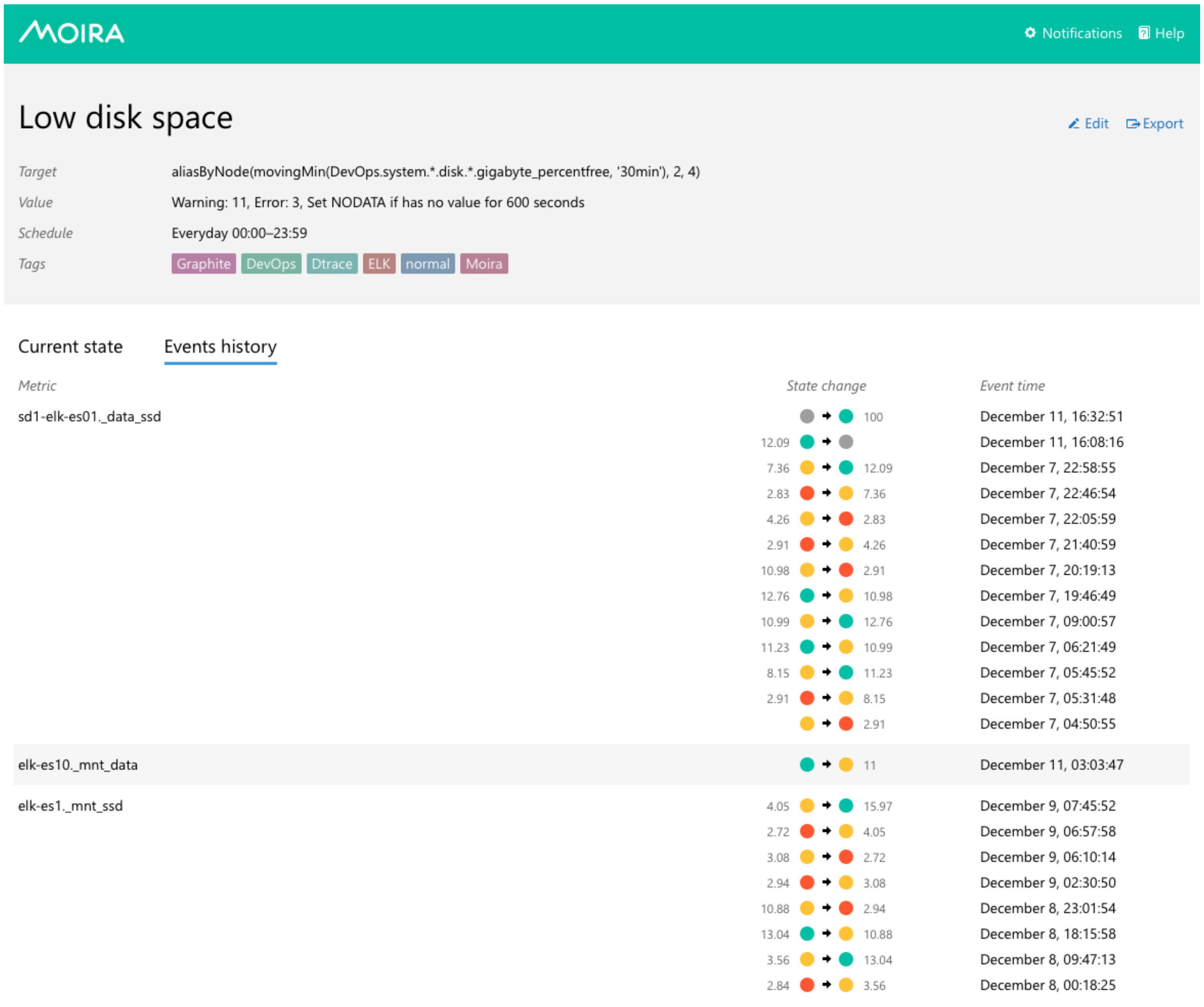
Low disk space

Target	aliasByNode(movingMin(DevOps.system.*.disk.*.gigabyte_percentfree, '30min'), 2, 4)
Value	Warning: 11, Error: 3, Set NODATA if has no value for 600 seconds
Schedule	Everyday 00:00–23:59
Tags	Graphite DevOps Dtrace ELK normal Moira

	Name	Last event	Value		
●	elk-es9._mnt_data2	November 23, 22:04:01	4.23	Maintenance	Del
●	bst-elk-es03._data_hdd2	December 1, 09:11:08	4.38	Maintenance	Del
●	elk-es8._mnt_data3	November 26, 19:18:01	4.59	Maintenance	Del
●	elk-es1._mnt_data3	November 18, 18:23:23	4.67	Maintenance	Del
●	bst-elk-es02._data_hdd2	December 7, 13:27:42	4.71	Maintenance	Del
●	sd1-elk-es01._data_hdd1	November 20, 20:39:11	4.78	Maintenance	Del
●	elk-es1._mnt_data2	November 18, 19:44:24	4.81	Maintenance	Del
●	bst-elk-es03._data_hdd1	November 21, 06:26:01	4.87	Maintenance	Del
●	bst-elk-es02._data_hdd1	November 19, 10:21:08	4.91	Maintenance	Del
●	elk-es10._mnt_data3	November 26, 17:47:01	4.95	Maintenance	Del
●	elk-es8._mnt_data2	November 20, 15:19:02	4.95	Maintenance	Del
●	sd1-elk-es01._data_hdd2	December 3, 12:35:08	4.97	Maintenance	Del
●	elk-es10._mnt_data2	November 21, 19:22:01	4.98	Maintenance	Del
●	elk-es9._mnt_data3	November 26, 12:47:08	4.99	Maintenance	Del
●	elk-es10._mnt_data	December 11, 03:03:47	10.6	Maintenance	Del
●	elk-es1._mnt_data	December 2, 14:15:08	11.47	Maintenance	Del
●	elk-es8._mnt_data	November 26, 13:51:08	13.52	Maintenance	Del
●	graphite01._mnt_data	December 1, 15:14:08	14.62	Maintenance	Del
●	graphite02._mnt_data	November 7, 19:06:49	15.7	Maintenance	Del
●	elk-es8.root	December 8, 20:19:59	23.8	Maintenance	Del
●	bst-graphite01.root	November 7, 19:05:43	23.81	Maintenance	Del
●	elk-es10.root	December 9, 00:41:47	24.02	Maintenance	Del

Event History

On this tab you can see a chronologically sorted list of events for each separate metric. Each event includes time, old and new values. Please, note that the left (old) value is taken from the previous event, and does not represent metric value just before the event.



Low disk space

Target	aliasByNode(movingMin(DevOps.system.*.disk.*.gigabyte_percentfree, '30min'), 2, 4)
Value	Warning: 11, Error: 3, Set NODATA if has no value for 600 seconds
Schedule	Everyday 00:00–23:59
Tags	Graphite DevOps Dtrace ELK normal Moira

Current state   Events history

Metric	*State change*	*Event time*
sd1-elk-es01._data_ssd	⚪ → 🟢 100	December 11, 16:32:51
	12.09 🟢 → ⚪	December 11, 16:08:16
	7.36 🟡 → 🟢 12.09	December 7, 22:58:55
	2.83 🔴 → 🟡 7.36	December 7, 22:46:54
	4.26 🟡 → 🔴 2.83	December 7, 22:05:59
	2.91 🔴 → 🟡 4.26	December 7, 21:40:59
	10.98 🟡 → 🔴 2.91	December 7, 20:19:13
	12.76 🟢 → 🟡 10.98	December 7, 19:46:49
	10.99 🟡 → 🟢 12.76	December 7, 09:00:57
	11.23 🟢 → 🟡 10.99	December 7, 06:21:49
	8.15 🟡 → 🟢 11.23	December 7, 05:45:52
	2.91 🔴 → 🟡 8.15	December 7, 05:31:48
	🟡 → 🔴 2.91	December 7, 04:50:55
elk-es10._mnt_data	🟢 → 🟡 11	December 11, 03:03:47
elk-es1._mnt_ssd	4.05 🟡 → 🟢 15.97	December 9, 07:45:52
	2.72 🔴 → 🟡 4.05	December 9, 06:57:58
	3.08 🟡 → 🔴 2.72	December 9, 06:10:14
	2.94 🔴 → 🟡 3.08	December 9, 02:30:50
	10.88 🟡 → 🔴 2.94	December 8, 23:01:54
	13.04 🟢 → 🟡 10.88	December 8, 18:15:58
	3.56 🟡 → 🟢 13.04	December 8, 09:47:13
	2.84 🔴 → 🟡 3.56	December 8, 00:18:25

1.4.6 Throttling

Throttling is a distinctive and controversial feature of Moira. If you are experiencing a delay or any other strange behavior of notifications, chances are, it is because of throttling.

To understand throttling, imagine two triggers:

1. Send notification if CPU load on any of your servers is more than 75%.
2. Send notification if there is a fire in your server room.

It is a busy day, your servers are overloaded, and you are receiving a ton of notifications about CPU load. Probably, you already have several dozens of notifications in your inbox. You will likely delete all of them at once, and you probably won't notice that one of these hundreds of letters was about a fire in your server room.

So, the problem is: one misconfigured trigger spoils everything by spamming your inbox with irrelevant notifications. Moira provides a protection mechanism called throttling. Simple rules:

1. If a trigger sends more than 10 notifications per 1 hour, limit this trigger to 1 message per 30 minutes.
2. If a trigger sends more than 20 notifications per 3 hours, limit this trigger to 1 message per 1 hour.

It works like this:

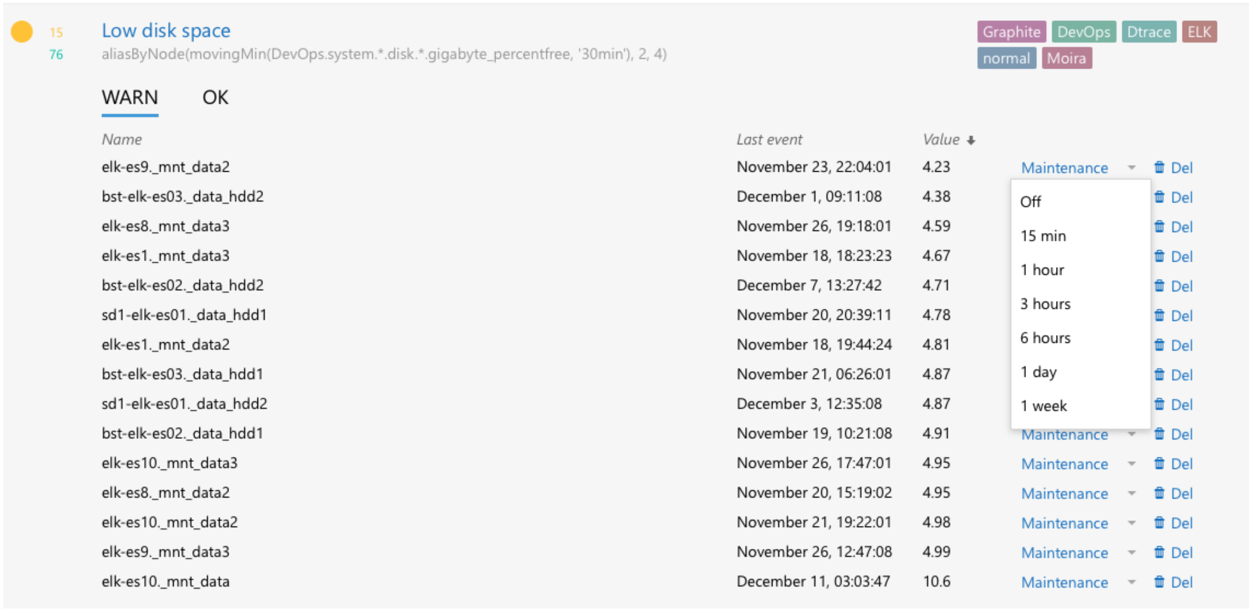
- First notification is delivered immediately.
- Second notification is delivered immediately.
- . . .
- Tenth notification is delivered immediately, and you get a warning: “Please, fix your system or tune this trigger to generate less events.”
- Next notifications are delayed so that you receive one message per 30 minutes/1 hour. Nothing is lost, you just receive one message with a pack of events. Every message contains a warning: “Please, fix your system or tune this trigger to generate less events.”

Moira will enable and disable throttling automatically based on frequency of events.

Disabling Throttling

There are four ways to disable throttling for a specific trigger:

1. Obey the warning message. That is, fix your system to generate less events. Or change trigger thresholds. Or use Graphite functions like `movingAverage` to remove spikes from your metric graph. This is the best method to deal with throttling.
2. Enable *Maintenance* mode for some of your metrics. This will temporarily disable checking of a metric and give you time to fix the system:

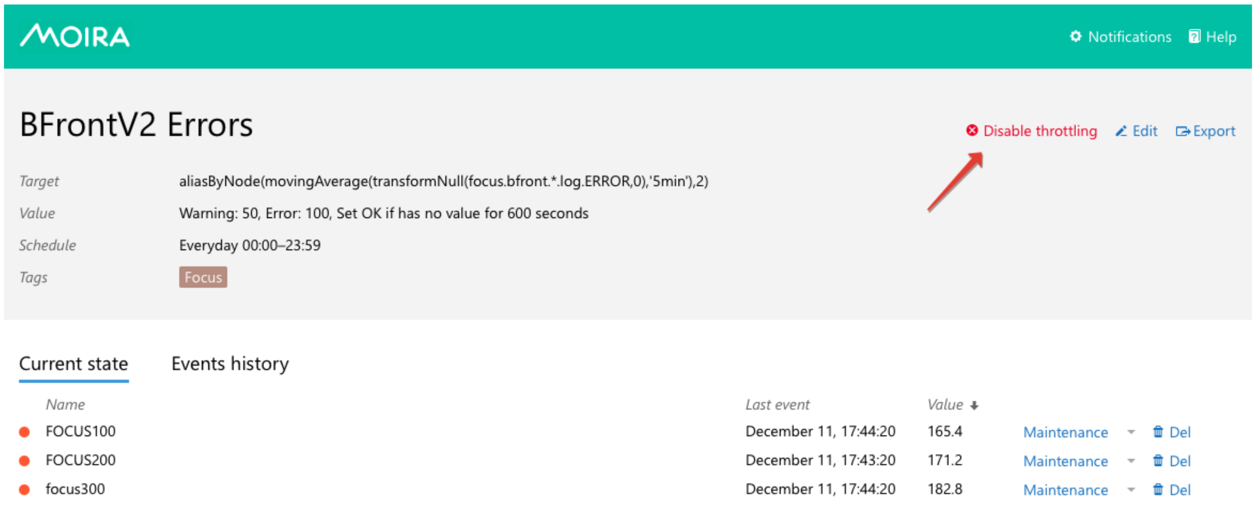


Low disk space

aliasByNode(movingMin(DevOps.system.*.disk.*.gigabyte_percentfree, '30min'), 2, 4)

Name	Last event	Value		
elk-es9._mnt_data2	November 23, 22:04:01	4.23	Maintenance	Del
bst-elk-es03._data_hdd2	December 1, 09:11:08	4.38		Del
elk-es8._mnt_data3	November 26, 19:18:01	4.59		Del
elk-es1._mnt_data3	November 18, 18:23:23	4.67		Del
bst-elk-es02._data_hdd2	December 7, 13:27:42	4.71		Del
sd1-elk-es01._data_hdd1	November 20, 20:39:11	4.78		Del
elk-es1._mnt_data2	November 18, 19:44:24	4.81		Del
bst-elk-es03._data_hdd1	November 21, 06:26:01	4.87		Del
sd1-elk-es01._data_hdd2	December 3, 12:35:08	4.87		Del
bst-elk-es02._data_hdd1	November 19, 10:21:08	4.91	Maintenance	Del
elk-es10._mnt_data3	November 26, 17:47:01	4.95	Maintenance	Del
elk-es8._mnt_data2	November 20, 15:19:02	4.95	Maintenance	Del
elk-es10._mnt_data2	November 21, 19:22:01	4.98	Maintenance	Del
elk-es9._mnt_data3	November 26, 12:47:08	4.99	Maintenance	Del
elk-es10._mnt_data	December 11, 03:03:47	10.6	Maintenance	Del

3. Manually reset throttling for your trigger. This basically means that you’ve fixed the system and would like to resume operation normally. It won’t help if your trigger is still spamming notifications:



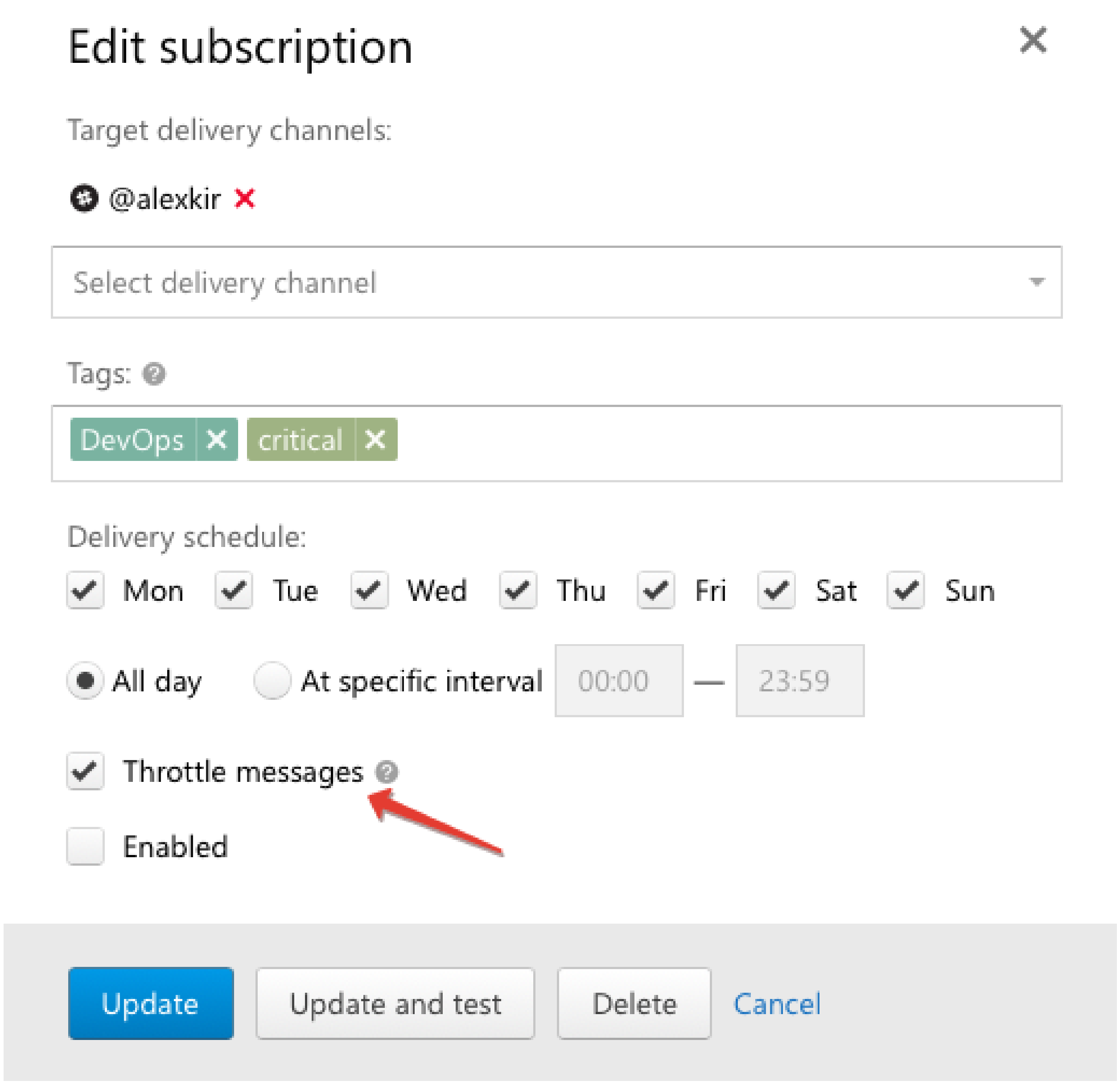
BFrontV2 Errors

Target	aliasByNode(movingAverage(transformNull(focus.bfront.*.log.ERROR,0),'5min'),2)
Value	Warning: 50, Error: 100, Set OK if has no value for 600 seconds
Schedule	Everyday 00:00–23:59
Tags	Focus

Current state | Events history

	Name	Last event	Value
●	FOCUS100	December 11, 17:44:20	165.4
●	FOCUS200	December 11, 17:43:20	171.2
●	focus300	December 11, 17:44:20	182.8

4. Entirely disable throttling for a subscription. *This is not recommended*, unless you really know what you are doing:


Edit subscription

Target delivery channels:

@alexkir

Select delivery channel

Tags:

DevOps, critical

Delivery schedule:

✓ Mon ✓ Tue ✓ Wed ✓ Thu ✓ Fri ✓ Sat ✓ Sun

● All day ○ At specific interval 00:00 — 23:59

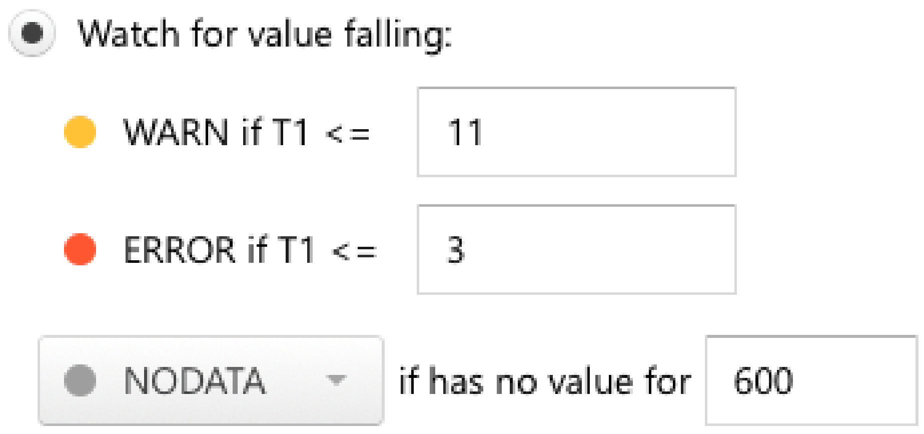
✓ Throttle messages

☐ Enabled

1.4.7 Dealing with NODATA

If you have a simple trigger (like the one described in *Simple Threshold Trigger*), you probably know what happens when a metric has a very high or a very low value. Free disk space is too low? You get a notification.

But what if your metric has *no* value? Literally, what if Moira is not receiving any data for your metric? How can you know, whether you have enough disk space left or not? In this case, a trigger setting defines the behavior:


● Watch for value falling:

● WARN if T1 <= 11

● ERROR if T1 <= 3

● NODATA if has no value for 600

When Moira hasn't been receiving data for more than default 600 seconds, it will set a special NODATA state for this metric. You can set any other state or change time delay here. For example, if you have an error metric, and no data means no errors, you should set this to OK.

You can also select DEL here to automatically delete all metrics that no longer provide data. A simple use case is when you often rename metrics and Moira quickly becomes flooded with old irrelevant metric names.

Warning: DEL is a dangerous setting, you can easily miss a real notification if your system stops sending metric data.

You will receive notifications when your metric goes in and out of NODATA state, just like any other state.

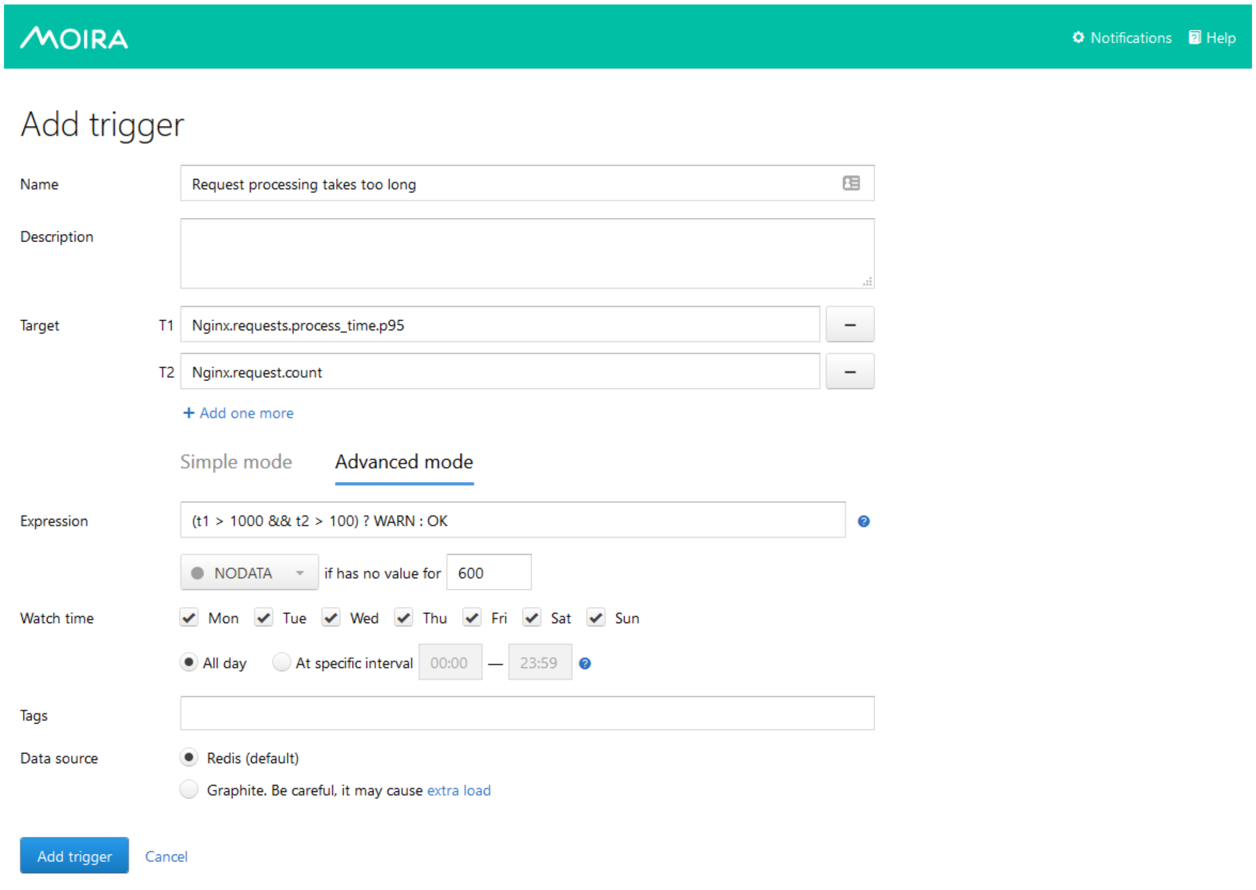
1.4.8 Advanced Mode Trigger

Sometimes a simple trigger (*Simple Threshold Trigger*) doesn't provide enough flexibility for your task.

For example, you may want to receive a notification when 5% of user requests take up more than a second to process, but only if there are more than 100 requests per minute. Usually, you will have two separate metrics for this:

1. `Nginx.requests.process_time.p95` - 95th percentile of request processing time in milliseconds
2. `Nginx.requests.count` - request count per minute

Maybe you can construct a monstrous Graphite expression to reflect this combination, but Moira's Advanced Mode is better:



Add trigger

Name		Request processing takes too long
Description		
Target	T1	Nginx.requests.process_time.p95
	T2	Nginx.request.count
		+ Add one more
		Simple mode / Advanced mode
Expression		(t1 > 1000 && t2 > 100) ? WARN : OK
		NODATA if has no value for 600
Watch time		✓ Mon ✓ Tue ✓ Wed ✓ Thu ✓ Fri ✓ Sat ✓ Sun
		● All day ○ At specific interval 00:00 — 23:59
Tags		
Data source		● Redis (default)
		○ Graphite. Be careful, it may cause extra load

You can use any govaluate expression with predefined constants here:

- `t1, t2, ...` are values from your targets
- `OK`, `WARN`, `ERROR`, `NODATA` are states that must be the result of evaluation
- `PREV_STATE` is equal to previously set state, and allows you to prevent frequent state changes

Note: Only T1 target can resolve into multiple metrics in Advanced Mode. T2, T3, . . . must resolve to single metrics. Moira will calculate expression separately for every metric in T1.

Any incorrect expressions or bad syntax will result in EXCEPTION trigger state.

Data source

If *Remote Triggers Checker* is enabled, you can choose between following Data Sources:

- Redis — Moira database. By default Redis stores data for only several hours. It covers most of user cases when you need real-time alerting.
- Graphite — remote Graphite-like HTTP API. It should be used only when you need to get metrics for a large period.

Warning: Please, use this Data Source with caution. It may cause extra load on Graphite HTTP API.

Important: Please, keep in mind that functions in Remote and Local triggers can work differently. To avoid this, make sure you use Carbonapi with the same revision as in Moira. Latest Carbonapi listed in *Changelog*.

1.4.9 Hidden Pages

Some rarely used features of Moira are hidden on pages that are not linked from anywhere. This is a deliberate design decision to reduce visual clutter in the main UI.

You need to type an address of a hidden page manually, like this: `http://moira.example.com/hidden_page`.

Notifications

If Moira encounters an error while sending a notification, it will try again every minute for the next 24 hours. After that period, the notification is considered lost. You can configure this via `resending_timeout` parameter in notifier yaml config.

In some cases notifications will never be delivered, for example if a user specifies invalid contact.

If you need to interrupt this behavior, you can manually delete failing notifications at `/notifications`.

Tags

Deleting a tag is a rare and dangerous operation, but you still can do it at `/tags`.

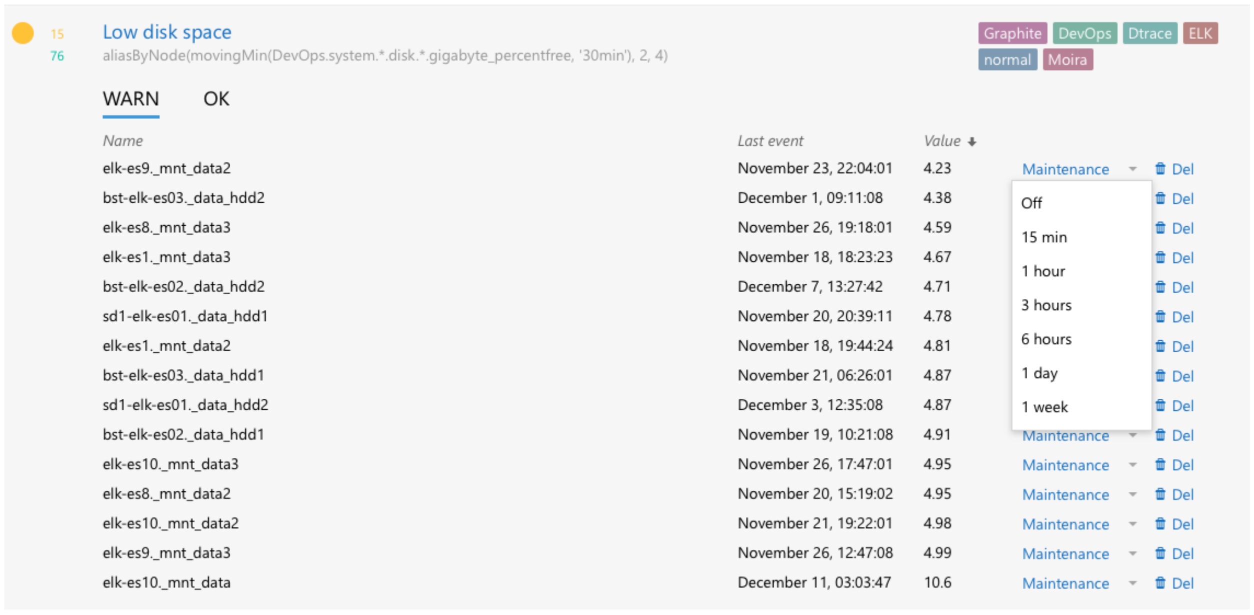
Tags list shows how many triggers and subscriptions use a tag. You can't delete a tag if there is at least one trigger that uses it. You **can** delete a tag that is used in a subscription.

Patterns

You can see a list of all Graphite patterns with links to corresponding triggers and list of all matching metrics at `/patterns`.

1.4.10 Maintenance

Maintenance is a proper way to mute alerting on specific metrics. It can be useful during planned work. E.g., you are going to move server from one data center to another and don't want Moira to disturb you.



15
76
Low disk space
aliasByNode(movingMin(DevOps.system.*.disk.*.gigabyte_percentfree, '30min'), 2, 4)

WARN OK

Name	Last event	Value		
elk-es9._mnt_data2	November 23, 22:04:01	4.23	Maintenance	Del
bst-elk-es03._data_hdd2	December 1, 09:11:08	4.38		Del
elk-es8._mnt_data3	November 26, 19:18:01	4.59		Del
elk-es1._mnt_data3	November 18, 18:23:23	4.67		Del
bst-elk-es02._data_hdd2	December 7, 13:27:42	4.71		Del
sd1-elk-es01._data_hdd1	November 20, 20:39:11	4.78		Del
elk-es1._mnt_data2	November 18, 19:44:24	4.81		Del
bst-elk-es03._data_hdd1	November 21, 06:26:01	4.87		Del
sd1-elk-es01._data_hdd2	December 3, 12:35:08	4.87		Del
bst-elk-es02._data_hdd1	November 19, 10:21:08	4.91	Maintenance	Del
elk-es10._mnt_data3	November 26, 17:47:01	4.95	Maintenance	Del
elk-es8._mnt_data2	November 20, 15:19:02	4.95	Maintenance	Del
elk-es10._mnt_data2	November 21, 19:22:01	4.98	Maintenance	Del
elk-es9._mnt_data3	November 26, 12:47:08	4.99	Maintenance	Del
elk-es10._mnt_data	December 11, 03:03:47	10.6	Maintenance	Del

Examples

When you switch a metric into maintenance, Moira will mute all state changes during that period. You will receive notification, if the state before and after maintenance turn out to be different.

Example 1. Alert will not be sent

- metric `awesomeMetric1` is in `OK` state;
- Rick switches metric into maintenance for an hour;
- within the hour metric changes its state several times:
  - `OK` → `WARN`,
  - `WARN` → `ERROR`,
  - `ERROR` → `OK`;
- after one-hour maintenance ends, metric is in `OK` state;
- Moira checks if metric state changed during maintenance:
  - `awesomeMetric1` state before maintenance: `OK`;
  - `awesomeMetric1` state after maintenance `OK`;
- nothing to notify about: the state remained the same as it was before the maintenance period.

Example 2. Alert will be sent

- metric `awesomeMetric2` is in `OK` state;
- Rick switches metric into maintenance for an hour;
- within the hour metric changes its state several times:
  - `OK` → `WARN`,

    - WARN → ERROR,
    - ERROR → OK,
    - OK → ERROR;
- after one-hour maintenance ends, metric is in ERROR state;
- Moira checks if metric state changed during maintenance:
    - awesomeMetric2 state before maintenance: OK;
    - awesomeMetric2 state after maintenance ERROR;
- Moira sends message to user: the state has changed from that which was before the maintenance period.

1.4.11 Self State Monitor

Self State Monitor is a built-in mechanism designed to protect end user from false NODATA notifications and notify administrator about issues in Moira and/or Graphite systems.

Why Self State Monitor

A situation is possible when Graphite Relay, Redis DB or Moira-Filter service breaks down. This leads to the fact that Moira doesn't receive any metrics from Graphite. In this case, Moira has no metrics on which it could check state of the triggers. According to the Moira logic, it should switch triggers to NODATA state and send alert messages to users.

To handle this situation properly, we recommend turning on the Self State Monitor. In this case, Moira will **prevent itself from sending alert messages to end users but notify administrators of the existing problem**.

Warning: When Self State Monitor detects a problem, it disables any notifications to end users and does not turn it back on without manual intervention.

Please, read this manual before using Self State Monitor in production.

See also:

For a better understanding, look at the architecture of the *Moira microservices*.

When Self State Monitor helps

Self state monitor checks these situations:

1. If there is no connection between Moira and Redis for longer than redis_disconect_delay.
2. If Moira-Filter receive no metrics for longer than last_metric_received_delay.
3. If Moira-Checker checks no triggers for longer than last_check_delay.

See also:

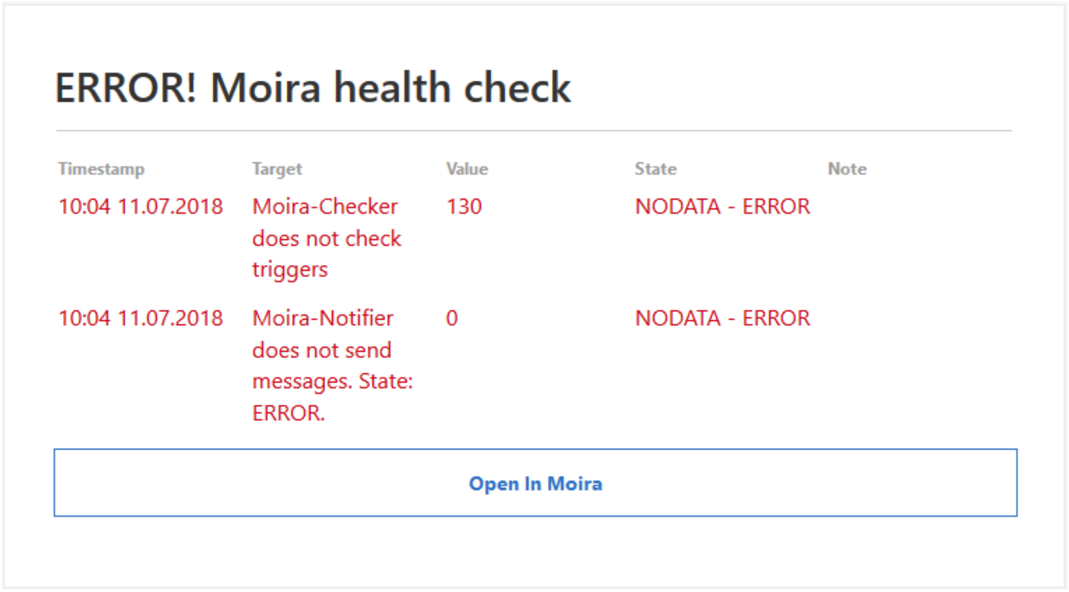
All the above configuration parametres can be found in the *Moira-Notifier section* on configuration page.

How Self State Monitor works

When you turn Self State Monitor on, it works this way:

- Self State Monitor checks *Moira state* every 10 seconds.
- Something breaks down. It can be Graphite-Relay, connection to Redis DB or crashed Moira-Filter docker container.
- Self State send alarm message to administrator with issue discription.

  Here is an example of message:



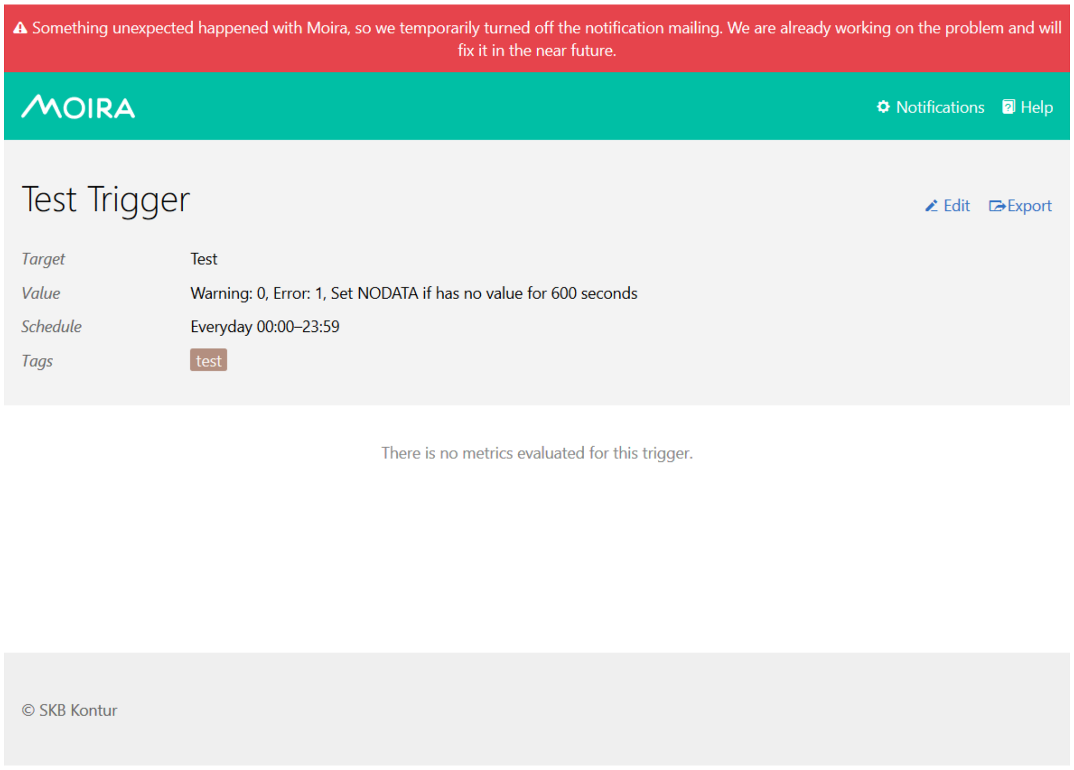
ERROR! Moira health check

Timestamp	Target	Value	State	Note
10:04 11.07.2018	Moira-Checker does not check triggers	130	NODATA - ERROR	
10:04 11.07.2018	Moira-Notifier does not send messages. State: ERROR.	0	NODATA - ERROR	

- Self State Monitor turns Moira-Notifier service off, switching it in `ERROR` state.

Note: When Moira-Notifier switches to `ERROR` state, it mutes all messages to end users and only alerts administrators about Moira health issues. You need to fix existing problems and then manually switch Moira-Notifier back to `OK` using *API*.

When Moira-Notifier not in `OK` *state, Moira will show you an error in Web UI*:


Something unexpected happened with Moira, so we temporarily turned off the notification mailing. We are already working on the problem and will fix it in the near future.

Test Trigger

Target	Test
Value	Warning: 0, Error: 1, Set NODATA if has no value for 600 seconds
Schedule	Everyday 00:00–23:59
Tags	test

There is no metrics evaluated for this trigger.

© SKB Kontur

Turn Moira-Notifier ON and OFF using API

You can get current Moira-Notifier state or update it using API. At the moment there are only two methods available.

1. Get current Moira-Notifier state:

```
GET /api/health/notifier HTTP/1.1
Host: MOIRA-URL:8081
```

   Returns JSON with Notifier state and a message of error. Message is omitted if state is OK.

```
{
    "state": "ERROR",
    "message": "Something unexpected happened with Moira, so we temporarily turned off the notification mailing. We are already working on the problem and will fix it in the near future."
}
```

2. Update Moira-Notifier state:

```
PUT /api/health/notifier HTTP/1.1
Host: MOIRA-URL:8081
Content-Type: application/json

{
    "state": "OK"
}
```

   Allowed state values: <OK|ERROR>.

1.5 Development

All services use Redis database to store and exchange data. Therefore, it is important to maintain an accurate description of data storage formats and conventions.

Following topics describe database structure, running tests, developing notification plugins, etc.

1.5.1 Architecture

Terminology

Pattern

A Graphite pattern is a single dot-separated metric name, possibly containing one or more wildcards.

Examples:

```
server.web*.load
server.web{1,2,3}.load
server.web1.load
```

Target

A Graphite target is one or more patterns, possibly combined using Graphite functions.

Examples:

```
averageSeries(server.web*.load)
```

Metric

A metric is a single time-series that is a result of parsing some Graphite target.

Some targets produce a single metric, for example:

```
server.web1.load
highestCurrent(server.web*.load)
```

Some targets produce several metrics, for example:

```
movingAverage(server.web*.load, 10)
```

State

Moira stores separate state for every metric. Each metric can be in only one state at any moment:

Trigger

Trigger is a configuration that tells Moira which metrics to watch for. Triggers consist of:

- Name. This is just for convenience, user can enter anything here.
- Description. Longer text that gets included in notification to delivery channels that support long texts.
- One or more targets.
- WARN and ERROR value limits, or a Python expression to calculate state.
- One or more tags.
- TTL value. Metrics switch to NODATA state when new data doesn't arrive for TTL seconds.
- Check schedule. For example, a trigger can be set to check only during business hours.

Last Check

When Moira checks a trigger, it stores the following information on each metric:

- Current value.
- Current timestamp.
- Current state.

Trigger Event

When Moira checks a trigger, if any of the metric states change, Moira generates an event. Events consist of:

- Trigger ID.
- Metric name (as given by parsed target).
- New state.
- Previous state.
- Current timestamp.

Tags

Tags are simple string markers for grouping of triggers and configuring subscriptions.

Subscription

Moira generates notifications for an event only if trigger tags match any of the user-created subscriptions. Each subscription consists of:

- One or more tags.
- Contact information.
- Quiet time schedule.

Dataflow

Filter and Check Incoming Metrics

When user adds a new trigger, Moira parses patterns from targets and saves them to `moira-pattern-list` key in Redis. Filter rereads this list every second. When a metric value arrives, Filter checks metric name against the list of patterns. Matching metrics are saved to `moira-metric:<metricname>` keys in Redis. Redis pub/sub mechanism is used to inform Checker of incoming metric value that should be checked as soon as possible.

Checker metrics handler reads triggers by pattern from `moira-pattern-triggers:<pattern>` and add `trigger_id` to Redis set `moira-triggers-to-check`. NODATA Checker adds all triggers to Redis set `moira-triggers-to-check` once per `nodata_check_interval` setting. *Remote Triggers Checker* gets all remote trigger ID and adds it to Redis set `moira-remote-triggers-to-check` once per `remote\check_interval` setting.

Checker pops `trigger_id` from `moira-triggers-to-check` and starts checking procedure. *Remote Triggers Checker* does the same, but pops `trigger_id` from `moira-remote-triggers-to-check` and starts remote check, which involve remote Graphite HTTP API.

Trigger target can contain one or multiple metrics, so results are written per metric. `moira-metric-last-check:<trigger_id>` Redis key contains last check JSON with metric states.

When a metric changes its state, a new event is written to `moira-trigger-events` Redis key. This happens only if value timestamp falls inside time period allowed by trigger schedule.

If a metric has been in NODATA or ERROR state for a long period, every 24 hours Moira will issue an additional reminder event.

Trigger switches to EXCEPTION state, if any exception occurs during trigger checking.

Process Trigger Events

Notifier constantly pulls new events from `moira-trigger-events` Redis key and schedules notifications according to subscription schedule and throttling rules. If a trigger contains *all* of the tags in a subscription, and only in this case, a notification is created for this subscription.

Subscription schedule delays notifications of occurred event to the beginning of next allowed time interval. Note that this differs from trigger schedule, which suppresses event generation entirely.

Throttling rules will delay notifications:

- If there are more than 10 events per hour, a notification will be sent at most once per 30 minutes.
- If there are more than 20 events per 3 hours, a notification will be sent at most once per hour.

Scheduled notifications are written to `moira-notifier-notifications` Redis key.

Process Notifications

Notifier constantly pulls scheduled notifications from `moira-notifier-notifications` Redis key. It calls sender for certain contact type and writes notification back to Redis in case of sender error.

1.5.2 UI

UI is a static web application built with RetailUI based on React.

Install dependencies.

```
npm install
```

Run webpack dev server at http://localhost:9000.

```
npm start
```

Note: UI doesn't work without running API microservice.

1.5.3 Backend

Backend microservices are written in Go. To run tests, first get all dependencies.

```
go get github.com/kardianos/govendor
govendor sync
```

Then, run GoConvey tests.

```
go get github.com/smartystreets/goconvey
goconvey
```

Writing Your Own Notification Sender

First, look at built-in senders:

- senders/slack
- senders/pushover
- senders/mail

All of them implement interface `Sender` from `interfaces.go`. Please, note that scheduling and throttling require senders to support packing several events into one message.

You should include your new sender in `RegisterSenders` method of `notifier/registrator.go` with appropriate type.

Senders have access to their settings in common config, which is passed to the `Init` method.

1.6 Contact Moira Developers

The best way to contact us is to visit our Gitter chat. We usually reply within a day, but sometimes immediately :)

CHAPTER 2

Overview

Moira is a real-time alerting tool, based on Graphite data.

2.1 Key Features

- **Graphite storage independence**

  Some Graphite queries are *very* ineffective. Tools like Seyren multiply this effect every minute making lots of ineffective queries and overloading your cluster. Moira relies on the incoming metric stream, and has its own fast cache for recent data.

- **Support for (almost) all Graphite functions**

  Graphite function library (carbonapi) is embedded directly into Moira source code. You can use any function and get predictable results, like in your Graphite or Grafana dashboards.

- **Support for custom expressions**

  If simple warning/error threshold is not enough, you can write flexible govaluate expressions to calculate trigger state based on metric data.

- **Tags for triggers and subscriptions**

  When several teams/services share one monitoring tool, it is essential to provide some way of filtering triggers and subscriptions in the UI. Moira has a flexible tag system.

- **Extendable notification channels**

  Moira supports email, Slack, Pushover and many other channels of notification out-of-the-box. But you can always write your own plugin in Go and rebuild Moira Notifier microservice.

- **Alarm fatigue protection**

  Sometimes one of your triggers goes mad and switches back and forth between states, sending you hundreds of notifications. Sometimes you just ignore and delete all messages, accidentally also deleting one that is actually important. Moira tries to protect you with a feature called *throttling*. It's simple: if one of your triggers starts to send over 10 messages per an hour, Moira limits this trigger to one message per 30 minutes. Alerts from this trigger are combined, and not lost - just packaged into a single message.

2.2 Limitations

By default, Moira stores metric history for one hour. This ensures performance under heavy load. You can tweak this in config file, but note that performance will degrade.

In order to reduce database load, Moira checks every single trigger at most once every 5 seconds. Probably, your metrics arrive once every minute, so you really won't notice this limitation. You can also tweak this in config file.

2.3 Microservices

In spirit of Graphite architecture, Moira consists of several loosely coupled microservices. You are welcome to replace or to add new ones.

2.3.1 Filter

Filter is a lightweight service responsible for receiving lots of metric data in Graphite format. It filters received data and saves only metrics that match any of user triggers. This reduces load on all other parts of Moira.

2.3.2 Checker

Checker is an application with embedded Graphite functions. Checker watches for incoming metric values and performs checks according to saved trigger settings. When state of any trigger changes, Checker generates an event.

2.3.3 Notifier

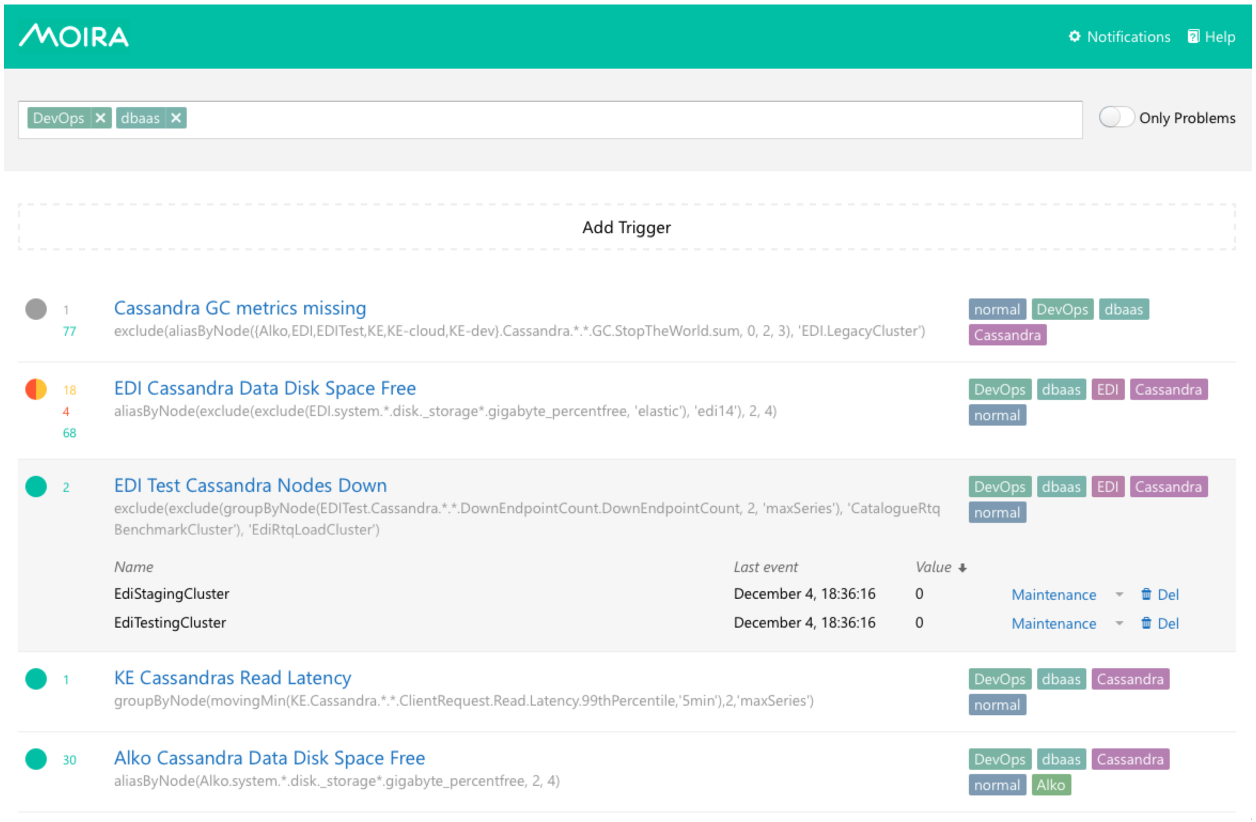
Notifier is an application that watches for generated events. Notifier is responsible for scheduling and sending notifications, observing quiet hours, retrying failed notifications, etc.

2.3.4 API

API is an application that serves as a backend for UI.

2.3.5 Web 2.0

Web 2.0 is a frontend React application, it looks like this:



1
77
Cassandra GC metrics missing
exclude(aliasByNode({Alko,EDI,EDITest,KE,KE-cloud,KE-dev}.Cassandra.*.*.GC.StopTheWorld.sum, 0, 2, 3), 'EDI.LegacyCluster')
normal DevOps dbaas Cassandra

18
4
68
EDI Cassandra Data Disk Space Free
aliasByNode(exclude(exclude(EDI.system.*.disk._storage*.gigabyte_percentfree, 'elastic'), 'edi14'), 2, 4)
DevOps dbaas EDI Cassandra normal

2
EDI Test Cassandra Nodes Down
exclude(exclude(groupByNode(EDITest.Cassandra.*.*.DownEndpointCount.DownEndpointCount, 2, 'maxSeries'), 'CatalogueRtqBenchmarkCluster'), 'EdiRtqLoadCluster')
DevOps dbaas EDI Cassandra normal

Name	*Last event*	*Value*		
EdiStagingCluster	December 4, 18:36:16	0	Maintenance	Del
EdiTestingCluster	December 4, 18:36:16	0	Maintenance	Del

1
KE Cassandras Read Latency
groupByNode(movingMin(KE.Cassandra.*.*.ClientRequest.Read.Latency.99thPercentile,'5min'),2,'maxSeries')
DevOps dbaas Cassandra normal

30
Alko Cassandra Data Disk Space Free
aliasByNode(Alko.system.*.disk._storage*.gigabyte_percentfree, 2, 4)
DevOps dbaas Cassandra normal Alko