Tensor Documentation

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Tensor is a modular gateway and event router for Riemann, built using the Twisted framework.

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CHAPTER 1

Getting started

1.1 Installation

Tensor can be installed from PyPi with pip

```
$ pip install tensor
```

This will also install Twisted, protobuf and PyYAML

Or you can use the .deb package. Let the latest release from https://github.com/calston/tensor/releases/latest

```
$ aptitude install python-twisted python-protobuf python-yaml
$ wget https://github.com/calston/tensor/releases/download/0.3.0/tensor_0.3.0_amd64.deb
$ dpkg -i tensor_0.3.0_amd64.deb
```

This also gives you an init script and default config in /etc/tensor/

1.2 Creating a configuration file

Tensor uses a simple YAML configuration file

The first basic requirements are the Riemann server and port (defaults to localhost:5555) and the queue interval:

```
server: localhost
port: 5555
interval: 1.0
proto: udp
```

Tensors checks are Python classes (called sources) which are instantiated with the configuration block which defines them. Rather than being one-shot scripts, a source object remains in memory with its own timer which adds events to a queue. The *interval* defined above is the rate at which these events are rolled up into a message and sent to Riemann.

It is important then that *interval* is set to a value appropriate to how frequently you want to see them in Riemann, as well as the rate at which they collect metrics from the system. All *interval* attributes are floating point in seconds, this means you can check (and send to Riemann) at rates well below 1 second.

1.3 Using outputs

You can configure multiple outputs which receive a copy of every message for example

```
outputs:
    - output: tensor.outputs.riemann.RiemannTCP
      server: localhost
      port: 5555
```

If you enable multiple outputs then the *server*, *port* and *proto* options will go un-used and the default Riemann TCP transport won't start.

You can configure as many outputs as you like, or create your own.

1.4 Using sources

To configure the basic CPU usage source add it to the *sources* list in the config file

```
sources:
    - service: cpu
      source: tensor.sources.linux.basic.CPU
      interval: 1.0
      warning: {
        cpu: "> 0.5"
      }
      critical: {
        cpu: "> 0.8"
      }
```

This will measure the CPU from /proc/stat every second, with a warning state if the value exceeds 50%, and a critical state if it exceeds 80%

The *service* attribute can be any string you like, populating the *service* field in Riemann. The logical expression to raise the state of the event is (eg. critical) is assigned to a key which matches the service name.

Sources may return more than one metric, in which case it will add a prefix to the service. The state expression must correspond to that as well.

For example, the Ping check returns both latency and packet loss:

```
service: googledns
source: tensor.sources.network.Ping
interval: 60.0
destination: 8.8.8.8
critical: {
    googledns.latency: "> 100",
    googledns.loss: "> 0"
}
```

This will ping *8.8.8.8* every 60 seconds and raise a critical alert for the latency metric if it exceeds 100ms, and the packet loss metric if there is any at all.

1.5 Configuration

Sources can contain any number of configuration attributes which vary between them. All sources take the following options though

service	mandatory	Service name after which extra metric names are appended, dot separated
interval	depends	Clock tick interval, for sources which implement a polling clock
ttl	optional	TTL for metric expiry in Riemann
hostname	optional	Hostname to tag this service with. Defaults to system FQDN but can be overriden.
tags	optional	Comma separated list of tags for metrics

1.6 State triggers

critical and *warning* matches can also be a regular expression for sources which output keys for different devices and metrics:

```
service: network
source: tensor.sources.linux.basic.Network
...
critical: {
    network.\w+.tx_packets: "> 1000",
}
```

1.7 Routing sources

Since multiple outputs can be added, Tensor events can be routed from sources to specific outputs or multiple outputs. By default events are routed to all outputs.

To enable routing, outputs need a unique *name* attribute:

```
outputs:
    - output: tensor.outputs.riemann.RiemannTCP
      name: riemann1
      server: riemann1.acme.com
      port: 5555

    - output: tensor.outputs.riemann.RiemannTCP
      name: riemann2
      server: riemann2.acme.com
      port: 5555

    - output: tensor.outputs.riemann.RiemannUDP
      name: riemannudp
      server: riemann1.acme.com
      port: 5555

sources:
    - service: cpu1
      source: tensor.sources.linux.basic.CPU
      interval: 1.0
      route: riemannudp

    - service: cpu2
      source: tensor.sources.linux.basic.CPU
      interval: 1.0
      route:
        - riemann1
        - riemann2
```

The *route* attribute can also accept a list of output names. The above configuration would route cpu1 metrics to the UDP output, and the cpu2 metrics to both riemann1 and riemann2 TCP outputs.

1.8 Starting Tensor

To start Tensor, simply use twistd to run the service and pass a config file:

```
twistd -n tensor -c tensor.yml
```

If you're using the Debian package then an init script is included.

CHAPTER 2

Sources

2.1 Introduction

Sources are Python objects which subclass *tensor.objects.Source*. They are constructed with a dictionary parsed from the YAML configuration block which defines them, and as such can read any attributes from that either optional or mandatory.

Since sources are constructed at startup time they can retain any required state, for example the last metric value to report rates of change or for any other purpose. However since a Tensor process might be running many checks a source should not use an excessive amount of memory.

The *source* configuration option is passed a string representing an object in much the same way as you would import it in a python module. The final class name is split from this string. For example specifying:

```
source: tensor.sources.network.Ping
```

is equivalent to:

```
from tensor.sources.network import Ping
```

2.2 Writing your own sources

A source class must subclass *tensor.objects.Source* and also implement the interface `tensor.interfaces.ITensorSource`

The source must have a *get* method which returns a *tensor.objects.Event* object. The Source parent class provides a helper method *createEvent* which performs the metric level checking (evaluating the simple logical statement in the configuration), sets the correct service name and handles prefixing service names.

A "Hello world" source:

```
from zope.interface import implements

from tensor.interfaces import ITensorSource
from tensor.objects import Source

class HelloWorld(Source):
    implements(ITensorSource)

    def get(self):
        return self.createEvent('ok', 'Hello world!', 0)
```

To hold some state, you can re-implement the *__init__* method, as long as the arguments remain the same.

Extending the above example to create a simple flip-flop metric event:

```
from zope.interface import implements

from tensor.interfaces import ITensorSource
from tensor.objects import Source

class HelloWorld(Source):
    implements(ITensorSource)

    def __init__(self, *a):
        Source.__init__(self, *a)
        self.bit = False

    def get(self):
        self.bit = not self.bit
        return self.createEvent('ok', 'Hello world!', self.bit and 0.0 or 1.0)
```

You could then place this in a Python module like *hello.py* and as long as it's in the Python path for Tensor it can be used as a source with *hello.HelloWorld*

A list of events can also be returned but be careful of overwhelming the output buffer, and if you need to produce lots of metrics it may be worthwhile to return nothing from *get* and call *self.queueBack* as needed.

2.3 Using custom sources

When a source is specified, eg

```
source: tensor.sources.network.Ping
```

Tensor will import and instantiate the *Ping* class from *tensor.sources.network*. Consequently a source can be any installed Python module.

For the sake of convenience, however, Tensor also appends */var/lib/tensor* to the Python path. This means you can easily create, test and distribute sources in that directory.

For example, create the above *hello.py* file and place it in */var/lib/tensor* then use the configuration

```
source: hello.HelloWorld
```

You can also always submit Github pull request with sources to have them added to Tensor for others to benefit from!

2.4 Handling asynchronous tasks

Since Tensor is written using the Twisted asynchronous framework, sources can (and in most cases *must*) make full use of it to implement network checks, or execute other processes.

The simplest example of a source which executes an external process is the ProcessCount check:

```
from zope.interface import implements

from twisted.internet import defer

from tensor.interfaces import ITensorSource
from tensor.objects import Source
```

```
from tensor.utils import fork

class ProcessCount(Source):
    implements(ITensorSource)

    @defer.inlineCallbacks
    def get(self):
        out, err, code = yield fork('/bin/ps', args=('-e',))

        count = len(out.strip('\n').split('\n'))

        defer.returnValue(
            self.createEvent('ok', 'Process count %s' % (count), count)
        )
```

For more information please read the Twisted documentation at https://twistedmatrix.com/trac/wiki/Documentation

The *tensor.utils.fork()* method returns a deferred which can timeout after a specified time.

2.5 Thinking outside the box

Historically monitoring systems are poorly architected, and terribly inflexible. To demonstrate how Tensor offers a different concept to the boring status quo it's interesting to note that there is nothing preventing you from starting a listening service directly within a source which processes and relays events to Riemann implementing some protocol.

Here is an example of a source which listens for TCP connections to port 8000, accepting any number on a line and passing that to the event queue:

```
from twisted.internet.protocol import Factory
from twisted.protocols.basic import LineReceiver
from twisted.internet import reactor

from zope.interface import implements

from tensor.interfaces import ITensorSource
from tensor.objects import Source

class Numbers(LineReceiver):
    def __init__(self, source):
        self.source = source

    def lineReceived(self, line):
        """
        Send any numbers received back to the Tensor queue
        """
        print repr(line)
        try:
            num = float(line)
            self.source.queueBack(
                self.source.createEvent('ok', 'Number: %s' % num, num)
            )
        except:
            pass

class NumbersFactory(Factory):
    def __init__(self, source):
        self.source = source
```

```
    def buildProtocol(self, addr):
        return Numbers(self.source)

class NumberProxy(Source):
    implements(ITensorSource)

    def startTimer(self):
        # Override starting the source timer, we don't need it
        f = NumbersFactory(self)
        reactor.listenTCP(8000, f)

    def get(self):
        # Implement the get method, but we can ignore it
        pass
```

CHAPTER 3

Outputs

3.1 Introduction

Outputs are Python objects which subclass *tensor.objects.Output*. They are constructed with a dictionary parsed from the YAML configuration block which defines them, and as such can read any attributes from that either optional or mandatory.

Since outputs are constructed at startup time they can retain any required state. A copy of the queue is passed to all **:method:'tensor.objects.Output.eventsReceived'** calls which happen at each queue *interval* config setting as the queue is emptied. This list of *tensor.objects.Event* objects must not be altered by the output.

The *output* configuration option is passed a string representing an object the same way as *sources* configurations are

```
outputs:
    - output: tensor.outputs.riemann.RiemannTCP
      server: 127.0.0.1
      port: 5555
```

3.2 Using TLS

The TCP output also supports TLS, which can make use of Puppet certs for convenience

```
outputs:
    - output: tensor.outputs.riemann.RiemannTCP
      server: 127.0.0.1
      port: 5554
      tls: true
      cert: /var/lib/puppet/ssl/certs/test.acme.com.pem
      key: /var/lib/puppet/ssl/private_keys/test.acme.com.pem
```

3.3 Writing your own outputs

An output clas should subclass *tensor.objects.Output*.

The output can implement a *createClient* method which starts the output in whatever way necessary and can be a deferred. The output must also have a *eventsReceived* method which takes a list of *tensor.objects.Event* objects and process them accordingly, it can also be a deferred.

An example logging source:

```
from twisted.internet import reactor, defer
from twisted.python import log

from tensor.objects import Output

class Logger(Output):
    def eventsReceived(self, events):
        log.msg("Events dequeued: %s" % len(events))
```

If you save this as *test.py* the basic configuration you need is simply

```
outputs:
    - output: tensor.outputs.riemann.RiemannUDP
      server: localhost
      port: 5555

    - output: test.Logger
```

You should now see how many events are exiting in the Tensor log file

```
2014-10-24 15:35:27+0200 [-] Starting protocol <tensor.protocol.riemann.RiemannUDP object at 0x7f3b5a
2014-10-24 15:35:28+0200 [-] Events dequeued: 7
2014-10-24 15:35:29+0200 [-] Events dequeued: 2
2014-10-24 15:35:30+0200 [-] Events dequeued: 3
```

CHAPTER 4

Example configurations

4.1 Replacing Munin

The first step is to create a TRIG stack (Tensor Riemann InfluxDB Grafana).

4.1.1 Step 1: Install Riemann

```
$ wget http://aphyr.com/riemann/riemann_0.2.6_all.deb
$ aptitude install openjdk-7-jre
$ dpkg -i riemann_0.2.6_all.deb
```

4.1.2 Step 2: Install InfluxDB

```
$ wget http://s3.amazonaws.com/influxdb/influxdb_latest_amd64.deb
$ sudo dpkg -i influxdb_latest_amd64.deb
```

Start InfluxDB, then quickly change the root/root default password because it also defaults to listening on all interfaces and apparently this is not important enough for them to fix.

Create a *riemann* and *grafana* database, and some users for them

```
$ curl -X POST 'http://localhost:8086/db?u=root&p=root' \
  -d '{"name": "riemann"}'
$ curl -X POST 'http://localhost:8086/db?u=root&p=root' \
  -d '{"name": "grafana"}'
$ curl -X POST 'http://localhost:8086/db/riemann/users?u=root&p=root' \
  -d '{"name": "riemann", "password": "riemann"}'
$ curl -X POST 'http://localhost:8086/db/grafana/users?u=root&p=root' \
  -d '{"name": "grafana", "password": "grafana"}'
```

NB. InfluxDB is easy to get running but is not production ready or stable so your data can very easily be lost.

4.1.3 Step 3: Install Grafana

```
$ aptitude install nginx
$ mkdir /var/www
$ cd /var/www
$ wget http://grafanarel.s3.amazonaws.com/grafana-1.8.1.tar.gz
```

```
$ tar -zxf grafana-1.8.1.tar.gz
$ mv grafana-1.8.1 grafana
```

Now we must create an nginx configuration in */etc/nginx/sites-enabled*.

You can use something like this

```
server {
    listen 80;
    server_name <your hostname>;
    access_log /var/log/nginx/grafana-access.log;
    error_log /var/log/nginx/grafana-error.log;

    location / {
        alias /var/www/grafana/;
        index index.html;
        try_files $uri $uri/ /index.html;
    }
}
```

Next we need a configuration file for grafana. Open */var/www/grafana/config.js* and use the following configuration

```
define(['settings'],
function (Settings) {
  return new Settings({
    datasources: {
      influxdb: {
        type: 'influxdb',
        url: "http://<your hostname>:8086/db/riemann",
        username: 'riemann',
        password: 'riemann',
      },
      grafana: {
        type: 'influxdb',
        url: "http://<your hostname>:8086/db/grafana",
        username: 'grafana',
        password: 'grafana',
        grafanaDB: true
      },
    },
    search: {
      max_results: 20
    },
    default_route: '/dashboard/file/default.json',
    unsaved_changes_warning: true,
    playlist_timespan: "1m",
    admin: {
      password: ''
    },
    window_title_prefix: 'Grafana - ',
    plugins: {
      panels: [],
      dependencies: [],
    }
  });
});
```

4.1.4 Step 4: Glue things together

Lets start by configuring Riemann to talk to InfluxDB. This is the full /etc/riemann/riemann.config file.

```
; -*- mode: clojure; -*-
; vim: filetype=clojure
(require 'capacitor.core)
(require 'capacitor.async)
(require 'clojure.core.async)

(defn make-async-influxdb-client [opts]
    (let [client (capacitor.core/make-client opts)
          events-in (capacitor.async/make-chan)
          resp-out (capacitor.async/make-chan)]
        (capacitor.async/run! events-in resp-out client 100 10000)
        (fn [series payload]
            (let [p (merge payload {
                    :series series
                    :time   (* 1000 (:time payload)) ;; s → ms
                })]
                (clojure.core.async/put! events-in p)))))

(def influx (make-async-influxdb-client {
        :host     "localhost"
        :port     8086
        :username "riemann"
        :password "riemann"
        :db       "riemann"
    }))

(logging/init {:file "/var/log/riemann/riemann.log"})

; Listen on the local interface over TCP (5555), UDP (5555), and websockets
; (5556)
(let [host "0.0.0.0"]
  (tcp-server {:host host})
  (udp-server {:host host})
  (ws-server  {:host host}))

(periodically-expire 60)

(let [index (index)]
  (streams
        index

        (fn [event]
            (let [series (format "%s.%s" (:host event) (:service event))]
                (influx series {
                    :time  (:time event)
                    :value (:metric event)
                }))))))
```

You're pretty much done at this point, and should see the metrics from the Riemann server process if you open up Grafana and look through the query builder.

4.1.5 Step 5: Using Tensor to retrieve stats from munin-node

First of all, install Tensor

```
$ pip install tensor
```

Next create /etc/tensor and a *tensor.yml* file in that directory.

The *tensor.yml* config file should look like this

```
ttl: 60.0
interval: 1.0

outputs:
    - output: tensor.outputs.riemann.RiemannTCP
      port: 5555
      server: <riemann server>

# Sources
sources:
    - service: mymunin
      source: tensor.sources.munin.MuninNode
      interval: 60.0
      ttl: 120.0
      critical: {
        mymunin.system.load.load: "> 2"
      }
```

This configures Tensor to connect to the munin-node on the local machine and retrieve all configured plugin values. You can create critical alert levels by setting the dot separated prefix for the service name and munin plugin.

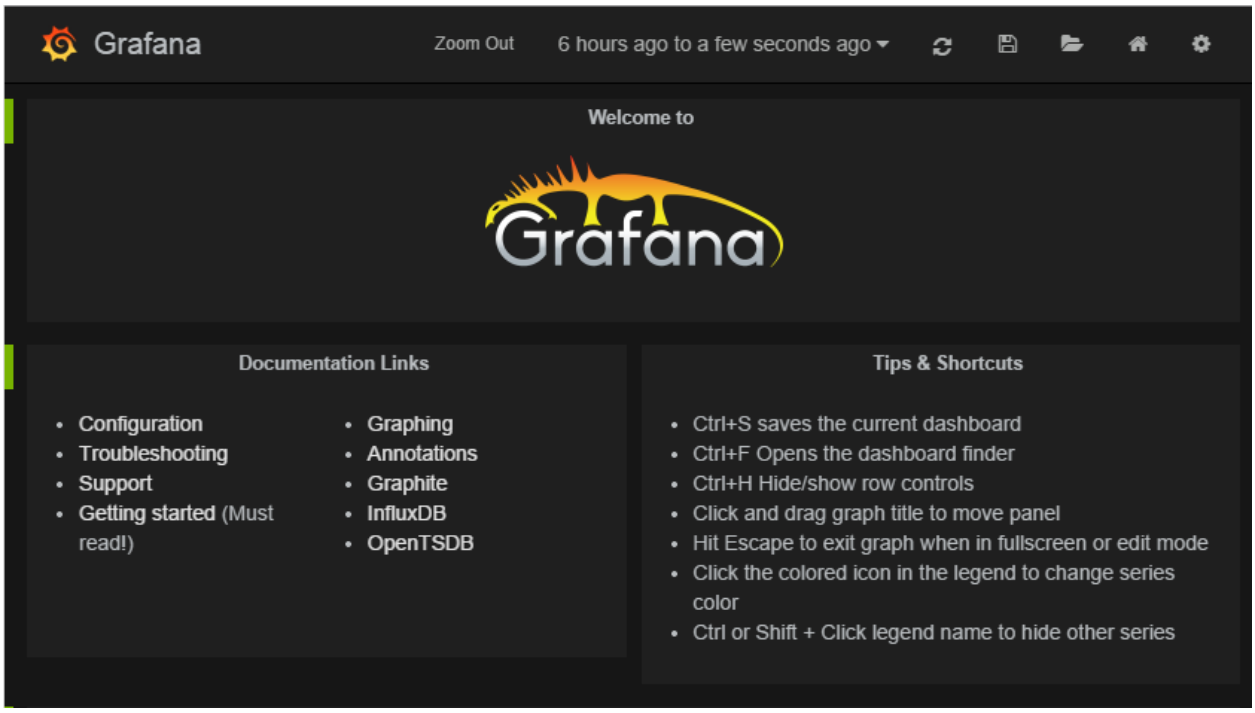
You can now start Tensor

```
$ twistd -n tensor -c /etc/tensor/tensor.yml
2014-10-22 13:30:38+0200 [-] Log opened.
2014-10-22 13:30:38+0200 [-] twistd 14.0.2 (/home/colin/riemann-tensor/ve/bin/python 2.7.6) starting
2014-10-22 13:30:38+0200 [-] reactor class: twisted.internet.epollreactor.EPollReactor.
2014-10-22 13:30:38+0200 [-] Starting factory <tensor.protocol.riemann.RiemannClientFactory instance
```

This pretty much indiciates everything is alright, or else we'd see quickly see some errors.

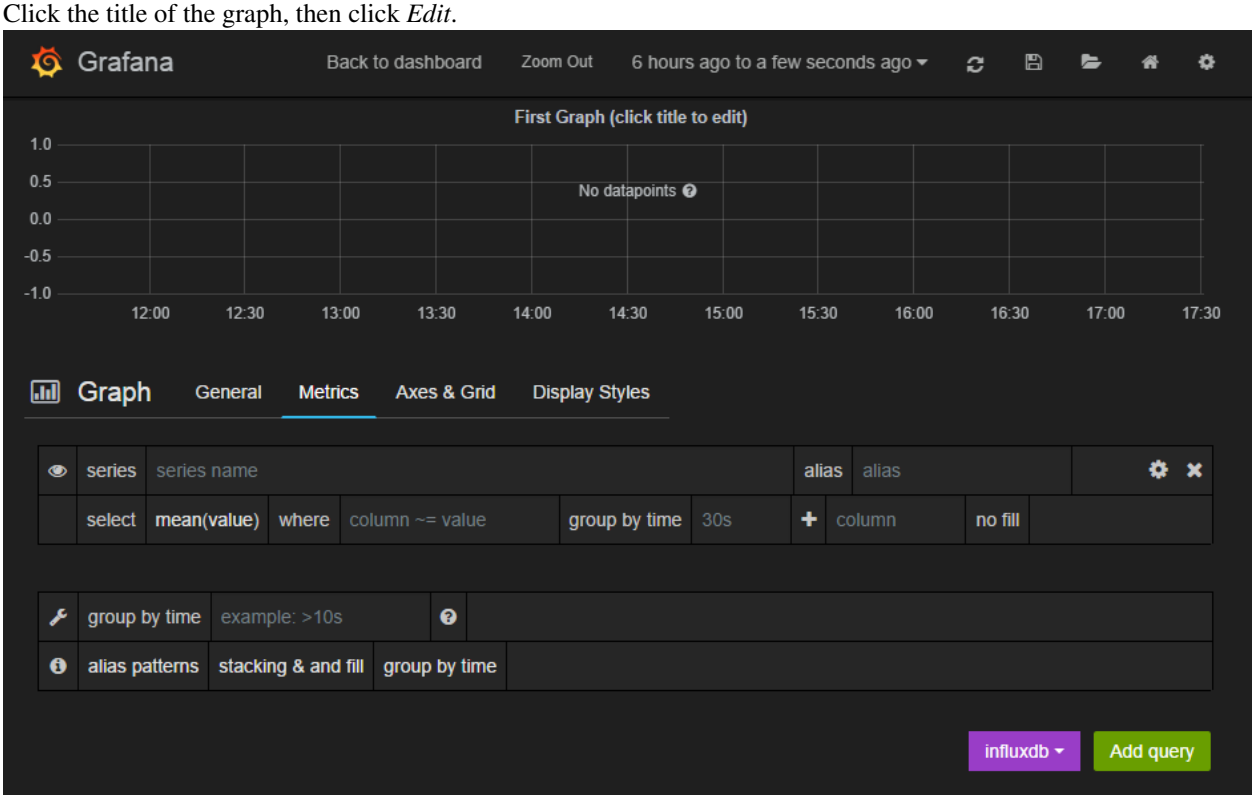
Next we will add some graphs to Grafana

4.1.6 Step 6: Creating graphs in Grafana

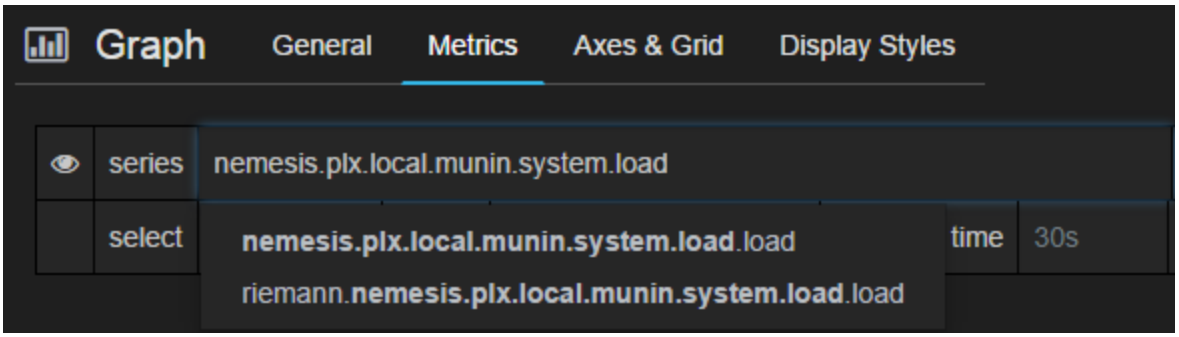


Click on the green row tag on the left, and delete all but the last row. This will leave you with an empty graph.

Click the title of the graph, then click *Edit*.



In the edit screen the Metrics tab will be open already. Now we can add our munin metrics. If you start typing in the *series* field you should see your hosts and metrics autocomplete.



Many Munin metrics are *counter* types which are usually converted to a rate by the RRD aggregation on Munin Graph.

Handily the `tensor.sources.munin.MuninNode` source takes care of this by caching the metric between run intervals when that type is used.

If we wanted to graph our network interface all we need to do is make it a slightly better unit by multiplying the Byte/sec metric by 8, since Grafana provides a bit/sec legend format.

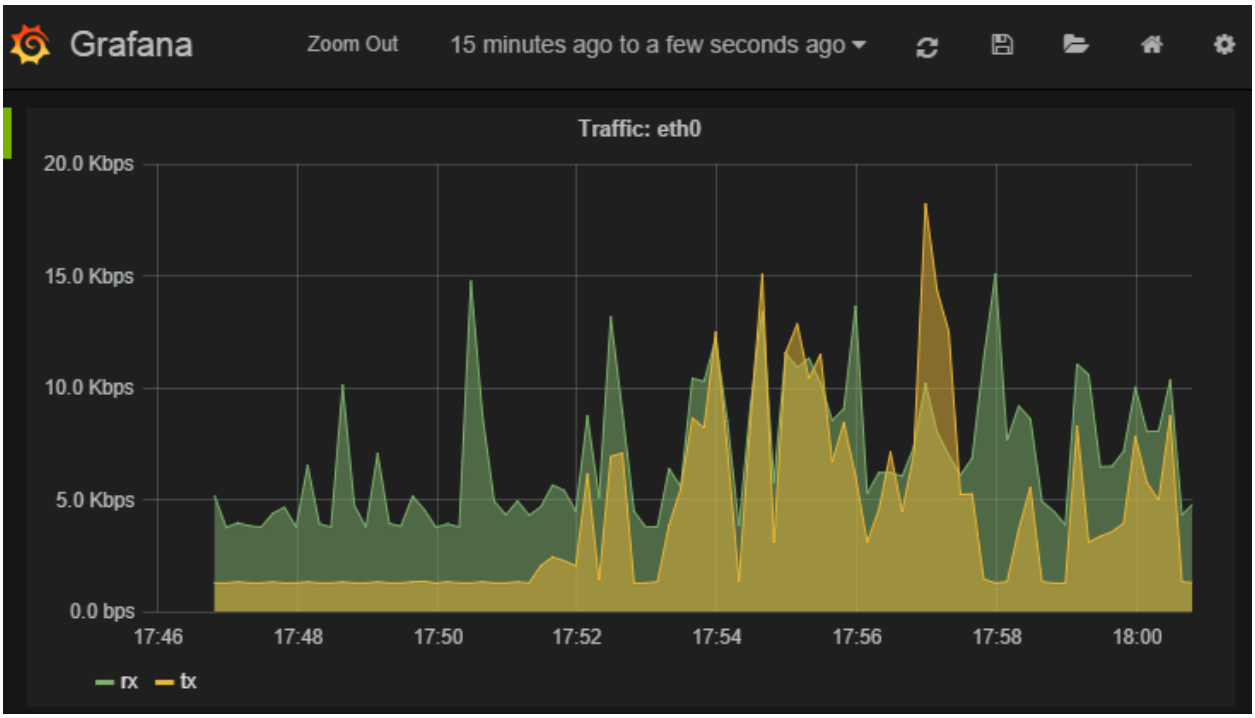
To do this start by clicking the gear icon on the metric query, then select *Raw query mode*.

Use the following query

```
select value * 8 from "<your hostname>.munin.network.if_eth0.down" where $timeFilter group by time($i
```

And chose an alias of "RX". Do the same for if_eth0.up and alias that "TX". You should end up with something like this

Click on *General* to edit the title, and then on *Axes & Grid* change the Format to *bps*. Under *Display Styles* you can stack the data or play around with the look of the graph. Click *Back to dashboard* and you should end up with something as follows



API Documentation:

CHAPTER 5

tensor

5.1 tensor.aggregators

tensor.aggregators.**Counter**(*a*, *b*, *delta*)
Counter derivative

tensor.aggregators.**Counter32**(*a*, *b*, *delta*)
32bit counter aggregator with wrapping

tensor.aggregators.**Counter64**(*a*, *b*, *delta*)
64bit counter aggregator with wrapping

5.2 tensor.interfaces

5.3 tensor.objects

class tensor.objects.**Event**(*state*, *service*, *description*, *metric*, *ttl*, *tags=None*, *hostname=None*, *aggregation=None*, *evtime=None*, *attributes=None*, *type='riemann'*)

Bases: object

Tensor Event object

All sources pass these to the queue, which form a proxy object to create protobuf Event objects

Parameters

- **state** – Some sort of string < 255 chars describing the state
- **service** – The service name for this event
- **description** – A description for the event, ie. "My house is on fire!"
- **metric** – int or float metric for this event
- **ttl** – TTL (time-to-live) for this event
- **tags** – List of tag strings
- **hostname** – Hostname for the event (defaults to system fqdn)
- **aggregation** – Aggregation function
- **attributes** – A dictionary of key/value attributes for this event
- **evtime** – Event timestamp override

class tensor.objects.**Output**(*config*, *tensor*)
Bases: object

Output parent class

Outputs can inherit this object which provides a construct for a working output

Parameters

- **config** – Dictionary config for this queue (usually read from the yaml configuration)
- **tensor** – A TensorService object for interacting with the queue manager

createClient()
Deferred which sets up the output

eventsReceived()
Receives a list of events and processes them

Arguments: events – list of *tensor.objects.Event*

stop()
Called when the service shuts down

class tensor.objects.**Source**(*config*, *queueBack*, *tensor*)
Bases: object

Source parent class

Sources can inherit this object which provides a number of utility methods.

Parameters

- **config** – Dictionary config for this queue (usually read from the yaml configuration)
- **queueBack** – A callback method to recieve a list of Event objects
- **tensor** – A TensorService object for interacting with the queue manager

createEvent(*state*, *description*, *metric*, *prefix=None*, *hostname=None*, *aggregation=None*, *evtime=None*)
Creates an Event object from the Source configuration

createLog(*type*, *data*, *evtime=None*, *hostname=None*)
Creates an Event object from the Source configuration

startTimer()
Starts the timer for this source

stopTimer()
Stops the timer for this source

tick(**args*, ***kwargs*)
Called for every timer tick. Calls self.get which can be a deferred and passes that result back to the queueBack method

Returns a deferred

5.4 tensor.service

class tensor.service.**TensorService**(*config*)
Bases: twisted.application.service.Service

Tensor service

Runs timers, configures sources and and manages the queue

sendEvent(*source*, *events*)
Callback that all event sources call when they have a new event or list of events

setupOutputs(*config*)
Setup output processors

setupSources(*config*)
Sets up source objects from the given config

sourceWatchdog()
Watchdog timer function.

Recreates sources which have not generated events in 10*interval if they have watchdog set to true in their configuration

5.5 tensor.utils

class tensor.utils.**BodyReceiver**(*finished*)
Bases: twisted.internet.protocol.Protocol

Simple buffering consumer for body objects

class tensor.utils.**PersistentCache**(*location='/var/lib/tensor/cache'*)
Bases: object

A very basic dictionary cache abstraction. Not to be used for large amounts of data or high concurrency

contains(*k*)
Return True if key *k* exists

delete(*k*)
Remove key *k* from the cache

expire(*age*)
Expire any items in the cache older than *age* seconds

get(*k*)
Returns key contents, and modify time

set(*k*, *v*)
Set a key *k* to value *v*

class tensor.utils.**ProcessProtocol**(*deferred*, *timeout*)
Bases: twisted.internet.protocol.ProcessProtocol

ProcessProtocol which supports timeouts

class tensor.utils.**Resolver**
Bases: object

Helper class for DNS resolution

class tensor.utils.**StringProducer**(*body*)
Bases: object

String producer for writing to HTTP requests

exception tensor.utils.**Timeout**
Bases: exceptions.Exception

Raised to notify that an operation exceeded its timeout.

tensor.utils.**fork**(*executable*, *args=()*, *env={}*, *path=None*, *timeout=3600*)
Provides a deferred wrapper function with a timeout function

Parameters

- **executable** (*str.*) – Executable
- **args** (*tupple.*) – Tupple of arguments
- **env** (*dict.*) – Environment dictionary
- **timeout** (*int.*) – Kill the child process if timeout is exceeded

CHAPTER 6

tensor.protocol

6.1 tensor.protocol.elasticsearch

class tensor.protocol.elasticsearch.**ElasticSearch**(*url='http://localhost:9200'*, *user=None*, *password=None*, *index='logstash-%Y.%m.%d'*)

Bases: object

Twisted ElasticSearch API

6.2 tensor.protocol.icmp

class tensor.protocol.icmp.**EchoPacket**(*seq=0*, *id=None*, *data=None*, *packet=None*)

Bases: object

ICMP Echo packet encoder and decoder

class tensor.protocol.icmp.**ICMPPing**(*d*, *dst*, *count*, *inter=0.2*, *maxwait=1000*, *size=64*)

Bases: twisted.internet.protocol.DatagramProtocol

ICMP Ping implementation

class tensor.protocol.icmp.**ICMPPort**(*port*, *proto*, *interface=''*, *maxPacketSize=8192*, *reactor=None*)

Bases: twisted.internet.udp.Port

Raw socket listener for ICMP

class tensor.protocol.icmp.**IP**(*packet*)

Bases: object

IP header decoder

tensor.protocol.icmp.**ping**(*dst*, *count*, *inter=0.2*, *maxwait=1000*, *size=64*)

Sends ICMP echo requests to destination *dst count* times. Returns a deferred which fires when responses are finished.

6.3 tensor.protocol.riemann

class tensor.protocol.riemann.**RiemannClientFactory**(*hosts*, *failover=False*)

Bases: twisted.internet.protocol.ReconnectingClientFactory

A reconnecting client factory which creates RiemannProtocol instances

class tensor.protocol.riemann.**RiemannProtocol**
Bases: twisted.protocols.basic.Int32StringReceiver, tensor.protocol.riemann.RiemannProtobu

Riemann protobuf protocol

class tensor.protocol.riemann.**RiemannUDP**(*host*, *port*)
Bases: twisted.internet.protocol.DatagramProtocol, tensor.protocol.riemann.RiemannProtobuf

UDP datagram protocol for Riemann

6.4 tensor.protocol.sflow

6.4.1 tensor.protocol.sflow.server

class tensor.protocol.sflow.server.**DatagramReceiver**
Bases: twisted.internet.protocol.DatagramProtocol

DatagramReceiver for sFlow packets

6.4.2 tensor.protocol.sflow.protocol

CHAPTER 7

tensor.logs

7.1 tensor.logs.follower

class tensor.logs.follower.**LogFollower**(*logfile*, *parser=None*, *tmp_path='/var/lib/tensor/'*, *history=False*)

Bases: object

Provides a class for following log files between runs

Parameters

- **logfile** (*str*) – Full path to logfile
- **parser** (*str*) – Optional parser method for log lines

get(*max_lines=None*)
Returns a big list of all log lines since the last run

get_fn(*fn*, *max_lines=None*)
Passes each parsed log line to *fn* This is a better idea than storing a giant log file in memory

7.2 tensor.logs.parsers

class tensor.logs.parsers.**ApacheLogParser**(*format*)
Parses Apache log format

Adapted from http://code.google.com/p/apachelog

Parameters **format** (*str*) – Apache log format definition eg r'%h %l %u %t "%r" %>s %b "%{Referer}i" "%{User-Agent}i"' or one of 'common', 'vhcommon' or 'combined'

names()
Returns the field names the parser extracted from the input format (a list)

parse(*line*)
Parses a single line from the log file and returns a dictionary of it's contents.

Raises and exception if it couldn't parse the line

pattern()
Returns the compound regular expression the parser extracted from the input format (a string)

CHAPTER 8

tensor.sources

8.1 tensor.sources.database.postgresql

class tensor.sources.database.postgresql.**PostgreSQL**(*a, **kw)
Bases: *tensor.objects.Source*

Reads PostgreSQL metrics

Configuration arguments:

Parameters

- **host** (*str.*) – Database host
- **port** (*int.*) – Database port
- **user** (*str.*) – Username
- **password** (*str.*) – Password

Metrics:

(service name).(database name).(metrics) Metrics from pg_stat_database

8.2 tensor.sources.database.elasticsearch

class tensor.sources.database.elasticsearch.**ElasticSearch**(*a, **kw)
Bases: *tensor.objects.Source*

Reads elasticsearch metrics

Configuration arguments:

Parameters

- **url** (*str.*) – Elasticsearch base URL (default: http://localhost:9200)
- **user** (*str.*) – Basic auth username
- **password** (*str.*) – Password

Metrics:

(service name).cluster.status Cluster status (Red=0, Yellow=1, Green=2)

(service name).cluster.nodes Cluster node count

(service name).indices Total indices in cluster

(service name).shards.total Total number of shards

(service name).shards.primary Number of primary shards

(service name).documents.total Total documents

(service name).documents.rate Documents per second

(service name).documents.size Size of document store in bytes

8.3 tensor.sources.database.memcache

class tensor.sources.database.memcache.**Memcache**(**a*, ***kw*)
Bases: *tensor.objects.Source*

Reads memcache metrics

Configuration arguments:

Parameters

- **host** (*str.*) – Database host (default localhost)
- **port** (*int.*) – Database port (default 11211)

Metrics:

(service name).(metrics) Metrics from memcached

8.4 tensor.sources.docker

class tensor.sources.docker.**ContainerStats**(**a*, ***kw*)
Bases: *tensor.objects.Source*

Returns stats for Docker containers on this host

Configuration arguments:

Parameters **url** (*str.*) – Docker stats URL

Metrics:

(service name).(container name).mem_limit Maximum memory for container

(service name).(container name).mem_used Memory used by container

(service name).(container name).cpu Percentage of system CPU in use

(service name).(container name).io_read IO reads per second

(service name).(container name).io_write IO writes per second

(service name).(container name).io_sync IO synchronous op/s

(service name).(container name).io_async IO asynchronous op/s

(service name).(container name).io_total Total IOPS

Note. If a MARATHON_APP_ID environment variable exists on the container then *container name* will be used instead of that.

8.5 tensor.sources.haproxy

class tensor.sources.haproxy.**HAProxy**(**a*, ***kw*)
Bases: *tensor.objects.Source*

Reads Nginx stub_status

Configuration arguments:

Parameters

- **url** (*str.*) – URL to fetch stats from
- **user** (*str.*) – Username
- **password** (*str.*) – Password

Metrics:

(service name).(backend|frontend|nodes).(stats) Various statistics

8.6 tensor.sources.generator

class tensor.sources.generator.**Function**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Produces an arbitrary function

Functions can contain the functions sin, cos, sinh, cosh, tan, tanh, asin, acos, atan, asinh, acosh, atanh, log(n, [base|e]), abs

Or the constants e, pi, and variable x

Configuration arguments:

Parameters

- **dx** (*float.*) – Resolution with time (steps of x)
- **function** (*string.*) – Function to produce

8.7 tensor.sources.linux

8.7.1 tensor.sources.linux.basic

class tensor.sources.linux.basic.**CPU**(**a*)
Bases: *tensor.objects.Source*

Reports system CPU utilisation as a percentage/100

Metrics:

(service name) Percentage CPU utilisation

(service name).(type) Percentage CPU utilisation by type

class tensor.sources.linux.basic.**DiskFree**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Returns the free space for all mounted filesystems

Configuration arguments:

Parameters **disks** (*list.*) – List of devices to check (optional)

Metrics:

(service name).(device) Used space (%)

(service name).(device).bytes Used space (kbytes)

(service name).(device).free Free space (kbytes)

class tensor.sources.linux.basic.**DiskIO**(**a*, ***kw*)
Bases: *tensor.objects.Source*

Reports disk IO statistics per device

Configuration arguments:

Parameters **devices** (*list.*) – List of devices to check (optional)

Metrics:

(service name).(device name).reads Number of completed reads

(service name).(device name).read_bytes Bytes read per second

(service name).(device name).read_latency Disk read latency

(service name).(device name).writes Number of completed writes

(service name).(device name).write_bytes Bytes written per second

(service name).(device name).write_latency Disk write latency

class tensor.sources.linux.basic.**LoadAverage**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Reports system load average for the current host

Metrics:

(service name) Load average

class tensor.sources.linux.basic.**Memory**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Reports system memory utilisation as a percentage/100

Metrics:

(service name) Percentage memory utilisation

class tensor.sources.linux.basic.**Network**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Returns all network interface statistics

Configuration arguments:

Parameters **interfaces** (*list.*) – List of interfaces to check (optional)

Metrics:

(service name).(device).tx_bytes Bytes transmitted

(service name).(device).tx_packets Packets transmitted

(service name).(device).tx_errors Errors

(service name).(device).rx_bytes Bytes received

(service name).(device).rx_packets Packets received

(service name).(device).rx_errors Errors

8.7.2 tensor.sources.linux.process

class tensor.sources.linux.process.**ProcessCount**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Returns the ps count on the system

Metrics:

(service name) Number of processes

class tensor.sources.linux.process.**ProcessStats**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Returns memory used by each active parent process

Metrics:

(service name).proc.(process name).cpu Per process CPU usage

(service name).proc.(process name).memory Per process memory use

(service name).proc.(process name).age Per process age

(service name).user.(user name).cpu Per user CPU usage

(service name).user.(user name).memory Per user memory use

8.7.3 tensor.sources.linux.sensors

class tensor.sources.linux.sensors.**SMART**(**a*, ***kw*)
Bases: *tensor.objects.Source*

Returns SMART output for all disks

Metrics:

(service name).(disk).(sensor) Sensor value

class tensor.sources.linux.sensors.**Sensors**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Returns lm-sensors output

NB. This is very untested on different configurations and versions. Please report any issues with the output of the *sensors* command to help improve it.

Metrics:

(service name).(adapter).(sensor) Sensor value

8.8 tensor.sources.media

8.8.1 tensor.sources.media.libav

class tensor.sources.media.libav.**DarwinRTSP**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Makes avprobe requests of a Darwin RTSP sample stream (sample_100kbit.mp4)

Configuration arguments:

Parameters **destination** – Host name or IP address to check

Metrics: :(service name): Time to complete request

You can also override the *hostname* argument to make it match metrics from that host.

8.9 tensor.sources.munin

class tensor.sources.munin.**MuninNode**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Connects to munin-node and retrieves all metrics

Configuration arguments:

Parameters

- **host** (*str.*) – munin-node hostname (probably localhost)
- **port** (*int.*) – munin-node port (probably 4949)

Metrics:

(service name).(plugin name).(keys...) A dot separated tree of munin plugin keys

class tensor.sources.munin.**MuninProtocol**
Bases: twisted.protocols.basic.LineReceiver

MuninProtocol - provides a line receiver protocol for making requests to munin-node

Requests must be made sequentially

8.10 tensor.sources.network

class tensor.sources.network.**HTTP**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Performs an HTTP request

Configuration arguments:

Parameters

- **url** (*str.*) – HTTP URL
- **method** (*str.*) – HTTP request method to use (default GET)
- **match** (*str.*) – A text string to match in the document when it is correct
- **useragent** (*str.*) – User-Agent header to use

- **timeout** (*int.*) – Timeout for connection (default 60s)

Metrics:

(service name).latency Time to complete request

class tensor.sources.network.**Ping**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Performs an Ping checks against a destination

Configuration arguments:

Parameters **destination** (*str.*) – Host name or IP address to ping

Metrics:

(service name).latency Ping latency

(service name).loss Packet loss

You can also override the *hostname* argument to make it match metrics from that host.

8.11 tensor.sources.nginx

class tensor.sources.nginx.**Nginx**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Reads Nginx stub_status

Configuration arguments:

Parameters **stats_url** (*str.*) – URL to fetch stub_status from

Metrics:

(service name).active Active connections at this time

(service name).accepts Accepted connections

(service name).handled Handled connections

(service name).requests Total client requests

(service name).reading Reading requests

(service name).writing Writing responses

(service name).waiting Waiting connections

class tensor.sources.nginx.**NginxLog**(**a*)
Bases: *tensor.objects.Source*

Tails Nginx log files, parses them and returns log events for outputs which support them.

Configuration arguments:

Parameters

- **log_format** (*str.*) – Log format passed to parser, same as the config definition (default: combined)
- **file** (*str.*) – Log file
- **max_lines** (*int.*) – Maximum number of log lines to read per interval to prevent overwhelming Tensor when reading large logs (default 2000)

class tensor.sources.nginx.**NginxLogMetrics**(**a*)
Bases: *tensor.objects.Source*

Tails Nginx log files, parses them and returns metrics for data usage and requests against other fields.

Configuration arguments:

Parameters

- **log_format** (*str.*) – Log format passed to parser, same as the config definition
- **file** (*str.*) – Log file
- **max_lines** (*int.*) – Maximum number of log lines to read per interval to prevent overwhelming Tensor when reading large logs (default 2000)
- **resolution** (*int.*) – Aggregate bucket resolution in seconds (default 10)
- **history** (*bool.*) – Read the entire file from scratch if we've never seen it (default false)

Metrics:

(service name).total_bytes Bytes total for all requests

(service name).total_requests Total request count

(service name).stats.(code).(requests|bytes) Metrics by status code

(service name).user-agent.(agent).(requests|bytes) Metrics by user agent

(service name).client.(ip).(requests|bytes) Metrics by client IP

(service name).request.(request path).(requests|bytes) Metrics by request path

8.12 tensor.sources.python

8.12.1 tensor.sources.python.uwsgi

class tensor.sources.python.uwsgi.**Emperor**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Connects to UWSGI Emperor stats and creates useful metrics

Configuration arguments:

Parameters

- **host** (*str.*) – Hostname (default localhost)
- **port** (*int.*) – Port

class tensor.sources.python.uwsgi.**JSONProtocol**
Bases: twisted.internet.protocol.Protocol

JSON line protocol

8.13 tensor.sources.rabbitmq

class tensor.sources.rabbitmq.**Queues**(**a*, ***kw*)
Bases: *tensor.objects.Source*

Returns Queue information for a particular vhost

Configuration arguments:

Parameters **vhost** (*str.*) – Vhost name

Metrics:

(service_name).(queue).ready Ready messages for queue

(service_name).(queue).unack Unacknowledged messages for queue

(service_name).(queue).ready_rate Ready rate of change per second

(service_name).(queue).unack_rate Unacknowledge rate of change per second

8.14 tensor.sources.redis

class tensor.sources.redis.**Queues**(**a*, ***kw*)

Bases: *tensor.objects.Source*

Query llen from redis-cli

Configuration arguments:

Parameters

- **queue** (*str.*) – Queue name (defaults to 'celery', just because)
- **db** (*int.*) – DB number
- **clipath** (*str.*) – Path to redis-cli (default: /usr/bin/redis-cli)

Metrics:

(service_name) Queue length

(service_name) Queue rate

8.15 tensor.sources.riak

class tensor.sources.riak.**RiakStats**(*config*, *queueBack*, *tensor*)

Bases: *tensor.objects.Source*

Returns GET/PUT rates for a Riak node

Configuration arguments:

Parameters

- **url** (*str.*) – Riak stats URL
- **useragent** (*str.*) – User-Agent header to use

Metrics:

(service name).latency Time to complete request

8.16 tensor.sources.riemann

class tensor.sources.riemann.**RiemannTCP**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Provides a listening server which accepts Riemann metrics and proxies them to our queue.

Configuration arguments:

Parameters **port** (*int.*) – Port to listen on (default 5555)

startTimer()
Creates a Riemann TCP server instead of a timer

class tensor.sources.riemann.**RiemannTCPServer**(*source*)
Bases: *tensor.protocol.riemann.RiemannProtocol*

Server implementation of the Riemann protocol

8.17 tensor.sources.sflow

class tensor.sources.sflow.**sFlow**(*config*, *queueBack*, *tensor*)
Bases: *tensor.objects.Source*

Provides an sFlow server Source

Configuration arguments:

Parameters

- **port** (*int.*) – UDP port to listen on
- **dnslookup** (*bool.*) – Enable reverse DNS lookup for device IPs (default: True)

Metrics:

Metrics are published using the key patterns (device).(service name).(interface).(in|out)Octets (device).(service name).(interface).ip (device).(service name).(interface).port

startTimer()
Creates a sFlow datagram server

class tensor.sources.sflow.**sFlowReceiver**(*source*)
Bases: *tensor.protocol.sflow.server.DatagramReceiver*

sFlow datagram protocol

8.18 tensor.sources.snmp

class tensor.sources.snmp.**SNMP**(**a*, ***kw*)
Bases: *tensor.objects.Source*

Connects to an SNMP agent and retrieves OIDs

Configuration arguments:

Parameters

- **ip** (*str.*) – SNMP agent host (default: 127.0.0.1)

- **port** (*int.*) – SNMP port (default: 161)
- **community** (*str.*) – SNMP read community

class tensor.sources.snmp.**SNMPCisco837**(**a*, ***kw*)
Bases: *tensor.sources.snmp.SNMP*

Connects to a Cisco 837 and makes metrics

Configuration arguments:

Parameters

- **ip** (*str.*) – SNMP agent host (default: 127.0.0.1)
- **port** (*int.*) – SNMP port (default: 161)
- **community** (*str.*) – SNMP read community

class tensor.sources.snmp.**SNMPConnection**(*host*, *port*, *community*)
Bases: object

A wrapper class for PySNMP functions

Parameters

- **host** (*str.*) – SNMP agent host
- **port** (*int.*) – SNMP port
- **community** (*str.*) – SNMP read community

(This is not a source and you shouldn't try to use it as one)

CHAPTER 9

tensor.outputs

9.1 tensor.outputs.riemann

class tensor.outputs.riemann.**RiemannTCP**(**a*)

Bases: *tensor.objects.Output*

Riemann TCP output

Configuration arguments:

Parameters

- **server** (*str.*) – Riemann server hostname (default: localhost)
- **port** (*int.*) – Riemann server port (default: 5555)
- **failover** (*bool.*) – Enable server failover, in which case *server* may be a list
- **maxrate** (*int.*) – Maximum de-queue rate (0 is no limit)
- **maxsize** (*int.*) – Maximum queue size (0 is no limit, default is 250000)
- **interval** (*float.*) – De-queue interval in seconds (default: 1.0)
- **pressure** (*int.*) – Maximum backpressure (-1 is no limit)
- **tls** (*bool.*) – Use TLS (default false)
- **cert** (*str.*) – Host certificate path
- **key** (*str.*) – Host private key path
- **allow_nan** (*bool*) – Send events with None metric value (default true)

createClient()

Create a TCP connection to Riemann with automatic reconnection

emptyQueue()

Remove all or self.queueDepth events from the queue

eventsReceived(*events*)

Receives a list of events and transmits them to Riemann

Arguments: events – list of *tensor.objects.Event*

stop()

Stop this client.

tick()
Clock tick called every self.inter

class tensor.outputs.riemann.**RiemannUDP**(*a)
Bases: *tensor.objects.Output*

Riemann UDP output (spray-and-pray mode)

Configuration arguments:

Parameters

- **server** (*str.*) – Riemann server IP address (default: 127.0.0.1)
- **port** (*int.*) – Riemann server port (default: 5555)

createClient()
Create a UDP connection to Riemann

eventsReceived(*events*)
Receives a list of events and transmits them to Riemann

Arguments: events – list of *tensor.objects.Event*

9.2 tensor.outputs.elasticsearch

class tensor.outputs.elasticsearch.**ElasticSearchLog**(*a)
Bases: *tensor.objects.Output*

ElasticSearch HTTP API output

This Output transposes events to a Logstash format

Configuration arguments:

Parameters

- **url** (*str*) – Elasticsearch URL (default: http://localhost:9200)
- **maxsize** (*int*) – Maximum queue backlog size (default: 250000, 0 disables)
- **maxrate** (*int*) – Maximum rate of documents added to index (default: 100)
- **interval** (*int*) – Queue check interval in seconds (default: 1.0)
- **user** (*str*) – Optional basic auth username
- **password** (*str*) – Optional basic auth password

createClient()
Sets up HTTP connector and starts queue timer

eventsReceived(*events*)
Receives a list of events and queues them

Arguments: events – list of *tensor.objects.Event*

stop()
Stop this client.

tick(**args*, ***kwargs*)
Clock tick called every self.inter

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