Lumberjack Documentation

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Contents

Lumberjack is a library which connects the Python logging framework to an Elasticsearch backend.

It has a number of useful features, including:

- Asynchronous logging by default
- Automatic time-rotating indices
- Elasticsearch mapping management

CHAPTER 1

Installation

Lumberjack can be installed with:

```
$ python setup.py install
```

CHAPTER 2

Quickstart

To use Lumberjack, you should have an Elasticsearch cluster already running.

You should instantiate the main Lumberjack class once in your application, specifying a list of Elasticsearch nodes to connect to:

```
from lumberjack import Lumberjack
lj = Lumberjack(hosts=[{'host': 'localhost', 'port': 9200}])
```

for an Elasticsearch node running locally on port 9200.

Once you have your Lumberjack object, you can then create log handlers to attach to loggers from `logging`:

```
from logging import getLogger, INFO

a_logger = getLogger(__name__)
a_logger.setLevel(INFO)

handler = lj.get_handler()

a_logger.addHandler(handler)
```

Then, you can log events to `a_logger` (or any of its children in the logger hierarchy) and they will be stored in Elasticsearch:

```
a_logger.error('Oh no!  Something bad happened...')
```

Isn't that easy!

Note: you might need to wait for the periodic flush of the log queue before the entry actually appears in Elasticsearch. By default this is every 30 seconds.

2.1 Usage

Since you're using Elasticsearch to store log data, you probably don't want to just store messages as strings. Good! Lumberjack supports (and encourages) logging dicts to be stored directly in Elasticsearch as JSON:

```
a_logger.info({'message': 'User did something.',
               'username': 'rory',
               'uid': 23})
```

Note: the 'type' of the document in Elasticsearch is determined by the logger's name. For `a_logger` that's `__name__`. This means that it's a good idea to register several sub-loggers, one for each type of event being logged, and then attach the handler to the parent for all of them.

2.1.1 Schemas

Lumberjack also abstracts away creating mappings and templates for your data.

Before you log any events, it's a good idea to tell Elasticsearch what kind of data to expect in them. To do this you use the `register_schema` method:

Schemas correspond closely with mappings in Elasticsearch, but are processed by Lumberjack to include some sensible defaults. An example schema might be:

```
{
    '_source': True,
    'properties': {
        'ip_address': {'type': 'ip'},
        'user_id': {'type': 'long'},
        'username': {'type': 'string'}
    }
}
```

This method should be called once per schema to register; it's probably a good idea to call it at the same time as attaching your handler to a `logging.Logger` object.

2.1.2 A complete example

So now we've covered an introduction, basic usage and how to use schemas, let's put it all together.

Suppose we are writing a web app, and we want to log logins and searches:

In the general initialisation we put:

```
from logging import getLogger, INFO
from lumberjack import Lumberjack

lj = Lumberjack(hosts=[{'host': 'localhost', 'port': 9200}])

# Register a schema for logins
lj.register_schema('appname.login',
    {
        'properties': {
            'ip_address': {'type': 'ip'},
            'username': {'type': 'string'},
            'successful': {'type': 'boolean'},
            'attempt_number': {'type': 'short'}
        }
    })

# Register a schema for searches
lj.register_schema('appname.search',
    {
        'properties': {
            'ip_address': {'type': 'ip'},
            'query': {
                'type': 'string',
                'index': 'analyzed'
            }
        }
    })

logger = getLogger('appname')
```

```
handler = lj.get_handler()

logger.addHandler(handler)
logger.setLevel(INFO)
```

In the login handling function we put:

```
from logging import getLogger

logger = getLogger('appname.login')

log_event = {'ip_address': some_ip_address_variable,
             'username': the_username,
             'successful': login_ok,
             'attempt_number': attempt_number}
logger.info(log_event)
```

And in the search handling function we put:

```
from logging import getLogger

logger = getLogger('appname.search')

log_event = {'ip_address': some_ip_address_variable,
             'query': query_string}
logger.info(log_event)
```

Now we've integrated elasticsearch logging into our web application.

2.1.3 Next steps

At the minimum, you should read the index prefixes bit of the Configuration section.

2.2 Configuration

The default config is included at the end of this file for reference.

Lumberjack is configured using a dict of config options passed to the Lumberjack object on instantiation. A safely-modifiable copy of the default config dict can be obtained by calling `lumberjack.get_default_config()`:

```
from lumberjack import Lumberjack, get_default_config
lj = Lumberjack(hosts=[...], config=get_default_config())
```

With the exception of `index_prefix`, these defaults should be sensible for production. You should change `index_prefix` to something different for each of your applications.

The config returned is a deep copy of the default one, so it can be modified as you like without breaking subsequent calls to `lumberjack.get_default_config()`:

```
from lumberjack import Lumberjack, get_default_config

my_config = get_default_config()
my_config['index_prefix'] = 'a-special-prefix-'

lj = Lumberjack(hosts=[...], config=my_config)
```

2.2.1 The index prefix

This configures the prefix for the created elasticsearch indices. Indices are created with a constant prefix and a time-based suffix, so might be named *generic-logging-2014.10* for log entries from an unconfigured Lumberjack instance in October 2014.

2.2.2 The default mapping

This contains the basis for generating mappings in Elasticsearch. Its values are overridden by the values in the *schema* dict passed to `lumberjack.Lumberjack.register_schema()`. It contains keys like `_source`, `_all`, and `_ttl`.

Note that special processing happens to the `properties` key: instead of being overwritten by the schema's `properties` key, the fields provided to Elasticsearch are the union of the two, with the schema's fields taking precedence.

2.2.3 Default properties for types

When a field is given a particular type in the schema, Lumberjack automatically adds some properties to the field. For example, for `string` type fields, Lumberjack disables analysis on them. (The reason for this is that while analysis is a powerful Elasticsearch feature when dealing with natural language documents, for log data it makes little sense.)

2.2.4 The interval

This is the (maximum) amount of time to wait between flushes of the log event queue to Elasticsearch. It is an integer or floating-point value in seconds.

2.2.5 The maximum queue length

This is the maximum length the queue can grow to before a flush is triggered automatically.

2.2.6 The fallback log file

If Lumberjack experiences an error when indexing to Elasticsearch, it will fall back to dumping JSON to the file given in this variable.

2.2.7 The default config

```
# -*- coding: utf-8 -*-
#
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"""The default configuration for Lumberjack."""

from __future__ import absolute_import
from copy import deepcopy

DEFAULT_CONFIG = {
    'default_mapping': {
        '_source': {'enabled': True},
        '_all': {'enabled': False},
        '_ttl': {'enabled': True},
        'properties': {
            'message': {
                'type': 'string'
            },
            '@timestamp': {
                'type': 'date',
            },
            'level': {
                'type': 'integer'
            }
        }
    },
    'default_type_properties': {
        'string': {
            'index': 'not_analyzed',
            'norms': {'enabled': False}
        },
        'date': {
            'format': 'dateOptionalTime'
        }
    },
    'index_prefix': 'generic-logging-',
    'interval': 30,
    'max_queue_length': None,
    'fallback_log_file': '/tmp/lumberjack_fallback.log'
}


def get_default_config():
    """Get a copy of the default config.

    The copy can be modified in-place without affecting the default config
    itself.

    """
    return deepcopy(DEFAULT_CONFIG)
```

2.3 Advanced Usage

This details some more advanced usages of Lumberjack. You don't need to read this just to get up and running, but it might be handy when tweaking your cluster later on.

2.3.1 Custom Elasticsearch objects

You can also create an `elasticsearch.Elasticsearch` object yourself and pass it in. This is useful if you want to do some customisation of the Elasticsearch connection, for example to connect using Thrift:

```
from elasticsearch import Elasticsearch
from lumberjack import Lumberjack

es = Elasticsearch(connection_class=ThriftConnection)
lj = Lumberjack(elasticsearch=es)
```

2.3.2 Index suffixes

Indices created by Lumberjack are named using a constant prefix and a time-based suffix, so might be named generic-logging-2014.10 for log entries from an unconfigured Lumberjack instance in October 2014. (For details about the prefix, see the Configuration section of the documentation.)

When calling the `lumberjack.Lumberjack.get_handler()` method, you can specify a 'suffix format'. When the handler receives a new log event, it determines the suffix by formatting the time of the event with this string using `time.strftime()`. In this way you can alter the time-period your indices span:

```
from lumberjack import Lumberjack
import logging

lj = Lumberjack(hosts=[...])

day_handler = lj.get_handler(suffix_format='%Y.%m.%d')

my_logger = logging.getLogger(__name__)
my_logger.setLevel(logging.INFO)
my_logger.addHandler(day_handler)
```

In this example a log event that happened on 2014-10-07 would be stored in a different index to one that happened on 2014-10-08. This is useful if you end up with lots of indices that are too small, or too few indices that are too big. (Both of these cases are inefficient.)

In fact you can even customise your handlers based on the frequency of various different events that Lumberjack is attached to:

```
from lumberjack import Lumberjack
import logging

lj = Lumberjack(hosts=[...])

day_handler = lj.get_handler(suffix_format='%Y.%m.%d')
month_handler = lj.get_handler(suffix_format='%Y.%m') # The default

high_volume_logger = logging.getLogger('pageviews')
high_volume_logger.setLevel(logging.INFO)
high_volume_logger.addHandler(day_handler)
```

```
low_volume_logger = logging.getLogger('logins.by.admin')
low_volume_logger.setLevel(logging.INFO)
low_volume_logger.addHandler(month_handler)
```

2.4 Post-processors

Post-processors are arbitrary functions which are applied to log entries directly before they go into Elasticsearch. They can be specified easily in the call to `logging.Logger.log()` and family:

```
from logging import getLogger
my_logger = getLogger(__name__)
# Assume we set up Lumberjack and attach it somewhere in the heirarchy of
# this logger.

my_logger.info({'a': 'message'}, {'postprocessors': [some_postprocessor]})
```

In this example, the post-processor `some_postprocessor` will be applied to the logged document immediately before sending to Elasticsearch.

A post-processor is simply a function which is passed the document, and should return a modified version of it. For example, a postprocessor might add the hostname of the machine currently running the program:

```
import socket
def hostname(doc):
    doc['hostname'] = socket.gethostname()

my_logger.info({'a': 'message'}, {'postprocessors': [hostname]})
```

On a system with hostname `load-balancer-01`, this would result in the following document being sent to Elasticsearch:

```
{
    'a': 'message',
    '@timestamp': 1438353254000, # Timestamp added automatically
    'level': 20, # Log level (logging.INFO) added automatically
    'hostname': 'load-balancer-01'
}
```

2.4.1 Included post-processors

Lumberjack provides some postprocessors out-of-the-box for you to use, which you can find in `lumberjack.postprocessors`.

GeoIP

This post-processor will perform a GeoIP lookup on a field containing an IP address, and include the results in the document:

```
from lumberjack.postprocessors import geoip
my_geoip = geoip(field='ip')

my_logger.info({
    'a': 'message',
```

```
    'ip': '128.141.43.1'
}, {'postprocessors': [my_geoip]})
```

This will result in the following document being sent to Elasticsearch:

```
{
    'a': 'message',
    '@timestamp': 1438353254000, # Timestamp added automatically
    'level': 20, # Log level (logging.INFO) added automatically
    'ip': '128.141.43.1',
    'geoip': {
        'country_code': 'CH',
        'location': {'lat': 46.1956, 'lon': 6.1481}
    }
}
```

2.5 API

Module for integrating Elasticsearch into Python's `logging` library.

class `lumberjack.`**Lumberjack**(*hosts=None*, *elasticsearch=None*, *config=None*)

This is the initialisation point for using the lumberjack library.

In the intended use-case, this class is instantiated once and creates handlers for use with Python's logging module.

For each type of log you want to store, you should provide a schema. If you don't, nothing bad will happen, but it makes your cluster rather space-inefficient by default.

You should provide either a list of Elasticsearch hosts, or an already-instantiated `Elasticsearch` object from elasticsearch-py.

Parameters

- **hosts** – A list of Elasticsearch nodes to connect to, in the form `[{'host': '127.0.0.1', 'port': 9200}]`. This is passed directly to elasticsearch.Elasticsearch.
- **elasticsearch** – As an alternative to hosts, an already-instantiated `elasticsearch.Elasticsearch` object, perhaps with custom transports etc.
- **config** – A configuration for Lumberjack. See the Configuration section in the docs for details.

get_handler(*suffix_format='%Y.%m'*)

Spawn a new logging handler.

You should use this method to get a `logging.Handler` object to attach to a `logging.Logger` object.

Note It is almost definitely unwise to set the formatter of this handler yourself. The integrated formatter prepares documents ready to be inserted into Elasticsearch.

Parameters **suffix_format** – The time format string to use as the suffix for the indices. By default your indices will be called, e.g., `generic-logging-2014.09`.

register_schema(*logger*, *schema*)

Register a new log entry schema.

It is a good idea to register a 'schema' for every logger that you attach a handler to. This helps Elasticsearch store the data you provide optimally.

Note This method will block until the mapping is registered with Elasticsearch, so you should do it in your initialisation.

Parameters

- **logger** – The name of the logger this schema will apply to.
- **schema** – The schema to be used.

trigger_flush()
Manually trigger a flush of the log queue.

Note This is not guaranteed to flush immediately; it merely cancels the wait before the next flush in the `ActionQueue` thread.

`lumberjack`.**get_default_config**()
Get a copy of the default config.

The copy can be modified in-place without affecting the default config itself.

2.6 Backend Modules

You shouldn't need to actually have anything to do with these modules; interaction with the main Lumberjack object should be sufficient.

2.6.1 Actions

Provide the ActionQueue class.

class `lumberjack.actions`.**ActionQueue**(*elasticsearch*, *config*)
Hold a queue of actions and a thread to bulk-perform them.

This is instantiated automatically by the `lumberjack.Lumberjack` object. It will keep a queue of indexing actions to be performed in Elasticsearch, and perform them bulk ('flush') when one of three things happens:

1. It has waited `interval` seconds without flushing, or
2. The length of the queue has exceeded `max_queue_length`, or
3. A flush is triggered manually.

Note You should not need to instantiate, or even interact with, this yourself. It is intended to be wrapped by `lumberjack.Lumberjack`. If you do, for some reason, use this yourself, it is a subclass of `threading.Thread`, so you should call its `start()` method after initialisation.

Parameters

- **elasticsearch** – The `elasticsearch.Elasticsearch` object on which to perform the bulk indexing.
- **config** – The Lumberjack config. See the Configuration section in the docs for details.

last_exception
The last exception raised in the ActionQueue thread.

queue_index(*suffix*, *doc_type*, *body*, *postprocessors=None*)
Queue a new document to be added to Elasticsearch.

If the queue becomes longer than self.max_queue_length then a flush is automatically triggered.

Parameters

- **suffix** – The suffix of the index into which we should index the document.
- **doc_type** – The Elasticsearch type of the document to be indexed. Usually this should correspond to a registered schema in Lumberjack.
- **body** – The actual document contents, as a dict.
- **postprocessors** – Any post-processing functions to be run on the document before indexing.

run()
The main method for the ActionQueue thread.

Called by the `start()` method. Not to be called directly.

trigger_flush()
Manually trigger a flush of the queue.

This is to be called from the main thread, and fires an interrupt in the timeout of the main loop. As such it is not guaranteed to immediately trigger a flush, only to skip the countdown to the next one. This means the flush will happen the next time this thread gets switched to by the Python interpreter.

2.6.2 Schemas

Provides SchemaManager class.

class `lumberjack.schemas.`**SchemaManager**(*elasticsearch*, *config*)
Manage the 'schemas' for different types of log data.

A detailed description of schemas is given in the documentation for `lumberjack.Lumberjack.register_schema`.

This class manages a list of schemas registered and ensures that they are processed and passed into Elasticsearch as appropriate.

Parameters

- **elasticsearch** – The `elasticsearch.Elasticsearch` object to register mappings and templates with.
- **config** – The Lumberjack config. See the Configuration section in the docs for details.

register_schema(*logger*, *schema*)
Take a new schema and add it to the roster.

This also automatically parses the schema into a mapping and adds it into the appropriate index template in Elasticsearch.

Parameters

- **logger** – The name of the logger which the log data will be emitted on.
- **schema** – The schema data to be processed into a mapping.

2.6.3 Handler

Provide classes to fit into the Python logging framework.

class `lumberjack.handler.`**`ElasticsearchFormatter`**(*fmt=None*, *datefmt=None*)
Formatter which prepares logs for insertion into Elasticsearch.

`format`(*record*)
Add some metadata and deals with string logs.

It adds a `@timestamp` field and a `level` field. `level` contains the loglevel as an integer.

Log data should be in a `dict`, but to be compatible with the generic Python logging recommendations, it can also format log data received as a string. In this case, a dict is returned containing a single `message` field, whose data is the string message.

Parameters **`record`** – The `logging.LogRecord` object to be formatted.

class `lumberjack.handler.`**`ElasticsearchHandler`**(*action_queue*, *suffix_format='%Y.%m'*)
Elasticsearch-specific subclass of `logging.LogHandler`.

Parameters

- **`action_queue`** – A `lumberjack.ActionQueue` object to which the formatted log entries are passed.
- **`suffix_format`** – The format from which to generate the time-based index suffixes for Elasticsearch. *strftime()* format.

`emit`(*record*)
Format the log and pass it to an ElasticsearchContext instance.

Generates the appropriate index time-suffix based on `self.suffix_format`.

Parameters **`record`** – The `logging.LogRecord` object to format and index.

2.7 Developers

2.7.1 Contributing

Bug reports, feature requests and other contributions are welcome.

2.7.2 Licence

Lumberjack is licensed under the GNU LGPL, which is a set of permissions additional to the GNU GPL.

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  You may convey a work based on the Program, or the modifications to
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    it, and giving a relevant date.

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    7.  This requirement modifies the requirement in section 4 to
    "keep intact all notices".

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    License will therefore apply, along with any applicable section 7
    additional terms, to the whole of the work, and all its parts,
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in or on a volume of a storage or distribution medium, is called an
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  You may convey a covered work in object code form under the terms
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in one of these ways:

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    Corresponding Source fixed on a durable physical medium
    customarily used for software interchange.

    b) Convey the object code in, or embodied in, a physical product
    (including a physical distribution medium), accompanied by a
    written offer, valid for at least three years and valid for as
    long as you offer spare parts or customer support for that product
    model, to give anyone who possesses the object code either (1) a
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    product that is covered by this License, on a durable physical
    medium customarily used for software interchange, for a price no
    more than your reasonable cost of physically performing this
    conveying of source, or (2) access to copy the
    Corresponding Source from a network server at no charge.

    c) Convey individual copies of the object code with a copy of the
    written offer to provide the Corresponding Source.  This
    alternative is allowed only occasionally and noncommercially, and
    only if you received the object code with such an offer, in accord
    with subsection 6b.

    d) Convey the object code by offering access from a designated
    place (gratis or for a charge), and offer equivalent access to the
    Corresponding Source in the same way through the same place at no
    further charge.  You need not require recipients to copy the
    Corresponding Source along with the object code.  If the place to
    copy the object code is a network server, the Corresponding Source
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    that supports equivalent copying facilities, provided you maintain
    clear directions next to the object code saying where to find the
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    e) Convey the object code using peer-to-peer transmission, provided
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  A separable portion of the object code, whose source code is excluded
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  A "User Product" is either (1) a "consumer product", which means any
tangible personal property which is normally used for personal, family,
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into a dwelling.  In determining whether a product is a consumer product,
doubtful cases shall be resolved in favor of coverage.  For a particular
product received by a particular user, "normally used" refers to a
typical or common use of that class of product, regardless of the status
of the particular user or of the way in which the particular user
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is a consumer product regardless of whether the product has substantial
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  If you convey an object code work under this section in, or with, or
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