
streamparse Documentation

Release 3.0.0.dev0

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March 11, 2016

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streamparse lets you run Python code against real-time streams of data. Integrates with Apache Storm.

1.1 Dependencies

1.1.1 Java and Clojure

To run local and remote computation clusters, streamparse relies upon a JVM technology called Apache Storm. The integration with this technology is lightweight, and for the most part, you don't need to think about it.

However, to get the library running, you'll need

1. JDK 7+, which you can install with `apt-get`, `homebrew`, or an installer; and
2. `lein`, which you can install from the [project's page](#) or [github](#)

Confirm that you have `lein` installed by running:

```
> lein version
```

You should get output similar to this:

```
Leiningen 2.3.4 on Java 1.7.0_55 Java HotSpot (TM) 64-Bit Server VM
```

If `lein` isn't installed, [follow these directions](#).

Once that's all set, you install `streamparse` using `pip`:

```
> pip install streamparse
```

1.2 Your First Project

When working with `streamparse`, your first step is to create a project using the command-line tool, `sparse`:

```
> sparse quickstart wordcount

Creating your wordcount streamparse project...
  create  wordcount
  create  wordcount/.gitignore
  create  wordcount/config.json
  create  wordcount/fabfile.py
  create  wordcount/project.clj
  create  wordcount/README.md
  create  wordcount/src
```

```
create wordcount/src/bolts/  
create wordcount/src/bolts/__init__.py  
create wordcount/src/bolts/wordcount.py  
create wordcount/src/spouts/  
create wordcount/src/spouts/__init__.py  
create wordcount/src/spouts/words.py  
create wordcount/topologies  
create wordcount/topologies/wordcount.py  
create wordcount/virtualenvs  
create wordcount/virtualenvs/wordcount.txt
```

Done.

Try running your topology locally with:

```
cd wordcount  
sparse run
```

The quickstart project provides a basic wordcount topology example which you can examine and modify. You can inspect the other commands that `sparse` provides by running:

```
> sparse -h
```

1.3 Project Structure

streamparse projects expect to have the following directory layout:

1.4 Defining Topologies

Storm's services are Thrift-based and although it is possible to define a topology in pure Python using Thrift. For details see *Topology DSL*.

Let's have a look at the definition file created by using the `sparse quickstart` command.

```
"""  
Word count topology  
"""  
  
from streamparse import Grouping, Topology  
  
from bolts.wordcount import WordCountBolt  
from spouts.words import WordSpout  
  
class WordCount(Topology):  
    word_spout = WordSpout.spec()  
    count_bolt = WordCountBolt.spec(inputs={word_spout: Grouping.fields('word')},  
                                   par=2)
```

In the `count_bolt` bolt, we've told Storm that we'd like the stream of input tuples to be grouped by the named field `word`. Storm offers comprehensive options for [stream groupings](#), but you will most commonly use a **shuffle** or **fields** grouping:

- **Shuffle grouping:** Tuples are randomly distributed across the bolt's tasks in a way such that each bolt is guaranteed to get an equal number of tuples. This is the default grouping if no other is specified.

- **Fields grouping:** The stream is partitioned by the fields specified in the grouping. For example, if the stream is grouped by the “user-id” field, tuples with the same “user-id” will always go to the same task, but tuples with different “user-id”’s may go to different tasks.

There are more options to configure with spouts and bolts, we’d encourage you to refer to our *Topology DSL* docs or Storm’s Concepts for more information.

1.5 Spouts and Bolts

The general flow for creating new spouts and bolts using streamparse is to add them to your `src` folder and update the corresponding topology definition.

Let’s create a spout that emits sentences until the end of time:

```
import itertools

from streamparse.spout import Spout

class SentenceSpout(Spout):
    outputs = ['sentence']

    def initialize(self, stormconf, context):
        self.sentences = [
            "She advised him to take a long holiday, so he immediately quit work and took a trip around the world",
            "I was very glad to get a present from her",
            "He will be here in half an hour",
            "She saw him eating a sandwich",
        ]
        self.sentences = itertools.cycle(self.sentences)

    def next_tuple(self):
        sentence = next(self.sentences)
        self.emit([sentence])

    def ack(self, tup_id):
        pass # if a tuple is processed properly, do nothing

    def fail(self, tup_id):
        pass # if a tuple fails to process, do nothing
```

The magic in the code above happens in the `initialize()` and `next_tuple()` functions. Once the spout enters the main run loop, streamparse will call your spout’s `initialize()` method. After initialization is complete, streamparse will continually call the spout’s `next_tuple()` method where you’re expected to emit tuples that match whatever you’ve defined in your topology definition.

Now let’s create a bolt that takes in sentences, and spits out words:

```
import re

from streamparse.bolt import Bolt

class SentenceSplitterBolt(Bolt):
    outputs = ['word']

    def process(self, tup):
        sentence = tup.values[0] # extract the sentence
```

```

sentence = re.sub(r"[.,;!?\]", "", sentence) # get rid of punctuation
words = [[word.strip()] for word in sentence.split(" ") if word.strip()]
if not words:
    # no words to process in the sentence, fail the tuple
    self.fail(tup)
    return

for word in words:
    self.emit([word])
# tuple acknowledgement is handled automatically

```

The bolt implementation is even simpler. We simply override the default `process()` method which streamparse calls when a tuple has been emitted by an incoming spout or bolt. You are welcome to do whatever processing you would like in this method and can further emit tuples or not depending on the purpose of your bolt.

If your `process()` method completes without raising an Exception, streamparse will automatically ensure any emits you have are anchored to the current tuple being processed and acknowledged after `process()` completes.

If an Exception is raised while `process()` is called, streamparse automatically fails the current tuple prior to killing the Python process.

1.5.1 Failed Tuples

In the example above, we added the ability to fail a sentence tuple if it did not provide any words. What happens when we fail a tuple? Storm will send a “fail” message back to the spout where the tuple originated from (in this case `SentenceSpout`) and streamparse calls the spout’s `fail()` method. It’s then up to your spout implementation to decide what to do. A spout could retry a failed tuple, send an error message, or kill the topology. See [Dealing With Errors](#) for more discussion.

1.5.2 Bolt Configuration Options

You can disable the automatic acknowledging, anchoring or failing of tuples by adding class variables set to false for: `auto_ack`, `auto_anchor` or `auto_fail`. All three options are documented in `streamparse.bolt.Bolt`.

Example:

```

from streamparse.bolt import Bolt

class MyBolt(Bolt):

    auto_ack = False
    auto_fail = False

    def process(self, tup):
        # do stuff...
        if error:
            self.fail(tup) # perform failure manually
            self.ack(tup) # perform acknowledgement manually

```

1.5.3 Handling Tick Tuples

Ticks tuples are built into Storm to provide some simple forms of cron-like behaviour without actually having to use cron. You can receive and react to tick tuples as timer events with your python bolts using streamparse too.

The first step is to override `process_tick()` in your custom Bolt class. Once this is overridden, you can set the storm option `topology.tick.tuple.freq.secs=<frequency>` to cause a tick tuple to be emitted every `<frequency>` seconds.

You can see the full docs for `process_tick()` in `streamparse.bolt.Bolt`.

Example:

```
from streamparse.bolt import Bolt

class MyBolt(Bolt):

    def process_tick(self, freq):
        # An action we want to perform at some regular interval...
        self.flush_old_state()
```

Then, for example, to cause `process_tick()` to be called every 2 seconds on all of your bolts that override it, you can launch your topology under `sparse run` by setting the appropriate `-o` option and value as in the following example:

```
$ sparse run -o "topology.tick.tuple.freq.secs=2" ...
```

1.6 Remote Deployment

1.6.1 Setting up a Storm Cluster

See Storm's [Setting up a Storm Cluster](#).

1.6.2 Submit

When you are satisfied that your topology works well via testing with:

```
> sparse run -d
```

You can submit your topology to a remote Storm cluster using the command:

```
sparse submit [--environment <env>] [--name <topology>] [-dv]
```

Before submitting, you have to have at least one environment configured in your project's `config.json` file. Let's create a sample environment called "prod" in our `config.json` file:

```
{
  "library": "",
  "topology_specs": "topologies/",
  "virtualenv_specs": "virtualenvs/",
  "envs": {
    "prod": {
      "user": "storm",
      "nimbus": "storm1.my-cluster.com",
      "workers": [
        "storm1.my-cluster.com",
        "storm2.my-cluster.com",
        "storm3.my-cluster.com"
      ],
      "log": {
        "path": "/var/log/storm/streamparse",
```

```
        "max_bytes": 100000,  
        "backup_count": 10,  
        "level": "info"  
    },  
    "use_ssh_for_nimbus": true,  
    "virtualenv_root": "/data/virtualenvs/"  
}  
}
```

We've now defined a `prod` environment that will use the user `storm` when deploying topologies. Before submitting the topology though, streamparse will automatically take care of installing all the dependencies your topology requires. It does this by sshing into everyone of the nodes in the `workers` config variable and building a virtualenv using the the project's local `virtualenvs/<topology_name>.txt` requirements file.

This implies a few requirements about the user you specify per environment:

1. Must have ssh access to all servers in your Storm cluster
2. Must have write access to the `virtualenv_root` on all servers in your Storm cluster

streamparse also assumes that virtualenv is installed on all Storm servers.

Once an environment is configured, we could deploy our wordcount topology like so:

```
> sparse submit
```

Seeing as we have only one topology and environment, we don't need to specify these explicitly. streamparse will now:

1. Package up a JAR containing all your Python source files
2. Build a virtualenv on all your Storm workers (in parallel)
3. Submit the topology to the nimbus server

1.6.3 Disabling & Configuring Virtualenv Creation

If you do not have ssh access to all of the servers in your Storm cluster, but you know they have all of the requirements for your Python code installed, you can set `"use_virtualenv"` to `false` in `config.json`.

If you would like to pass command-line flags to virtualenv, you can set `"virtualenv_flags"` in `config.json`, for example:

```
"virtualenv_flags": "-p /path/to/python"
```

Note that this only applies when the virtualenv is created, not when an existing virtualenv is used.

1.6.4 Using unofficial versions of Storm

If you wish to use streamparse with unofficial versions of storm (such as the HDP Storm) you should set `:repositories` in your `project.clj` to point to the Maven repository containing the JAR you want to use, and set the version in `:dependencies` to match the desired version of Storm.

For example, to use the version supplied by HDP, you would set `:repositories` to:

```
:repositories {"HDP Releases" "http://repo.hortonworks.com/content/repositories/releases" }
```

1.6.5 Local Clusters

Streamparse assumes that your Storm cluster is not on your local machine. If it is, such as the case with VMs or Docker images, change "use_ssh_for_nimbus" in `config.json` to `false`.

1.6.6 Logging

The Storm supervisor needs to have access to the `log.path` directory for logging to work (in the example above, `/var/log/storm/streamparse`). If you have properly configured the `log.path` option in your config, streamparse will automatically set up a log files on each Storm worker in this path using the following filename convention:

```
streamparse_<topology_name>_<component_name>_<task_id>_<process_id>.log
```

Where:

- `topology_name`: is the `topology.name` variable set in Storm
- `component_name`: is the name of the currently executing component as defined in your topology definition file (.clj file)
- `task_id`: is the task ID running this component in the topology
- `process_id`: is the process ID of the Python process

streamparse uses Python's `logging.handlers.RotatingFileHandler` and by default will only save 10 1 MB log files (10 MB in total), but this can be tuned with the `log.max_bytes` and `log.backup_count` variables.

The default logging level is set to `INFO`, but if you can tune this with the `log.level` setting which can be one of `critical`, `error`, `warning`, `info` or `debug`. **Note** that if you perform `sparse run` or `sparse submit` with the `--debug` set, this will override your `log.level` setting and set the log level to `debug`.

When running your topology locally via `sparse run`, your log path will be automatically set to `/path/to/your/streamparse/project/logs`.

New in version 3.0.0.

Topologies

Storm topologies are described as a Directed Acyclic Graph (DAG) of Storm components, namely *bolts* and *spouts*.

2.1 Topology DSL

To simplify the process of creating Storm topologies, streamparse features a Python Topology DSL. It lets you specify topologies as complex as those you can in [Java](#) or [Clojure](#), but in concise, readable Python.

Topology files are located in `topologies` in your streamparse project folder. There can be any number of topology files for your project in this directory.

- `topologies/my_topology.py`
- `topologies/my_other_topology.py`
- `topologies/my_third_topology.py`
- ...

A valid *Topology* may only have *Bolt* and *Spout* attributes.

2.1.1 Simple Python Example

The first step to putting together a topology, is creating the bolts and spouts, so let's assume we have the following bolt and spout:

```
import os
from collections import Counter

from redis import StrictRedis

from streamparse import Bolt

class WordCountBolt(Bolt):
    outputs = ['word', 'count']

    def initialize(self, conf, ctx):
        self.counter = Counter()
        self.pid = os.getpid()
        self.total = 0
```

```

def _increment(self, word, inc_by):
    self.counter[word] += inc_by
    self.total += inc_by

def process(self, tup):
    word = tup.values[0]
    self._increment(word, 10 if word == "dog" else 1)
    if self.total % 1000 == 0:
        self.logger.info("counted [{:},] words [pid={}]".format(self.total,
                                                                self.pid))

    self.emit([word, self.counter[word]])

```

```

from itertools import cycle

from streamparse import Spout

class WordSpout(Spout):
    outputs = ['word']

    def initialize(self, stormconf, context):
        self.words = cycle(['dog', 'cat', 'zebra', 'elephant'])

    def next_tuple(self):
        word = next(self.words)
        self.emit([word])

```

One important thing to note is that we have added an `outputs` attribute to these classes, which specify the names of the output fields that will be produced on their default streams. If we wanted to specify multiple streams, we could do that by specifying a list of *Stream* objects.

Now let's hook up the bolt to read from the spout:

```

"""
Word count topology (in memory)
"""

from streamparse import Grouping, Topology

from bolts import WordCountBolt
from spouts import WordSpout

class WordCount(Topology):
    word_spout = WordSpout.spec()
    count_bolt = WordCountBolt.spec(inputs={word_spout: Grouping.fields('word')},
                                   par=2)

```

Note: Your project's `src` directory gets added to `sys.path` before your topology is imported, so you should use absolute imports based on that.

As you can see, `streamparse.Bolt.spec()` and `streamparse.Spout.spec()` methods allow us to specify information about the components in your topology and how they connect to each other. Their respective docstrings outline all of the possible ways they can be used.

2.1.2 Java Components

The topology DSL fully supports JVM-based bolts and spouts via the *JavaBolt* and *JavaSpout* classes.

Here's an example of how we would use the *Storm Kafka Spout*:

```
"""
Pixel count topology
"""

from streamparse import Grouping, JavaSpout, Topology

from bolts.pixel_count import PixelCounterBolt
from bolts.pixel_deserializer import PixelDeserializerBolt

class PixelCount(Topology):
    pixel_spout = JavaSpout.spec(name="pixel-spout",
                                full_class_name="pixelcount.spouts.PixelSpout",
                                args_list=[],
                                outputs=["pixel"])
    pixel_deserializer = PixelDeserializerBolt.spec(name='pixel-deserializer-bolt',
                                                    inputs=[pixel_spout])
    pixel_counter = PixelCounterBolt.spec(name='pixel-count-bolt',
                                          inputs={pixel_deserializer:
                                                  Grouping.fields('url')},
                                          config={"topology.tick.tuple.freq.secs": 1})
```

One limitation of the Thrift interface we use to send the topology to Storm is that the constructors for Java components can only be passed basic Python data types: *bool*, *bytes*, *float*, *int*, and *str*.

2.1.3 Components in Other Languages

If you have components that are written in languages other than Java or Python, you can have those as part of your topology as well—assuming you're using the corresponding multi-lang library for that language.

To do that you just need to use the *streamparse.ShellBolt.spec()* and *streamparse.ShellSpout.spec()* methods. They take command and script arguments to specify a binary to run and its string-separated arguments.

2.2 Running Topologies

2.2.1 What Streamparse Does

When you run a topology either locally or by submitting to a cluster, streamparse will

1. Bundle all of your code into a JAR
2. Build a Thrift Topology struct out of your Python topology definition.
3. Pass the Thrift Topology struct to Nimbus on your Storm cluster.

If you invoked streamparse with `sparse run`, your code is executed directly from the `src/` directory.

If you submitted to a cluster with `sparse submit`, streamparse uses `lein` to compile the `src` directory into a jar file, which is run on the cluster. `Lein` uses the `project.clj` file located in the root of your project. This file is a standard `lein` project file and can be customized according to your needs.

2.2.2 Dealing With Errors

When detecting an error, bolt code can call its `fail()` method in order to have Storm call the respective spout's `fail()` method. Known error/failure cases result in explicit callbacks to the spout using this approach.

Exceptions which propagate without being caught will cause the component to crash. On `sparse run`, the entire topology will stop execution. On a running cluster (i.e. `sparse submit`), Storm will auto-restart the crashed component and the spout will receive a `fail()` call.

If the spout's fail handling logic is to hold back the tuple and not re-emit it, then things will keep going. If it re-emits it, then it may crash that component again. Whether the topology is tolerant of the failure depends on how you implement failure handling in your spout.

Common approaches are to:

- Append errant tuples to some sort of error log or queue for manual inspection later, while letting processing continue otherwise.
- Attempt 1 or 2 retries before considering the tuple a failure, if the error was likely an transient problem.
- Ignore the failed tuple, if appropriate to the application.

2.3 Parallelism and Workers

In general, use the “par” “parallelism hint” parameter per spout and bolt in your configuration to control the number of Python processes per component.

Reference: [Understanding the Parallelism of a Storm Topology](#)

Storm parallelism entities:

- A *worker process* is a JVM, i.e. a Java process.
- An *executor* is a thread that is spawned by a worker process.
- A *task* performs the actual data processing. (To simplify, you can think of it as a Python callable.)

Spout and bolt specs take a `par` keyword to provide a parallelism hint to Storm for the number of executors (threads) to use for the given spout/bolt; for example, `par=2` is a hint to use two executors. Because streamparse implements spouts and bolts as independent Python processes, setting `par=N` results in N Python processes for the given spout/bolt.

Many streamparse applications will need only to set this parallelism hint to control the number of resulting Python processes when tuning streamparse configuration. For the underlying topology workers, streamparse sets a default of 2 workers, which are independent JVM processes for Storm. This allows a topology to continue running when one worker process dies; the other is around until the dead process restarts.

Both `sparse run` and `sparse submit` accept a `-p N` command-line flag to set the number of topology workers to N. For convenience, this flag also sets the number of Storm's underlying messaging reliability *acker bolts* to the same N value. In the event that you need it (and you understand Storm ackers), use the `-a` and `-w` command-line flags instead of `-p` to control the number of acker bolts and the number of workers, respectively. The `sparse` command does not support Storm's rebalancing features; use `sparse submit -f -p N` to kill the running topology and redeploy it with N workers.

Note that the underlying Storm thread implementation, LMAX Disruptor, is designed with high-performance inter-thread messaging as a goal. Rule out Python-level issues when tuning your topology:

- bottlenecks where the number of spout and bolt processes are out of balance
- serialization/deserialization overhead of more data emitted than you need

- slow routines/callables in your code

3.1 Tuples

class `streamparse.Tuple` (*id, component, stream, task, values*)
Storm's primitive data type passed around via streams.

Variables

- **id** – the ID of the Tuple.
- **component** – component that the Tuple was generated from.
- **stream** – the stream that the Tuple was emitted into.
- **task** – the task the Tuple was generated from.
- **values** – the payload of the Tuple where data is stored.

You should never have to instantiate an instance of a `streamparse.Tuple` yourself as `streamparse` handles this for you prior to, for example, a `streamparse.Bolt`'s `process()` method being called.

None of the emit methods for bolts or spouts require that you pass a `streamparse.Tuple` instance.

3.2 Components

Both `streamparse.Bolt` and `streamparse.Spout` inherit from a common base-class, `streamparse.storm.component.Component`. It extends `pystorm`'s code for handling [Multi-Lang IPC between Storm and Python](#) and adds support for our Python *Topology DSL*.

3.2.1 Spouts

Spouts are data sources for topologies, they can read from any data source and emit tuples into streams.

class `streamparse.Spout` (*input_stream=<open file '<stdin>', mode 'r'>, output_stream=<open file '<stdout>', mode 'w'>, rdb_signal=10, serializer=u'json'*)
Bases: `pystorm.spout.Spout`, `streamparse.storm.spout.ShellSpout`
pystorm Spout with streamparse-specific additions

ack (*tup_id*)
Called when a bolt acknowledges a Tuple in the topology.

Parameters `tup_id` (*str*) – the ID of the Tuple that has been fully acknowledged in the topology.

emit (*tup*, *tup_id=None*, *stream=None*, *direct_task=None*, *need_task_ids=True*)

Emit a spout Tuple message.

Parameters

- **tup** (*list or tuple*) – the Tuple to send to Storm, should contain only JSON-serializable data.
- **tup_id** (*str*) – the ID for the Tuple. Leave this blank for an unreliable emit.
- **stream** (*str*) – ID of the stream this Tuple should be emitted to. Leave empty to emit to the default stream.
- **direct_task** (*int*) – the task to send the Tuple to if performing a direct emit.
- **need_task_ids** (*bool*) – indicate whether or not you'd like the task IDs the Tuple was emitted (default: True).

Returns a list of task IDs that the Tuple was sent to. Note that when specifying `direct_task`, this will be equal to `[direct_task]`. If you specify `need_task_ids=False`, this function will return `None`.

fail (*tup_id*)

Called when a Tuple fails in the topology

A spout can choose to emit the Tuple again or ignore the fail. The default is to ignore.

Parameters `tup_id` (*str*) – the ID of the Tuple that has failed in the topology either due to a bolt calling `fail()` or a Tuple timing out.

initialize (*storm_conf*, *context*)

Called immediately after the initial handshake with Storm and before the main run loop. A good place to initialize connections to data sources.

Parameters

- **storm_conf** (*dict*) – the Storm configuration for this component. This is the configuration provided to the topology, merged in with cluster configuration on the worker node.
- **context** (*dict*) – information about the component's place within the topology such as: task IDs, inputs, outputs etc.

is_heartbeat (*tup*)

Returns Whether or not the given Tuple is a heartbeat

log (*message*, *level=None*)

Log a message to Storm optionally providing a logging level.

Parameters

- **message** (*str*) – the log message to send to Storm.
- **level** (*str*) – the logging level that Storm should use when writing the message. Can be one of: trace, debug, info, warn, or error (default: info).

Warning: This will send your message to Storm regardless of what level you specify. In almost all cases, you are better off using `Component.logger` with a `pystorm.component.StormHandler`, because the filtering will happen on the Python side (instead of on the Java side after taking the time to serialize your message and send it to Storm).

next_tuple ()

Implement this function to emit Tuples as necessary.

This function should not block, or Storm will think the spout is dead. Instead, let it return and pystorm will send a noop to storm, which lets it know the spout is functioning.

raise_exception (exception, tup=None)

Report an exception back to Storm via logging.

Parameters

- **exception** – a Python exception.
- **tup** – a Tuple object.

read_handshake ()

Read and process an initial handshake message from Storm.

read_message ()

Read a message from Storm via serializer.

report_metric (name, value)

Report a custom metric back to Storm.

Parameters

- **name** – Name of the metric. This can be anything.
- **value** – Value of the metric. This is usually a number.

Only supported in Storm 0.9.3+.

run ()

Main run loop for all components.

Performs initial handshake with Storm and reads Tuples handing them off to subclasses. Any exceptions are caught and logged back to Storm prior to the Python process exiting.

Warning: Subclasses should **not** override this method.

send_message (message)

Send a message to Storm via stdout.

classmethod spec (name=None, par=None, config=None)

Create a ShellBoltSpec for a Python Spout.

This spec represents this Spout in a *Topology*.

Parameters

- **name** (*str*) – Name of this Spout. Defaults to name of *Topology* attribute this is assigned to.
- **par** (*int*) – Parallelism hint for this Spout. For Python Components, this works out to be the number of Python processes running it in the the topology (across all machines). See *Parallelism and Workers*.

Note: This can also be specified as an attribute of your Spout subclass.

- **config** (*dict*) – Component-specific config settings to pass to Storm.

Note: This can also be specified as an attribute of your `Spout` subclass.

Note: This method does not take a `outputs` argument because `outputs` should be an attribute of your `Spout` subclass.

3.2.2 Bolts

class `streamparse.Bolt` (**args, **kwargs*)

Bases: `pystorm.bolt.Bolt`, `streamparse.storm.bolt.ShellBolt`

`pystorm Bolt` with `streamparse`-specific additions

ack (*tup*)

Indicate that processing of a `Tuple` has succeeded.

Parameters `tup` (`str` or `pystorm.component.Tuple`) – the `Tuple` to acknowledge.

emit (*tup, stream=None, anchors=None, direct_task=None, need_task_ids=True*)

Emit a new `Tuple` to a stream.

Parameters

- **tup** (`list` or `pystorm.component.Tuple`) – the `Tuple` payload to send to Storm, should contain only JSON-serializable data.
- **stream** (`str`) – the ID of the stream to emit this `Tuple` to. Specify `None` to emit to default stream.
- **anchors** (`list`) – IDs the `Tuples` (or `pystorm.component.Tuple` instances) which the emitted `Tuples` should be anchored to. If `auto_anchor` is set to `True` and you have not specified `anchors`, `anchors` will be set to the incoming/most recent `Tuple` ID(s).
- **direct_task** (`int`) – the task to send the `Tuple` to.
- **need_task_ids** (`bool`) – indicate whether or not you'd like the task IDs the `Tuple` was emitted (default: `True`).

Returns a `list` of task IDs that the `Tuple` was sent to. Note that when specifying `direct_task`, this will be equal to `[direct_task]`. If you specify `need_task_ids=False`, this function will return `None`.

fail (*tup*)

Indicate that processing of a `Tuple` has failed.

Parameters `tup` (`str` or `pystorm.component.Tuple`) – the `Tuple` to fail (its `id` if `str`).

initialize (*storm_conf, context*)

Called immediately after the initial handshake with Storm and before the main run loop. A good place to initialize connections to data sources.

Parameters

- **storm_conf** (`dict`) – the Storm configuration for this component. This is the configuration provided to the topology, merged in with cluster configuration on the worker node.

- **context** (*dict*) – information about the component’s place within the topology such as: task IDs, inputs, outputs etc.

is_heartbeat (*tup*)

Returns Whether or not the given Tuple is a heartbeat

is_tick (*tup*)

Returns Whether or not the given Tuple is a tick Tuple

log (*message*, *level=None*)

Log a message to Storm optionally providing a logging level.

Parameters

- **message** (*str*) – the log message to send to Storm.
- **level** (*str*) – the logging level that Storm should use when writing the message. Can be one of: trace, debug, info, warn, or error (default: *info*).

Warning: This will send your message to Storm regardless of what level you specify. In almost all cases, you are better off using `Component.logger` with a `pystorm.component.StormHandler`, because the filtering will happen on the Python side (instead of on the Java side after taking the time to serialize your message and send it to Storm).

process (*tup*)

Process a single Tuple `pystorm.component.Tuple` of input

This should be overridden by subclasses. `pystorm.component.Tuple` objects contain metadata about which component, stream and task it came from. The actual values of the Tuple can be accessed by calling `tup.values`.

Parameters **tup** (`pystorm.component.Tuple`) – the Tuple to be processed.

process_tick (*tup*)

Process special ‘tick Tuples’ which allow time-based behaviour to be included in bolts.

Default behaviour is to ignore time ticks. This should be overridden by subclasses who wish to react to timer events via tick Tuples.

Tick Tuples will be sent to all bolts in a topology when the storm configuration option ‘`topology.tick.tuple.freq.secs`’ is set to an integer value, the number of seconds.

Parameters **tup** (`pystorm.component.Tuple`) – the Tuple to be processed.

raise_exception (*exception*, *tup=None*)

Report an exception back to Storm via logging.

Parameters

- **exception** – a Python exception.
- **tup** – a Tuple object.

read_handshake ()

Read and process an initial handshake message from Storm.

read_message ()

Read a message from Storm via serializer.

read_tuple ()

Read a tuple from the pipe to Storm.

report_metric (*name, value*)

Report a custom metric back to Storm.

Parameters

- **name** – Name of the metric. This can be anything.
- **value** – Value of the metric. This is usually a number.

Only supported in Storm 0.9.3+.

run ()

Main run loop for all components.

Performs initial handshake with Storm and reads Tuples handing them off to subclasses. Any exceptions are caught and logged back to Storm prior to the Python process exiting.

Warning: Subclasses should **not** override this method.

send_message (*message*)

Send a message to Storm via stdout.

classmethod spec (*name=None, inputs=None, par=None, config=None*)

Create a ShellBoltSpec for a Python Bolt.

This spec represents this Bolt in a *Topology*.

Parameters

- **name** (*str*) – Name of this Bolt. Defaults to name of *Topology* attribute this is assigned to.
- **inputs** – Streams that feed into this Bolt.
Two forms of this are acceptable:
 1. A *dict* mapping from *ComponentSpec* to *Grouping*.
 2. A *list* of *Stream* or *ComponentSpec*.
- **par** (*int*) – Parallelism hint for this Bolt. For Python Components, this works out to be the number of Python processes running it in the the topology (across all machines). See *Parallelism and Workers*.

Note: This can also be specified as an attribute of your Bolt subclass.

- **config** (*dict*) – Component-specific config settings to pass to Storm.

Note: This can also be specified as an attribute of your Bolt subclass.

Note: This method does not take a *outputs* argument because *outputs* should be an attribute of your Bolt subclass.

class streamparse.**BatchingBolt** (**args, **kwargs*)

Bases: pystorm.bolt.BatchingBolt, streamparse.storm.bolt.Bolt

pystorm BatchingBolt with streamparse-specific additions

ack (*tup*)

Indicate that processing of a Tuple has succeeded.

Parameters **tup** (*str* or `pystorm.component.Tuple`) – the Tuple to acknowledge.

emit (*tup*, ***kwargs*)

Modified emit that will not return task IDs after emitting.

See `pystorm.component.Bolt` for more information.

Returns `None`.

fail (*tup*)

Indicate that processing of a Tuple has failed.

Parameters **tup** (*str* or `pystorm.component.Tuple`) – the Tuple to fail (its `id` if *str*).

group_key (*tup*)

Return the group key used to group Tuples within a batch.

By default, returns `None`, which put all Tuples in a single batch, effectively just time-based batching. Override this to create multiple batches based on a key.

Parameters **tup** (`pystorm.component.Tuple`) – the Tuple used to extract a group key

Returns Any hashable value.

initialize (*storm_conf*, *context*)

Called immediately after the initial handshake with Storm and before the main run loop. A good place to initialize connections to data sources.

Parameters

- **storm_conf** (*dict*) – the Storm configuration for this component. This is the configuration provided to the topology, merged in with cluster configuration on the worker node.
- **context** (*dict*) – information about the component’s place within the topology such as: task IDs, inputs, outputs etc.

is_heartbeat (*tup*)

Returns Whether or not the given Tuple is a heartbeat

is_tick (*tup*)

Returns Whether or not the given Tuple is a tick Tuple

log (*message*, *level=None*)

Log a message to Storm optionally providing a logging level.

Parameters

- **message** (*str*) – the log message to send to Storm.
- **level** (*str*) – the logging level that Storm should use when writing the `message`. Can be one of: `trace`, `debug`, `info`, `warn`, or `error` (default: `info`).

Warning: This will send your message to Storm regardless of what level you specify. In almost all cases, you are better off using `Component.logger` with a `pystorm.component.StormHandler`, because the filtering will happen on the Python side (instead of on the Java side after taking the time to serialize your message and send it to Storm).

process (*tup*)

Group non-tick Tuples into batches by `group_key`.

Warning: This method should **not** be overridden. If you want to tweak how Tuples are grouped into batches, override `group_key`.

process_batch (*key, tups*)

Process a batch of Tuples. Should be overridden by subclasses.

Parameters

- **key** (*hashable*) – the group key for the list of batches.
- **tups** (*list*) – a *list* of `pystorm.component.Tuple`s for the group.

process_batches ()

Iterate through all batches, call `process_batch` on them, and ack.

Separated out for the rare instances when we want to subclass `BatchingBolt` and customize what mechanism causes batches to be processed.

process_tick (*tick_tup*)

Increment tick counter, and call `process_batch` for all current batches if tick counter exceeds `ticks_between_batches`.

See `pystorm.component.Bolt` for more information.

Warning: This method should **not** be overridden. If you want to tweak how Tuples are grouped into batches, override `group_key`.

raise_exception (*exception, tup=None*)

Report an exception back to Storm via logging.

Parameters

- **exception** – a Python exception.
- **tup** – a `Tuple` object.

read_handshake ()

Read and process an initial handshake message from Storm.

read_message ()

Read a message from Storm via serializer.

read_tuple ()

Read a tuple from the pipe to Storm.

report_metric (*name, value*)

Report a custom metric back to Storm.

Parameters

- **name** – Name of the metric. This can be anything.
- **value** – Value of the metric. This is usually a number.

Only supported in Storm 0.9.3+.

run ()

Main run loop for all components.

Performs initial handshake with Storm and reads Tuples handing them off to subclasses. Any exceptions are caught and logged back to Storm prior to the Python process exiting.

Warning: Subclasses should **not** override this method.

send_message (*message*)

Send a message to Storm via stdout.

spec (*name=None, inputs=None, par=None, config=None*)

Create a ShellBoltSpec for a Python Bolt.

This spec represents this Bolt in a *Topology*.

Parameters

- **name** (*str*) – Name of this Bolt. Defaults to name of *Topology* attribute this is assigned to.
- **inputs** – Streams that feed into this Bolt.
Two forms of this are acceptable:
 1. A *dict* mapping from *ComponentSpec* to *Grouping*.
 2. A *list* of *Stream* or *ComponentSpec*.
- **par** (*int*) – Parallelism hint for this Bolt. For Python Components, this works out to be the number of Python processes running it in the the topology (across all machines). See *Parallelism and Workers*.

Note: This can also be specified as an attribute of your Bolt subclass.

- **config** (*dict*) – Component-specific config settings to pass to Storm.

Note: This can also be specified as an attribute of your Bolt subclass.

Note: This method does not take a *outputs* argument because *outputs* should be an attribute of your Bolt subclass.

3.3 Logging

class streamparse.**StormHandler** (*stream=None*)

Bases: logging.Handler

Handler that will send messages back to Storm.

Initialize handler

emit (*record*)

Emit a record.

If a formatter is specified, it is used to format the record. If exception information is present, it is formatted using `traceback.print_exception` and sent to Storm.

3.4 Topology DSL

class `streamparse.Topology`

Class to define a Storm topology in a Python DSL.

class `streamparse.Grouping`

A Grouping describes how Tuples should be distributed to the tasks of a Bolt listening on a particular stream.

When no Grouping is specified, it defaults to *SHUFFLE* for normal streams, and *DIRECT* for direct streams.

Variables

- **SHUFFLE** – Tuples are randomly distributed across the Bolt’s tasks in a way such that each Bolt is guaranteed to get an equal number of Tuples.
- **GLOBAL** – The entire stream goes to a single one of the Bolt’s tasks. Specifically, it goes to the task with the lowest id.
- **DIRECT** – This is a special kind of grouping. A stream grouped this way means that the producer of the Tuple decides which task of the consumer will receive this Tuple. Direct groupings can only be declared on streams that have been declared as direct streams. Tuples emitted to a direct stream must be emitted using the the *direct_task* parameter to the `streamparse.Bolt.emit()` and `streamparse.Spout.emit()` methods.
- **ALL** – The stream is replicated across all the Bolt’s tasks. Use this grouping with care.
- **NONE** – This grouping specifies that you don’t care how the stream is grouped. Currently, none groupings are equivalent to shuffle groupings. Eventually though, Storm will push down Bolts with none groupings to execute in the same thread as the Bolt or Spout they subscribe from (when possible).
- **LOCAL_OR_SHUFFLE** – If the target Bolt has one or more tasks in the same worker process, Tuples will be shuffled to just those in-process tasks. Otherwise, this acts like a normal shuffle grouping.

classmethod `custom_object (java_class_name, arg_list)`

Tuples will be assigned to tasks by the given Java class.

classmethod `custom_serialized (java_serialized)`

Tuples will be assigned to tasks by the given Java serialized class.

classmethod `fields (*fields)`

The stream is partitioned by the fields specified in the grouping.

For example, if the stream is grouped by the *user-id* field, Tuples with the same *user-id* will always go to the same task, but Tuples with different *user-id*’s may go to different tasks.

class `streamparse.Stream (fields=None, name='default', direct=False)`

A Storm output stream

Parameters

- **fields** (*list* or *tuple* of *str*) – Field names for this stream.
- **name** (*str*) – Name of stream. Defaults to `default`.
- **direct** (*bool*) – Whether or not this stream is direct. Default is *False*. See `DIRECT`.

class `streamparse.JavaBolt (input_stream=<open file '<stdin>', mode 'r'>, output_stream=<open file '<stdout>', mode 'w'>, rdb_signal=10, serializer='u'json')`

classmethod spec (*name=None, serialized_java=None, full_class_name=None, args_list=None, inputs=None, par=1, config=None, outputs=None*)
 Create a JavaBoltSpec for a Java Bolt.

This spec represents this Bolt in a *Topology*.

You must add the appropriate entries to your classpath by editing your project's `project.clj` file in order for this to work.

Parameters

- **name** (*str*) – Name of this Bolt. Defaults to name of *Topology* attribute this is assigned to.
- **serialized_java** (*bytes*) – Serialized Java code representing the class. You must either specify this, or both `full_class_name` and `args_list`.
- **full_class_name** (*str*) – Fully qualified class name (including the package name)
- **args_list** (*list* of basic data types) – A list of arguments to be passed to the constructor of this class.
- **inputs** – Streams that feed into this Bolt.

Two forms of this are acceptable:

1. A *dict* mapping from *ComponentSpec* to *Grouping*.
2. A *list* of *Stream* or *ComponentSpec*.

- **par** (*int*) – Parallelism hint for this Bolt. For Python Components, this works out to be the number of Python processes running it in the the topology (across all machines). See *Parallelism and Workers*.
- **config** (*dict*) – Component-specific config settings to pass to Storm.
- **outputs** – Outputs this JavaBolt will produce. Acceptable forms are:
 1. A *list* of *Stream* objects describing the fields output on each stream.
 2. A *list* of *str* representing the fields output on the default stream.

class `streamparse.JavaSpout` (*input_stream=<open file '<stdin>', mode 'r'>, output_stream=<open file '<stdout>', mode 'w'>, rdb_signal=10, serializer='u'json'*)

classmethod spec (*name=None, serialized_java=None, full_class_name=None, args_list=None, par=1, config=None, outputs=None*)
 Create a JavaSpoutSpec for a Java Spout.

This spec represents this Spout in a *Topology*.

You must add the appropriate entries to your classpath by editing your project's `project.clj` file in order for this to work.

Parameters

- **name** (*str*) – Name of this Spout. Defaults to name of *Topology* attribute this is assigned to.
- **serialized_java** (*bytes*) – Serialized Java code representing the class. You must either specify this, or both `full_class_name` and `args_list`.
- **full_class_name** (*str*) – Fully qualified class name (including the package name)
- **args_list** (*list* of basic data types) – A list of arguments to be passed to the constructor of this class.

- **par** (*int*) – Parallelism hint for this Spout. See *Parallelism and Workers*.
- **config** (*dict*) – Component-specific config settings to pass to Storm.
- **outputs** – Outputs this JavaSpout will produce. Acceptable forms are:
 1. A *list* of *Stream* objects describing the fields output on each stream.
 2. A *list* of *str* representing the fields output on the default stream.

class streamparse.**ShellBolt** (*input_stream=<open file '<stdin>', mode 'r'>, output_stream=<open file '<stdout>', mode 'w'>, rdb_signal=10, serializer=u'json'*)

A Bolt that is started by running a command with a script argument.

classmethod spec (*name=None, command=None, script=None, inputs=None, par=None, config=None, outputs=None*)

Create a ShellBoltSpec for a non-Java, non-Python Bolt.

If you want to create a spec for a Python Bolt, use `spec()`.

This spec represents this Bolt in a *Topology*.

Parameters

- **name** (*str*) – Name of this Bolt. Defaults to name of *Topology* attribute this is assigned to.
- **command** (*str*) – Path to command the Storm will execute.
- **script** (*str*) – Arguments to *command*. Multiple arguments should just be separated by spaces.
- **inputs** – Streams that feed into this Bolt.

Two forms of this are acceptable:

 1. A *dict* mapping from *ComponentSpec* to *Grouping*.
 2. A *list* of *Stream* or *ComponentSpec*.
- **par** (*int*) – Parallelism hint for this Bolt. For shell Components, this works out to be the number of running it in the the topology (across all machines). See *Parallelism and Workers*.
- **config** (*dict*) – Component-specific config settings to pass to Storm.
- **outputs** – Outputs this ShellBolt will produce. Acceptable forms are:
 1. A *list* of *Stream* objects describing the fields output on each stream.
 2. A *list* of *str* representing the fields output on the default stream.

class streamparse.**ShellSpout** (*input_stream=<open file '<stdin>', mode 'r'>, output_stream=<open file '<stdout>', mode 'w'>, rdb_signal=10, serializer=u'json'*)

classmethod spec (*name=None, command=None, script=None, par=None, config=None, outputs=None*)

Create a ShellSpoutSpec for a non-Java, non-Python Spout.

If you want to create a spec for a Python Spout, use `spec()`.

This spec represents this Spout in a *Topology*.

Parameters

- **name** (*str*) – Name of this Spout. Defaults to name of *Topology* attribute this is assigned to.

- **command** (*str*) – Path to command the Storm will execute.
- **script** (*str*) – Arguments to *command*. Multiple arguments should just be separated by spaces.
- **par** (*int*) – Parallelism hint for this Spout. For shell Components, this works out to be the number of processes running it in the the topology (across all machines). See *Parallelism and Workers*.
- **config** (*dict*) – Component-specific config settings to pass to Storm.
- **outputs** – Outputs this ShellSpout will produce. Acceptable forms are:
 1. A *list* of *Stream* objects describing the fields output on each stream.
 2. A *list* of *str* representing the fields output on the `default` stream.

Developing Streamparse

4.1 Lein

Install Leiningen according to the instructions in the quickstart.

4.2 Local pip installation

In your virtualenv for this project, go into `~/repos/streamparse` (where you cloned streamparse) and simply run:

```
python setup.py develop
```

This will install a streamparse Python version into the virtualenv which is essentially symlinked to your local version.

NOTE: streamparse currently pip installs streamparse's **released** version on remote clusters automatically. Therefore, though this will work for local development, you'll need to push streamparse somewhere pip installable (or change requirements.txt) to make it pick up that version on a remote cluster.

4.3 Installing Storm pre-releases

You can clone Storm from Github here:

```
git clone git@github.com:apache/storm.git
```

There are tags available for releases, e.g.:

```
git checkout v0.10.0
```

To build a local Storm release, use:

```
mvn install
cd storm-dist/binary
mvn package
```

These steps will take awhile as they also run Storm's internal unit and integration tests.

The first line will actually install Storm locally in your maven (.m2) repository. You can confirm this with:

```
ls ~/.m2/repository/org/apache/storm/storm-core/0.9.2-incubating
```

You should now be able to change your `project.clj` to include a reference to this new release.

Once you change that, you can run:

```
lein deps :tree | grep storm
```

To confirm it is using the upgraded Clojure 1.5.1 (changed in 0.9.2), run:

```
lein repl
```

Frequently Asked Questions (FAQ)

5.1 General Questions

- *Why use streamparse?*
- *Is streamparse compatible with Python 3?*
- *How can I contribute to streamparse?*
- *How do I trigger some code before or after I submit my topology?*
- *How should I install streamparse on the cluster nodes?*
- *Should I install Clojure?*

5.1.1 Why use streamparse?

To lay your Python code out in topologies which can be automatically parallelized in a Storm cluster of machines. This lets you scale your computation horizontally and avoid issues related to Python's GIL. See *Parallelism and Workers*.

5.1.2 Is streamparse compatible with Python 3?

Yes, streamparse is fully compatible with Python 3 starting with version 3.3 which we use in our [unit tests](#).

5.1.3 How can I contribute to streamparse?

Thanks for your interest in contributing to streamparse. We think you'll find the core maintainers great to work with and will help you along the way when contributing pull requests.

If you already know what you'd like to add to streamparse then by all means, feel free to submit a pull request and we'll review it.

If you're unsure about how to contribute, check out our [open issues](#) and find one that looks interesting to you (we particularly need help on all issues marked with the "help wanted" label).

If you're not sure how to start or have some questions, shoot us an email in the [streamparse user group](#) and we'll give you a hand.

From there, get to work on your fix and submit a pull request when ready which we'll review.

5.1.4 How do I trigger some code before or after I submit my topology?

After you create a streamparse project using `sparse quickstart`, you'll have both a `tasks.py` in that directory as well as `fabric.py`. In either of these files, you can specify two functions: `pre_submit` and `post_submit` which are expected to accept three arguments:

- `topology_name`: the name of the topology being submitted
- `env_name`: the name of the environment where the topology is being submitted (e.g. "prod")
- `env_config`: the relevant config portion from the `config.json` file for the environment you are submitting the topology to

Here is a sample `tasks.py` file that sends a message to IRC after a topology is successfully submitted to prod.

```
# my_project/tasks.py
from __future__ import absolute_import, print_function, unicode_literals

from invoke import task, run
from streamparse.ext.invoke import *

def post_submit(topo_name, env_name, env_config):
    if env_name == "prod":
        write_to_irc("Deployed {} to {}".format(topo_name, env_name))
```

5.1.5 How should I install streamparse on the cluster nodes?

streamparse assumes your Storm servers have Python, pip, and virtualenv installed. After that, the installation of all required dependencies (including streamparse itself) is taken care of via the `config.json` file for the streamparse project and the `sparse submit` command.

5.1.6 Should I install Clojure?

No, the Java requirements for streamparse are identical to that of Storm itself. Storm requires Java and [bundles Clojure](#) as a requirement, so you do not need to do any separate installation of Clojure. You just need Java on all Storm servers.

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