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# HyperStream Documentation

*Release 0.3.8*

**SPHERE WP5**

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**HyperStream** is a large-scale, flexible and robust software package, written in the Python language, for processing streaming data with workflow creation capabilities. HyperStream overcomes the limitations of other computational engines and provides high-level interfaces to execute complex nesting, fusion, and prediction both in online and offline forms in streaming environments. HyperStream is a general purpose tool that is well-suited for the design, development, and deployment of Machine Learning algorithms and predictive models in a wide space of sequential predictive problems.

The code can be found on our [Github project page](#). It is released under the MIT open source license.

Tutorials:

- [Introduction](#)
- [Your own tools](#)
- [Stream composition](#)
- [Real-time streams](#)
- [Workflows](#)

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## 1.1 Subpackages

### 1.1.1 hyperstream.channels package

#### 1.1.1.1 Submodules

#### 1.1.1.2 hyperstream.channels.assets\_channel module

Assets channel module.

**class** `hyperstream.channels.assets_channel.AssetsChannel` (*channel\_id*)  
Bases: `hyperstream.channels.database_channel.DatabaseChannel`

Assets Channel. Special kind of database channel for static assets and user input data (workflow parameters etc)

**create\_stream** (*stream\_id, sandbox=None*)  
Create the stream

**Parameters**

- **stream\_id** – The stream identifier
- **sandbox** – The sandbox for this stream

**Returns** None

**Raises** NotImplementedError

**purge\_stream** (*stream\_id, remove\_definition=False, sandbox=None*)  
Purge the stream

**Parameters**

- **stream\_id** – The stream identifier
- **remove\_definition** – Whether to remove the stream definition as well

- **sandbox** – The sandbox for this stream

**Returns** None

**update\_streams** (*up\_to\_timestamp*)

Update the streams

**Parameters** *up\_to\_timestamp* –

**Returns**

**write\_to\_stream** (*stream\_id*, *data*, *sandbox=None*)

Write to the stream

**Parameters**

- **stream\_id** (*StreamId*) – The stream identifier
- **data** – The stream instances
- **sandbox** – The sandbox for this stream

**Returns** None

**Raises** `NotImplementedError`

### 1.1.1.3 hyperstream.channels.assets\_channel2 module

### 1.1.1.4 hyperstream.channels.base\_channel module

```
class hyperstream.channels.base_channel.BaseChannel (channel_id, can_calc=False,  
                                                    can_create=False,  
                                                    calc_agent=None)
```

Bases: `hyperstream.utils.containers.Printable`

Abstract base class for channels

**create\_stream** (*stream\_id*, *sandbox=None*)

Must be overridden by deriving classes, must create the stream according to the tool and return its unique identifier *stream\_id*

**execute\_tool** (*stream*, *interval*)

Executes the stream's tool over the given time interval

**Parameters**

- **stream** – the stream reference
- **interval** – the time interval

**Returns** None

**find\_stream** (*\*\*kwargs*)

Finds a single stream with the given meta data values. Useful for debugging purposes.

**Parameters** **kwargs** – The meta data as keyword arguments

**Returns** The stream found

**find\_streams** (*\*\*kwargs*)

Finds streams with the given meta data values. Useful for debugging purposes.

**Parameters** **kwargs** – The meta data as keyword arguments

**Returns** The streams found



**get\_or\_create\_stream** (*stream\_id*, *try\_create=True*)

Helper function to get a stream or create one if it's not already defined

**Parameters**

- **stream\_id** – The stream id
- **try\_create** – Whether to try to create the stream if not found

**Returns** The stream object

**get\_results** (*stream*, *time\_interval*)

Must be overridden by deriving classes. 1. Calculates/receives the documents in the stream for the time interval given 2. Returns success or failure and the results (for some channels the values of kwargs can override the return process, e.g. introduce callbacks)

**get\_stream\_writer** (*stream*)

Must be overridden by deriving classes, must return a function(*document\_collection*) which writes all the given documents of the form (*timestamp*,*data*) from *document\_collection* to the stream Example:

```
.. code-block:: python
```

```
if stream_id==1:
```

```
    def f(document_collection):
```

```
        for (timestamp,data) in document_collection: database[timestamp] = data
```

```
    return(f)
```

```
    else: raise Exception('No stream with id '+str(stream_id))
```

**purge\_node** (*node\_id*, *remove\_definition=False*, *sandbox=None*)

Purges a node (collection of streams)

**Parameters**

- **node\_id** – The node identifier
- **remove\_definition** – Whether to remove the stream definition as well
- **sandbox** – The sandbox

**Returns** None

**purge\_stream** (*stream\_id*, *remove\_definition=False*, *sandbox=None*)

Must be overridden by deriving classes, purges the stream and removes the calculated intervals

**update\_streams** (*up\_to\_timestamp*)

Deriving classes must override this function

### 1.1.1.5 hyperstream.channels.database\_channel module

Database channel module.

**class** `hyperstream.channels.database_channel.DatabaseChannel` (*channel\_id*)

Bases: `hyperstream.channels.base_channel.BaseChannel`

Database Channel. Data stored and retrieved in mongodb using mongoengine.

**create\_stream** (*stream\_id*, *sandbox=None*)

Create the stream

**Parameters**

- **stream\_id** – The stream identifier
- **sandbox** – The sandbox for this stream

**Returns** None**Raises** NotImplementedError**get\_results** (*stream, time\_interval*)

Get the results for a given stream

**Parameters**

- **time\_interval** – The time interval
- **stream** – The stream object

**Returns** A generator over stream instances**get\_stream\_writer** (*stream*)

Gets the database channel writer The mongoengine model checks whether a stream\_id/datetime pair already exists in the DB (unique pairs) Should be overridden by users' personal channels - allows for non-mongo outputs.

**Parameters** **stream** – The stream**Returns** The stream writer function**purge\_stream** (*stream\_id, remove\_definition=False, sandbox=None*)

Purge the stream

**Parameters**

- **stream\_id** – The stream identifier
- **remove\_definition** – Whether to remove the stream definition as well
- **sandbox** – The sandbox for this stream

**Returns** None**Raises** NotImplementedError**update\_streams** (*up\_to\_timestamp*)

Update the streams

**Parameters** **up\_to\_timestamp** –**Returns**

### 1.1.1.6 hyperstream.channels.file\_channel module

```
class hyperstream.channels.file_channel.FileChannel (channel_id, path,  
                                                    up_to_timestamp=datetime.datetime(1,  
                                                    1, 1, 0, 0, tzinfo=<UTC>))
```

Bases: `hyperstream.channels.memory_channel.ReadOnlyMemoryChannel`

An abstract stream channel where the streams are recursive sub-folders under a given path and documents correspond to all those files which have a timestamp as their prefix in the format yyyy\_mm\_dd\_hh\_mm\_ss\_mmm\_\*. All the derived classes must override the function `data_loader(short_path,file_long_name)` which determines how the data are loaded into the document of the stream. The files of the described format must never be deleted. The call `update(up_to_timestamp)` must not be called unless it is guaranteed that later no files with earlier timestamps are added.

```

data_loader (short_path, file_info)
file_filter (sorted_file_names)
get_results (stream, time_interval)
path = ''
update_streams (up_to_timestamp)
static walk (directory, level=1)
class hyperstream.channels.file_channel.FileDateTimeVersion (filename,
                                                             split_char='_')
    Bases: hyperstream.utils.containers.Printable
    Simple class to hold file details along with the timestamp and version number from the filename. Uses semantic
    version.
    is_python

```

#### 1.1.1.7 hyperstream.channels.memory\_channel module

```

class hyperstream.channels.memory_channel.MemoryChannel (channel_id)
    Bases: hyperstream.channels.base_channel.BaseChannel
    Channel whose data lives in memory
    check_calculation_times ()
    create_stream (stream_id, sandbox=None)
        Must be overridden by deriving classes, must create the stream according to the tool and return its unique
        identifier stream_id
    get_results (stream, time_interval)
        Calculates/receives the documents in the stream interval determined by the stream :param stream: The
        stream reference :param time_interval: The time interval :return: The sorted data items
    get_stream_writer (stream)
    non_empty_streams
    purge_all (remove_definitions=False)
        Clears all streams in the channel - use with caution!
        Returns None
    purge_stream (stream_id, remove_definition=False, sandbox=None)
        Clears all the data in a given stream and the calculated intervals
        Parameters
        • stream_id – The stream id
        • remove_definition – Whether to remove the stream definition as well
        • sandbox – The sandbox id
        Returns None
    update_streams (up_to_timestamp)

```

```
class hyperstream.channels.memory_channel.ReadOnlyMemoryChannel (channel_id,  
                                                                up_to_timestamp=datetime.datetime(1,  
                                                                1, 1, 0, 0, tz-  
                                                                info=<UTC>))
```

Bases: *hyperstream.channels.base\_channel.BaseChannel*

An abstract channel with a read-only set of memory-based streams. By default it is constructed empty with the last update at MIN\_DATE. New streams and documents within streams are created with the update(up\_to\_timestamp) method, which ensures that the channel is up to date until up\_to\_timestamp. No documents nor streams are ever deleted. Any deriving class must override update\_streams(up\_to\_timestamp) which must update self.streams to be calculated until up\_to\_timestamp exactly. The data structure self.streams is a dict of streams indexed by stream\_id, each stream is a list of tuples (timestamp,data), in no specific order. Names and identifiers are the same in this channel.

**create\_stream** (stream\_id, sandbox=None)

**get\_results** (stream, time\_interval)

**get\_stream\_writer** (stream)

**update\_state** (up\_to\_timestamp)

Call this function to ensure that the channel is up to date at the time of timestamp. I.e., all the streams that have been created before or at that timestamp are calculated exactly until up\_to\_timestamp.

**update\_streams** (up\_to\_timestamp)

Deriving classes must override this function

#### 1.1.1.8 hyperstream.channels.module\_channel module

```
class hyperstream.channels.module_channel.ModuleChannel (channel_id,          path,  
                                                         up_to_timestamp=datetime.datetime(1,  
                                                         1, 1, 0, 0, tz-  
                                                         info=<UTC>))
```

Bases: *hyperstream.channels.file\_channel.FileChannel*

A channel of module streams, the documents in the streams contain functions that can be called to import the respective module

**data\_loader** (short\_path, tool\_info)

**file\_filter** (sorted\_file\_names)

**update\_state** (up\_to\_timestamp)

**versions** = None

#### 1.1.1.9 hyperstream.channels.tool\_channel module

```
class hyperstream.channels.tool_channel.ToolChannel (channel_id,          path,  
                                                      up_to_timestamp=datetime.datetime(1,  
                                                      1, 1, 0, 0, tzinfo=<UTC>))
```

Bases: *hyperstream.channels.module\_channel.ModuleChannel*

Special case of the file/module channel to load the tools to execute other streams

**get\_results** (stream, time\_interval)

#### 1.1.1.10 Module contents

### 1.1.2 hyperstream.itertools2 package

#### 1.1.2.1 Submodules

#### 1.1.2.2 hyperstream.itertools2.itertools2 module

```
hyperstream.itertools2.itertools2.any_set(data)
hyperstream.itertools2.itertools2.count(data)
hyperstream.itertools2.itertools2.online_average(data, n=0, mean=0.0)
hyperstream.itertools2.itertools2.online_product(data, total=1.0)
hyperstream.itertools2.itertools2.online_sum(data, total=0.0)
hyperstream.itertools2.itertools2.online_variance(data, n=0, mean=0.0, m2=0.0)
```

#### 1.1.2.3 Module contents

### 1.1.3 hyperstream.models package

#### 1.1.3.1 Submodules

#### 1.1.3.2 hyperstream.models.factor module

```
class hyperstream.models.factor.FactorDefinitionModel (*args, **kwargs)
    Bases: mongoengine.document.EmbeddedDocument

    alignment_node
        A unicode string field.

    factor_type
        A unicode string field.

    output_plate
        An embedded document field - with a declared document_type. Only valid values are subclasses of
        EmbeddedDocument.

    sinks
        A list field that wraps a standard field, allowing multiple instances of the field to be used as a list in the
        database.

        If using with ReferenceFields see: one-to-many-with-listfields
```

---

**Note:** Required means it cannot be empty - as the default for ListFields is []

---

#### **sources**

A list field that wraps a standard field, allowing multiple instances of the field to be used as a list in the database.

If using with ReferenceFields see: one-to-many-with-listfields

---

**Note:** Required means it cannot be empty - as the default for ListFields is []

---

**splitting\_node**

A unicode string field.

**tool**

An embedded document field - with a declared document\_type. Only valid values are subclasses of EmbeddedDocument.

**class** hyperstream.models.factor.**OutputPlateDefinitionModel** (\*args, \*\*kwargs)

Bases: mongoengine.document.EmbeddedDocument

**description**

A unicode string field.

**meta\_data\_id**

A unicode string field.

**plate\_id**

A unicode string field.

**use\_provided\_values**

Boolean field type.

New in version 0.1.2.

### 1.1.3.3 hyperstream.models.meta\_data module

**class** hyperstream.models.meta\_data.**MetaDataModel** (\*args, \*\*values)

Bases: mongoengine.document.Document

**exception DoesNotExist**

Bases: mongoengine.errors.DoesNotExist

**exception MultipleObjectsReturned**

Bases: mongoengine.errors.MultipleObjectsReturned

**data**

A unicode string field.

**id**

A field wrapper around MongoDB's ObjectIds.

**identifier****objects**

The default QuerySet Manager.

Custom QuerySet Manager functions can extend this class and users can add extra queryset functionality. Any custom manager methods must accept a Document class as its first argument, and a QuerySet as its second argument.

The method function should return a QuerySet , probably the same one that was passed in, but modified in some way.

**parent**

A unicode string field.

**tag**

A unicode string field.

`to_dict()`

#### 1.1.3.4 hyperstream.models.node module

**class** `hyperstream.models.node.NodeDefinitionModel(*args, **kwargs)`

Bases: `mongoengine.document.EmbeddedDocument`

**channel\_id**

A unicode string field.

**plate\_ids**

A list field that wraps a standard field, allowing multiple instances of the field to be used as a list in the database.

If using with ReferenceFields see: one-to-many-with-listfields

---

**Note:** Required means it cannot be empty - as the default for ListFields is []

---

**stream\_name**

A unicode string field.

#### 1.1.3.5 hyperstream.models.plate module

**class** `hyperstream.models.plate.PlateDefinitionModel(*args, **values)`

Bases: `mongoengine.document.Document`

**exception DoesNotExist**

Bases: `mongoengine.errors.DoesNotExist`

**exception MultipleObjectsReturned**

Bases: `mongoengine.errors.MultipleObjectsReturned`

**complement**

Boolean field type.

New in version 0.1.2.

**description**

A unicode string field.

**id**

A field wrapper around MongoDB's ObjectIds.

**meta\_data\_id**

A unicode string field.

**objects**

The default QuerySet Manager.

Custom QuerySet Manager functions can extend this class and users can add extra queryset functionality. Any custom manager methods must accept a `Document` class as its first argument, and a `QuerySet` as its second argument.

The method function should return a `QuerySet`, probably the same one that was passed in, but modified in some way.

**parent\_plate**

A unicode string field.

**plate\_id**

A unicode string field.

**values**

A list field that wraps a standard field, allowing multiple instances of the field to be used as a list in the database.

If using with ReferenceFields see: one-to-many-with-listfields

---

**Note:** Required means it cannot be empty - as the default for ListFields is []

---

**class** hyperstream.models.plate.**PlateModel** (\*args, \*\*kwargs)

Bases: mongoengine.document.EmbeddedDocument

**complement**

Boolean field type.

New in version 0.1.2.

**meta\_data\_id**

A unicode string field.

**values**

A list field that wraps a standard field, allowing multiple instances of the field to be used as a list in the database.

If using with ReferenceFields see: one-to-many-with-listfields

---

**Note:** Required means it cannot be empty - as the default for ListFields is []

---

### 1.1.3.6 hyperstream.models.stream module

**class** hyperstream.models.stream.**StreamDefinitionModel** (\*args, \*\*values)

Bases: mongoengine.document.Document

**exception DoesNotExist**

Bases: mongoengine.errors.DoesNotExist

**exception MultipleObjectsReturned**

Bases: mongoengine.errors.MultipleObjectsReturned

**calculated\_intervals**

A ListField designed specially to hold a list of embedded documents to provide additional query helpers.

---

**Note:** The only valid list values are subclasses of EmbeddedDocument.

---

New in version 0.9.

**channel\_id**

A unicode string field.

**get\_calculated\_intervals** ()

**id**

A field wrapper around MongoDB's ObjectIds.



**last\_accessed**

Datetime field.

Uses the python-dateutil library if available alternatively use time.strptime to parse the dates. Note: python-dateutil's parser is fully featured and when installed you can utilise it to convert varying types of date formats into valid python datetime objects.

**Note: Microseconds are rounded to the nearest millisecond.** Pre UTC microsecond support is effectively broken. Use ComplexDateTimeField if you need accurate microsecond support.

**last\_updated**

Datetime field.

Uses the python-dateutil library if available alternatively use time.strptime to parse the dates. Note: python-dateutil's parser is fully featured and when installed you can utilise it to convert varying types of date formats into valid python datetime objects.

**Note: Microseconds are rounded to the nearest millisecond.** Pre UTC microsecond support is effectively broken. Use ComplexDateTimeField if you need accurate microsecond support.

**objects**

The default QuerySet Manager.

Custom QuerySet Manager functions can extend this class and users can add extra queryset functionality. Any custom manager methods must accept a Document class as its first argument, and a QuerySet as its second argument.

The method function should return a QuerySet, probably the same one that was passed in, but modified in some way.

**sandbox**

A unicode string field.

**set\_calculated\_intervals** (*intervals*)**stream\_id**

An embedded document field - with a declared document\_type. Only valid values are subclasses of EmbeddedDocument.

**stream\_type**

A unicode string field.

```
class hyperstream.models.stream.StreamIdField(*args, **kwargs)
```

Bases: mongoengine.document.EmbeddedDocument

**meta\_data**

A list field that wraps a standard field, allowing multiple instances of the field to be used as a list in the database.

If using with ReferenceFields see: one-to-many-with-listfields

---

**Note:** Required means it cannot be empty - as the default for ListFields is []

---

**name**

A unicode string field.

```
class hyperstream.models.stream.StreamInstanceModel(*args, **values)
```

Bases: mongoengine.document.Document

**exception DoesNotExist**

Bases: mongoengine.errors.DoesNotExist

**exception MultipleObjectsReturned**

Bases: `mongoengine.errors.MultipleObjectsReturned`

**datetime**

Datetime field.

Uses the `python-dateutil` library if available alternatively use `time.strptime` to parse the dates. Note: `python-dateutil`'s parser is fully featured and when installed you can utilise it to convert varying types of date formats into valid python datetime objects.

**Note: Microseconds are rounded to the nearest millisecond.** Pre UTC microsecond support is effectively broken. Use `ComplexDateTimeField` if you need accurate microsecond support.

**id**

A field wrapper around MongoDB's `ObjectIds`.

**objects**

The default `QuerySet` Manager.

Custom `QuerySet` Manager functions can extend this class and users can add extra `queryset` functionality. Any custom manager methods must accept a `Document` class as its first argument, and a `QuerySet` as its second argument.

The method function should return a `QuerySet`, probably the same one that was passed in, but modified in some way.

**stream\_id**

An embedded document field - with a declared `document_type`. Only valid values are subclasses of `EmbeddedDocument`.

**stream\_type**

A unicode string field.

**value**

A truly dynamic field type capable of handling different and varying types of data.

Used by `DynamicDocument` to handle dynamic data

### 1.1.3.7 hyperstream.models.time\_interval module

**class** `hyperstream.models.time_interval.TimeIntervalModel(*args, **kwargs)`

Bases: `mongoengine.document.EmbeddedDocument`

**end**

Datetime field.

Uses the `python-dateutil` library if available alternatively use `time.strptime` to parse the dates. Note: `python-dateutil`'s parser is fully featured and when installed you can utilise it to convert varying types of date formats into valid python datetime objects.

**Note: Microseconds are rounded to the nearest millisecond.** Pre UTC microsecond support is effectively broken. Use `ComplexDateTimeField` if you need accurate microsecond support.

**start**

Datetime field.

Uses the `python-dateutil` library if available alternatively use `time.strptime` to parse the dates. Note: `python-dateutil`'s parser is fully featured and when installed you can utilise it to convert varying types of date formats into valid python datetime objects.

**Note: Microseconds are rounded to the nearest millisecond.** Pre UTC microsecond support is effectively broken. Use `ComplexDateTimeField` if you need accurate microsecond support.

### 1.1.3.8 hyperstream.models.tool module

**class** `hyperstream.models.tool.ToolModel (*args, **kwargs)`

Bases: `mongoengine.document.EmbeddedDocument`

**name**

A unicode string field.

**parameters**

A `ListField` designed specially to hold a list of embedded documents to provide additional query helpers.

---

**Note:** The only valid list values are subclasses of `EmbeddedDocument`.

---

New in version 0.9.

**version**

A unicode string field.

**class** `hyperstream.models.tool.ToolParameterModel (*args, **kwargs)`

Bases: `mongoengine.document.EmbeddedDocument`

**is\_function**

Boolean field type.

New in version 0.1.2.

**is\_set**

Boolean field type.

New in version 0.1.2.

**key**

A unicode string field.

**value**

A truly dynamic field type capable of handling different and varying types of data.

Used by `DynamicDocument` to handle dynamic data

### 1.1.3.9 hyperstream.models.workflow module

**class** `hyperstream.models.workflow.WorkflowDefinitionModel (*args, **values)`

Bases: `mongoengine.document.Document`

**exception DoesNotExist**

Bases: `mongoengine.errors.DoesNotExist`

**exception MultipleObjectsReturned**

Bases: `mongoengine.errors.MultipleObjectsReturned`

**description**

A unicode string field.

**factors**

A `ListField` designed specially to hold a list of embedded documents to provide additional query helpers.

---

**Note:** The only valid list values are subclasses of `EmbeddedDocument`.

---

New in version 0.9.

**id**

A field wrapper around MongoDB's `ObjectIds`.

**monitor**

Boolean field type.

New in version 0.1.2.

**name**

A unicode string field.

**nodes**

A `ListField` designed specially to hold a list of embedded documents to provide additional query helpers.

---

**Note:** The only valid list values are subclasses of `EmbeddedDocument`.

---

New in version 0.9.

**objects**

The default `QuerySet` Manager.

Custom `QuerySet` Manager functions can extend this class and users can add extra `queryset` functionality. Any custom manager methods must accept a `Document` class as its first argument, and a `QuerySet` as its second argument.

The method function should return a `QuerySet`, probably the same one that was passed in, but modified in some way.

**online**

Boolean field type.

New in version 0.1.2.

**owner**

A unicode string field.

**workflow\_id**

A unicode string field.

**class** `hyperstream.models.workflow.WorkflowStatusModel(*args, **values)`

Bases: `mongoengine.document.Document`

**exception** `DoesNotExist`

Bases: `mongoengine.errors.DoesNotExist`

**exception** `MultipleObjectsReturned`

Bases: `mongoengine.errors.MultipleObjectsReturned`

**id**

A field wrapper around MongoDB's `ObjectIds`.

**last\_accessed**

Datetime field.

Uses the python-dateutil library if available alternatively use time.strptime to parse the dates. Note: python-dateutil's parser is fully featured and when installed you can utilise it to convert varying types of date formats into valid python datetime objects.

**Note: Microseconds are rounded to the nearest millisecond.** Pre UTC microsecond support is effectively broken. Use ComplexDateTimeField if you need accurate microsecond support.

#### **last\_updated**

Datetime field.

Uses the python-dateutil library if available alternatively use time.strptime to parse the dates. Note: python-dateutil's parser is fully featured and when installed you can utilise it to convert varying types of date formats into valid python datetime objects.

**Note: Microseconds are rounded to the nearest millisecond.** Pre UTC microsecond support is effectively broken. Use ComplexDateTimeField if you need accurate microsecond support.

#### **objects**

The default QuerySet Manager.

Custom QuerySet Manager functions can extend this class and users can add extra queryset functionality. Any custom manager methods must accept a Document class as its first argument, and a QuerySet as its second argument.

The method function should return a QuerySet , probably the same one that was passed in, but modified in some way.

#### **requested\_intervals**

A ListField designed specially to hold a list of embedded documents to provide additional query helpers.

---

**Note:** The only valid list values are subclasses of EmbeddedDocument.

---

New in version 0.9.

#### **workflow\_id**

A unicode string field.

### **1.1.3.10 Module contents**

## **1.1.4 hyperstream.stream package**

### **1.1.4.1 Submodules**

#### **1.1.4.2 hyperstream.stream.stream module**

```
class hyperstream.stream.stream.AssetStream(channel, stream_id, calculated_intervals,
                                             last_accessed, last_updated, sandbox,
                                             mongo_model=None)
```

Bases: `hyperstream.stream.stream.DatabaseStream`

Simple subclass that overrides the calculated intervals property

**calculated\_intervals**

```
class hyperstream.stream.stream.DatabaseStream(channel, stream_id, calculated_intervals, last_accessed, last_updated, sandbox, mongo_model=None)
```

Bases: `hyperstream.stream.stream.Stream`

Simple subclass that overrides the calculated intervals property

**calculated\_intervals**

Gets the calculated intervals from the database

**Returns** The calculated intervals

**last\_accessed**

Gets the last accessed time from the database

**Returns** The last accessed time

**last\_updated**

Gets the last updated time from the database

**Returns** The last updated time

**load()**

Load the stream definition from the database

**Returns** None

**save()**

Saves the stream definition to the database. This assumes that the definition doesn't already exist, and will raise an exception if it does.

**Returns** None

```
class hyperstream.stream.stream.Stream(channel, stream_id, calculated_intervals, sandbox)
```

Bases: `hyperstream.utils.containers.Hashable`

Stream reference class

**calculated\_intervals**

Get the calculated intervals This will be read from the stream\_status collection if it's in the database channel

**Returns** The calculated intervals

**parent\_node**

**purge()**

Purge the stream. This removes all data and clears the calculated intervals

**Returns** None

**set\_tool\_reference(tool\_reference)**

Set the back reference to the tool that populates this stream. This is needed to traverse the graph outside of workflows

**Parameters** **tool\_reference** – The tool

**Returns** None

**window(time\_interval=None, force\_calculation=False)**

Gets a view on this stream for the time interval given

**Parameters**

- **time\_interval** (*None* / *Iterable* / *TimeInterval*) – either a *TimeInterval* object or (start, end) tuple of type *str* or *datetime*
- **force\_calculation** (*bool*) – Whether we should force calculation for this stream view if data does not exist

**Returns** a stream view object

**writer**

#### 1.1.4.3 hyperstream.stream.stream\_collections module

**class** `hyperstream.stream.stream_collections.StreamDict` (\*args, \*\*kwargs)

Bases: `hyperstream.utils.containers.TypedBiDict`

Custom bi-directional dictionary where keys are *StreamID* objects and values are *Stream* objects. Raises *ValueDuplicationError* if the same *Stream* is added again

**class** `hyperstream.stream.stream_collections.StreamInstanceCollection`

Bases: `hyperstream.utils.containers.FrozenKeyDict`

A custom frozen dictionary for stream instances. Will raise an exception if a repeated instance is added

**append** (*instance*)

**extend** (*instances*)

#### 1.1.4.4 hyperstream.stream.stream\_id module

**class** `hyperstream.stream.stream_id.StreamId` (*name*, *meta\_data=None*)

Bases: `hyperstream.utils.containers.Hashable`

Helper class for stream identifiers. A stream identifier contains the stream name and any meta-data

**as\_dict** ()

**as\_raw** ()

Return a representation of this object that can be used with `mongoengine Document.objects(__raw__=x)`  
Example:

```
>>> stream_id = StreamId(name='test', meta_data=((u'house', u'1'), (u'resident', u'1')))
>>> stream_id.as_raw()
{'stream_id.meta_data': [(u'house', u'1'), (u'resident', u'1')], 'stream_id.name': 'test'}
```

**Returns** The raw representation of this object.

**to\_json** ()

`hyperstream.stream.stream_id.get_stream_id` (*item*)

#### 1.1.4.5 hyperstream.stream.stream\_instance module

**class** `hyperstream.stream.stream_instance.StreamInstance`

Bases: `hyperstream.stream.stream_instance.StreamInstance`

Simple helper class for storing data instances that's a bit neater than simple tuples

**as\_dict** (*flat=True*)

**as\_list** (*flat=True*)

**class** hyperstream.stream.stream\_instance.**StreamMetaInstance**

Bases: *hyperstream.stream.stream\_instance.StreamMetaInstance*

StreamInstance that also contains meta data

#### 1.1.4.6 hyperstream.stream.stream\_view module

**class** hyperstream.stream.stream\_view.**StreamView** (*stream*, *time\_interval*,  
*force\_calculation=False*)

Bases: *hyperstream.utils.containers.Printable*

Simple helper class for storing streams with a time interval (i.e. a “view” on a stream) :param stream: The stream upon which this is a view :param time\_interval: The time interval over which this view is defined :param force\_calculation: Whether we should force calculation for this stream view if data does not exist :type stream: Stream :type time\_interval: TimeInterval

**component** (*key*)

**component\_filter** (*key*, *values*)

**delete\_nones** ()

**dict\_items** (*flat=True*)

**dict\_iteritems** (*flat=True*)

**first** (*default=None*)

**head** (*n*)

**islice** (*start*, *stop=None*, *step=1*)

**items** ()

Return all results as a list :return: The results :rtype: list[StreamInstance]

**iteritems** ()

**itertimestamps** ()

**intervalvalues** ()

**last** (*default=None*)

**tail** (*n*)

**timestamps** ()

**values** ()



### 1.1.4.7 Module contents

## 1.1.5 hyperstream.tool package

### 1.1.5.1 Submodules

### 1.1.5.2 hyperstream.tool.aggregate\_tool module

**class** `hyperstream.tool.aggregate_tool.AggregateTool` (*aggregation\_meta\_data*,  
*\*\*kwargs*)

Bases: `hyperstream.tool.tool.Tool`

This type of tool aggregates over a given plate. For example, if the input is all the streams in a node on plate A.B, and the aggregation is over plate B, the results will live on plate A alone. This can also be thought of as marginalising one dimension of a tensor over the plates

### 1.1.5.3 hyperstream.tool.base\_tool module

**class** `hyperstream.tool.base_tool.BaseTool` (*\*\*kwargs*)

Bases: `hyperstream.utils.containers.Printable`, `hyperstream.utils.containers.Hashable`

Base class for all tools

**get\_model** ()

Gets the mongoengine model for this tool, which serializes parameters that are functions

**Returns** The mongoengine model. TODO: Note that the tool version is currently incorrect (0.0.0)

**message** (*interval*)

Get the execution message

**Parameters** *interval* – The time interval

**Returns** The execution message

**name**

Get the name of the tool, converted to snake format (e.g. “splitter\_from\_stream”)

**Returns** The name

**parameters**

Get the tool parameters

**Returns** The tool parameters along with additional information (whether they are functions or sets)

**parameters\_dict**

Get the tool parameters as a simple dictionary

**Returns** The tool parameters

**static parameters\_from\_dicts** (*parameters*)

Get the tool parameters model from dictionaries

**Parameters** *parameters* – The parameters as dictionaries

**Returns** The tool parameters model

**static** `parameters_from_model(parameters_model)`

Get the tool parameters model from dictionaries

**Parameters** `parameters_model` – The parameters as a mongoengine model

**Returns** The tool parameters as a dictionary

**static** `write_to_history(**kwargs)`

Write to the history of executions of this tool

**Parameters** `kwargs` – keyword arguments describing the executions

**Returns** None

#### 1.1.5.4 hyperstream.tool.multi\_output\_tool module

**class** `hyperstream.tool.multi_output_tool.MultiOutputTool(**kwargs)`

Bases: `hyperstream.tool.base_tool.BaseTool`

Special type of tool that outputs multiple streams on a new plate rather than a single stream. There are in this case multiple sinks rather than a single sink, and a single source rather than multiple sources. Note that no alignment stream is required here. Also note that we don't subclass Tool due to different calling signatures

**execute** (`source, splitting_stream, sinks, interval, meta_data_id, output_plate_values`)

Execute the tool over the given time interval.

**Parameters**

- **source** (`Stream`) – The source stream
- **splitting\_stream** – The stream over which to split
- **sinks** (`list[Stream] | tuple[Stream]`) – The sink streams
- **interval** (`TimeInterval`) – The time interval
- **meta\_data\_id** (`str`) – The meta data id of the output plate
- **output\_plate\_values** (`list | tuple`) – The values of the plate where data is put onto

**Returns** None

#### 1.1.5.5 hyperstream.tool.plate\_creation\_tool module

**class** `hyperstream.tool.plate_creation_tool.PlateCreationTool(**kwargs)`

Bases: `hyperstream.tool.base_tool.BaseTool`

Special type of tool that creates a new plate. There is no sink in this case, as it does not yet exist. Note that no alignment stream is required here. Also note that we don't subclass Tool due to different calling signatures

**execute** (`source, interval, input_plate_value`)

Execute the tool over the given time interval.

**Parameters**

- **source** (`Stream`) – The source stream
- **interval** (`TimeInterval`) – The time interval
- **input\_plate\_value** (`tuple[tuple[str, str]] | None`) – The value of the plate where data comes from (can be None)

**Returns** None

### 1.1.5.6 hyperstream.tool.selector\_tool module

**class** `hyperstream.tool.selector_tool.SelectorTool` (*selector\_meta\_data*, *\*\*kwargs*)

Bases: `hyperstream.tool.base_tool.BaseTool`

This type of tool performs sub-selection of streams within a node. This can either be done using a selector in the parameters or using an input stream. The sink node plate should be a sub-plate of the source node. Examples are `IndexOf` and `SubArray`, either with fixed or variable parameters

**execute** (*sources*, *sinks*, *interval*)

Execute the tool over the given time interval.

#### Parameters

- **sources** (*list[Stream]* | *tuple[Stream]*) – The source streams
- **sinks** (*list[Stream]* | *tuple[Stream]*) – The sink streams
- **interval** (*TimeInterval*) – The time interval

**Returns** `None`

### 1.1.5.7 hyperstream.tool.tool module

**class** `hyperstream.tool.tool.Tool` (*\*\*kwargs*)

Bases: `hyperstream.tool.base_tool.BaseTool`

Base class for tools. Tools are the unit of computation, operating on input streams to produce an output stream

**execute** (*sources*, *sink*, *interval*, *alignment\_stream=None*)

Execute the tool over the given time interval. If an alignment stream is given, the output instances will be aligned to this stream

#### Parameters

- **sources** (*list[Stream]* | *tuple[Stream]* | *None*) – The source streams (possibly `None`)
- **sink** (*Stream*) – The sink stream
- **alignment\_stream** (*Stream* | *None*) – The alignment stream
- **interval** (*TimeInterval*) – The time interval

**Returns** `None`

### 1.1.5.8 Module contents

Tool package. Defines `Tool`, `MultiOutputTool` and `SelectorTool` base classes.

## 1.1.6 hyperstream.utils package

### 1.1.6.1 Submodules

### 1.1.6.2 hyperstream.utils.decorators module

`hyperstream.utils.decorators.check_input_stream_count` (*expected\_number\_of\_streams*)

Decorator for `Tool.execute` that checks the number of input streams

**Parameters** `expected_number_of_streams` – The expected number of streams

**Returns** the decorator

`hyperstream.utils.decorators.check_output_format` (*expected\_formats*)

Decorator for stream outputs that checks the format of the outputs after modifiers have been applied :param `expected_formats`: The expected output formats :type `expected_formats`: tuple, set :return: the decorator

`hyperstream.utils.decorators.check_tool_defined` (*func*)

Decorator to check whether a tool stream has been defined before execution :return: the decorator

`hyperstream.utils.decorators.timeit` (*f*)

### 1.1.6.3 `hyperstream.utils.errors` module

**exception** `hyperstream.utils.errors.ChannelAlreadyExistsError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.ChannelNotFoundError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.ConfigurationError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.FactorAlreadyExistsError`

Bases: `exceptions.Exception`

`message = 'Cannot have duplicate factors - a new factor object should be created'`

**exception** `hyperstream.utils.errors.FactorDefinitionError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.IncompatiblePlatesError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.IncompatibleToolError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.LinkageError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.MultipleStreamsFoundError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.NodeAlreadyExistsError`

Bases: `exceptions.Exception`

`message = 'Cannot have duplicate nodes'`

**exception** `hyperstream.utils.errors.NodeDefinitionError`

Bases: `exceptions.Exception`

**exception** `hyperstream.utils.errors.PlateDefinitionError`

Bases: `exceptions.Exception`

`message = 'Empty values in plate definition and complement=False'`

**exception** `hyperstream.utils.errors.PlateEmptyError` (*plate\_id*)

Bases: `exceptions.Exception`

`message = 'Plate values for {} empty'`

**exception** `hyperstream.utils.errors.PlateNotFoundError`

Bases: `exceptions.Exception`

```

exception hyperstream.utils.errors.StreamAlreadyExistsError
    Bases: exceptions.Exception

exception hyperstream.utils.errors.StreamDataNotAvailableError
    Bases: exceptions.Exception

exception hyperstream.utils.errors.StreamNotAvailableError (up_to_timestamp)
    Bases: exceptions.Exception

    message = 'The stream is not available after {} and cannot be calculated'

exception hyperstream.utils.errors.StreamNotFoundError
    Bases: exceptions.Exception

exception hyperstream.utils.errors.ToolExecutionError (required_intervals)
    Bases: exceptions.Exception

    message = 'Tool execution did not cover the time interval {}'.

exception hyperstream.utils.errors.ToolInitialisationError
    Bases: exceptions.Exception

exception hyperstream.utils.errors.ToolNotFoundError
    Bases: exceptions.Exception

hyperstream.utils.errors.handle_exception (exc_type, exc_value, exc_traceback)

```

#### 1.1.6.4 hyperstream.utils.serialization module

```

hyperstream.utils.serialization.func_dump (func)
    Serialize user defined function. :param func: The function :return: Tuple of code, defaults and closure

hyperstream.utils.serialization.func_load (code, defaults=None, closure=None, globs=None)
    Reload a function :param code: The code object :param defaults: Default values :param closure: The closure
    :param globs: globals :return:

hyperstream.utils.serialization.func_reconstruct_closure (values)
    Deserialization helper that reconstructs a closure :param values: The closure values :return: The closure

```

#### 1.1.6.5 hyperstream.utils.time\_utils module

```

hyperstream.utils.time_utils.construct_experiment_id (time_interval)
    Construct an experiment id from a time interval :return: The experiment id :type time_interval: TimeInterval
    :rtype: str

hyperstream.utils.time_utils.datetime2unix (dt)

hyperstream.utils.time_utils.duration2str (x)

hyperstream.utils.time_utils.get_timedelta (value)

hyperstream.utils.time_utils.is_naive (dt)

hyperstream.utils.time_utils.json_serial (obj)
    JSON serializer for objects not serializable by default json code

hyperstream.utils.time_utils.reconstruct_interval (experiment_id)
    Reverse the construct_experiment_id operation :param experiment_id: The experiment id :return: time interval

hyperstream.utils.time_utils.remove_microseconds (ts)

```

```
hyperstream.utils.time_utils.unix2datetime(u)
```

```
hyperstream.utils.time_utils.utcnow()
```

Gets the current datetime in UTC format with millisecond precision :return:

#### 1.1.6.6 hyperstream.utils.utils module

#### 1.1.6.7 Module contents

### 1.1.7 hyperstream.workflow package

#### 1.1.7.1 Submodules

#### 1.1.7.2 hyperstream.workflow.factor module

#### 1.1.7.3 hyperstream.workflow.meta\_data\_manager module

#### 1.1.7.4 hyperstream.workflow.node module

#### 1.1.7.5 hyperstream.workflow.plate module

#### 1.1.7.6 hyperstream.workflow.plate\_manager module

#### 1.1.7.7 hyperstream.workflow.workflow module

Workflow and WorkflowMonitor definitions.

```
class hyperstream.workflow.workflow.Workflow (workflow_id, name, description, owner, on-  
line=False, monitor=False)
```

Bases: `hyperstream.utils.containers.Printable`

Workflow. This defines the graph of operations through “nodes” and “factors”.

```
static check_multi_output_plate_compatibility (source_plates, sink_plate)
```

Check multi-output plate compatibility. This ensures that the source plates and sink plates match for a multi- output plate

##### Parameters

- **source\_plates** – The source plates
- **sink\_plate** – The sink plate

**Returns** True if the plates are compatible

```
static check_plate_compatibility (tool, source_plate, sink_plate)
```

Checks whether the source and sink plate are compatible given the tool

##### Parameters

- **tool** (`Tool`) – The tool
- **source\_plate** (`Plate`) – The source plate
- **sink\_plate** (`Plate`) – The sink plate

**Returns** Either an error, or None

**Return type** None | str

**create\_factor** (*tool, sources, sink, alignment\_node=None*)

Creates a factor. Instantiates a single tool for all of the plates, and connects the source and sink nodes with that tool.

Note that the tool parameters these are currently fixed over a plate. For parameters that vary over a plate, an extra input stream should be used

#### Parameters

- **alignment\_node** (*Node | None*) –
- **tool** (*Tool | dict*) – The tool to use. This is either an instantiated Tool object or a dict with “name” and “parameters”
- **sources** (*list[Node] | tuple[Node] | None*) – The source nodes
- **sink** (*Node*) – The sink node

**Returns** The factor object

**Return type** Factor

**create\_factor\_general** (*\*args, \*\*kwargs*)

General signature for factor creation that tries each of the factor creation types using duck typing

#### Parameters

- **args** – The positional arguments
- **kwargs** – The named arguments

**Returns** The created factor

**create\_multi\_output\_factor** (*tool, source, splitting\_node, sink*)

Creates a multi-output factor. This takes a single node, applies a MultiOutputTool to create multiple nodes on a new plate Instantiates a single tool for all of the input plate values, and connects the source and sink nodes with that tool.

Note that the tool parameters these are currently fixed over a plate. For parameters that vary over a plate, an extra input stream should be used

#### Parameters

- **tool** (*MultiOutputTool | dict*) – The tool to use. This is either an instantiated Tool object or a dict with “name” and “parameters”
- **source** (*Node | None*) – The source node
- **splitting\_node** – The node over which to split
- **sink** (*Node*) – The sink node

**Returns** The factor object

**Return type** Factor

**create\_node** (*stream\_name, channel, plates*)

Create a node in the graph. Note: assumes that the streams already exist

#### Parameters

- **stream\_name** – The name of the stream
- **channel** – The channel where this stream lives
- **plates** – The plates. The stream meta-data will be auto-generated from these

**Returns** The streams associated with this node

**create\_node\_creation\_factor** (*tool, source, output\_plate, plate\_manager*)

Creates a factor that itself creates an output node, and ensures that the plate for the output node exists along with all relevant meta-data

**Parameters**

- **tool** – The tool
- **source** – The source node
- **output\_plate** (*dict*) – The details of the plate that will be created (dict)
- **plate\_manager** (*PlateManager*) – The hyperstream plate manager

**Returns** The created factor

**execute** (*time\_interval*)

Here we execute the factors over the streams in the workflow Execute the factors in reverse order. We can't just execute the last factor because there may be multiple "leaf" factors that aren't triggered by upstream computations.

**Parameters** **time\_interval** – The time interval to execute this workflow over

**static factorgraph\_viz** (*d*)

Map the dictionary into factorgraph-viz format. See <https://github.com/mbforbes/factorgraph-viz>

**Parameters** **d** – The dictionary

**Returns** The formatted dictionary

**requested\_intervals**

Get the requested intervals (from the database)

**Returns** The requested intervals

**to\_dict** (*tool\_long\_names=True*)

Get a representation of the workflow as a dictionary for display purposes

**Parameters** **tool\_long\_names** (*bool*) – Indicates whether to use long names, such as `SplitterFromStream(element=None, use_mapping_keys_only=True)` or short names, such as `splitter_from_stream`

**Returns** The dictionary of nodes, factors and plates

**to\_json** (*formatter=None, tool\_long\_names=True, \*\*kwargs*)

Get a JSON representation of the workflow

**Parameters**

- **tool\_long\_names** – Indicates whether to use long names, such as `SplitterFromStream(element=None, use_mapping_keys_only=True)` or short names, such as `splitter_from_stream`
- **formatter** – The formatting function
- **kwargs** – Keyword arguments for the json output

**Returns** A JSON string

**class** `hyperstream.workflow.workflow.WorkflowMonitor` (*workflow*)

Bases: `object`

Small helper class that provides logging output to monitor workflow progress



### 1.1.7.8 hyperstream.workflow.workflow\_manager module

```
class hyperstream.workflow.workflow_manager.WorkflowManager (channel_manager,
plate_manager)

Bases: hyperstream.utils.containers.Printable

Workflow manager. Responsible for reading and writing workflows to the database, and can execute all of the
workflows

add_workflow (workflow, commit=False)
    Add a new workflow and optionally commit it to the database :param workflow: The workflow :param
    commit: Whether to commit the workflow to the database :type workflow: Workflow :type commit: bool
    :return: None

commit_all ()
    Commit all workflows to the database :return: None

commit_workflow (workflow_id)
    Commit the workflow to the database :param workflow_id: The workflow id :return: None

delete_workflow (workflow_id)
    Delete a workflow from the database :param workflow_id: :return: None

execute_all ()
    Execute all workflows

load_workflow (workflow_id)
    Load workflow from the database and store in memory :param workflow_id: The workflow id :return: The
    workflow

set_all_requested_intervals (requested_intervals)
    Sets the requested intervals for all workflow :param requested_intervals: The requested intervals :return:
    None :type requested_intervals: TimeInterval

set_requested_intervals (workflow_id, requested_intervals)
    Sets the requested intervals for a given workflow :param workflow_id: The workflow id :param re-
    quested_intervals: The requested intervals :return: None :type requested_intervals: TimeInterval

hyperstream.workflow.workflow_manager.code_pickler (code)
hyperstream.workflow.workflow_manager.code_unpickler (data)
```

### 1.1.7.9 Module contents

## 1.2 Submodules

### 1.3 hyperstream.channel\_manager module

### 1.4 hyperstream.client module

The main hyperstream client connection that is used for storing runtime information. Note that this is also used by the default database channel, although other database channels (connecting to different database types) can also be used.

```
class hyperstream.client.Client (server_config, auto_connect=True)
    Bases: hyperstream.utils.containers.Printable

    The main mongo client
```

**client** = None

**connect** (*server\_config*)  
Connect using the configuration given

Parameters **server\_config** – The server configuration

**db** = None

**get\_config\_value** (*key, default=None*)  
Get a specific value from the configuration

Parameters

- **key** – The of the item
- **default** – A default value if not found

Returns The found value or the default

**session** = None

## 1.5 hyperstream.config module

HyperStream configuration module.

**class** hyperstream.config.**HyperStreamConfig** (*filename='hyperstream\_config.json'*)  
Bases: hyperstream.utils.containers.Printable

Wrapper around the hyperstream configuration file

**class** hyperstream.config.**OnlineEngineConfig** (*interval, sleep=5, iterations=100, alarm=None*)  
Bases: hyperstream.utils.containers.Printable

## 1.6 hyperstream.hyperstream module

Main HyperStream class

**class** hyperstream.hyperstream.**HyperStream** (*loglevel=20, file\_logger=True, console\_logger=True, mqtt\_logger=None, config\_filename='hyperstream\_config.json'*)  
Bases: object

HyperStream class: can be instantiated simply with `hyperstream = HyperStream()` for default operation. Use in the following way to create a session (and store history of execution etc). `>>> with Hyperstream(): >>> pass`

**Note that HyperStream uses the singleton pattern described here:** <https://stackoverflow.com/a/33201/1038264>

**For py2k/py3k compatability we use the six decorator add\_metaclass:** [https://pythonhosted.org/six/#six.add\\_metaclass](https://pythonhosted.org/six/#six.add_metaclass)

**add\_workflow** (*workflow*)  
Add the workflow to the workflow manager

Parameters **workflow** (*Workflow*) – The workflow

Returns None

**clear\_sessions** (*inactive\_only=True, clear\_history=False*)

Clears all stored sessions, optionally excluding active sessions

**Parameters**

- **inactive\_only** – Whether to clear inactive sessions only
- **clear\_history** – Whether to also clear session history

**Returns** None

**create\_workflow** (*\*args, \*\*kws*)

Create a new workflow. Simple wrapper for creating a workflow and adding it to the workflow manager.

**Parameters**

- **workflow\_id** – The workflow id
- **name** – The workflow name
- **owner** – The owner/creator of the workflow
- **description** – A human readable description
- **online** – Whether this workflow should be executed by the online engine
- **monitor** – Whether the workflow computations should be monitored
- **safe** – If safe=True, will throw an error if the workflow already exists

**Returns** The workflow

**current\_session**

Get the current session

**Returns** the current session

**new\_session** ()

Start a new session to record computation history

**Returns** the created session

**populate\_tools\_and\_factors** ()

Function to populate factory functions for the tools and factors for ease of access.

**Returns** None

**sessions**

Get the list of sessions

**Returns** the sessions

## 1.7 hyperstream.online\_engine module

Online Engine module. This will be used in the online execution mode.

**class** hyperstream.online\_engine.**OnlineEngine** (*hyperstream*)

Bases: object

OnlineEngine class.

**execute** (*\*args, \*\*kwargs*)

Execute the engine - currently simple executes all workflows.

## 1.8 hyperstream.plugin\_manager module

Plugin manager module for additional user added channels and tools.

```
class hyperstream.plugin_manager.Plugin
    Bases: hyperstream.plugin_manager.PluginBase, hyperstream.utils.containers.
    Printable

    Plugin class - simple wrapper over namedtuple

    load_channels()
        Loads the channels and tools given the plugin path specified

        Returns The loaded channels, including a tool channel, for the tools found.
```

## 1.9 hyperstream.time\_interval module

Module for dealing with time intervals containing TimeInterval, TimeIntervals, and RelativeTimeInterval

```
class hyperstream.time_interval.RelativeTimeInterval (start, end)
    Bases: hyperstream.time_interval.TimeInterval

    Relative time interval object. Thin wrapper around a (start, end) tuple of timedelta objects that provides some
    validation

    absolute (dt)

    end

    start

class hyperstream.time_interval.TimeInterval (start, end)
    Bases: hyperstream.time_interval.TimeInterval

    Time interval object. Thin wrapper around a (start, end) tuple of datetime objects that provides some validation

    classmethod all_time()

    end

    humanized

    classmethod now_minus (weeks=0, days=0, hours=0, minutes=0, seconds=0, milliseconds=0)

    start

    to_json()

    to_tuple()

    classmethod up_to_now()

    width

class hyperstream.time_interval.TimeIntervals (intervals=None)
    Bases: hyperstream.utils.containers.Printable

    Container class for time intervals, that manages splitting and joining Example object: (t1,t2] U (t3,t4] U ...

    compress()

    end

    humanized
```

`is_empty``parse (intervals)``span``split (points)``start``to_json()``hyperstream.time_interval.parse_time_tuple (start, end)`

**Parse a time tuple. These can be:** relative in seconds, e.g. `(-4, 0)` relative in timedelta, e.g. `(timedelta(seconds=-4), timedelta(0))` absolute in date/datetime, e.g. `(datetime(2016, 4, 28, 20, 0, 0, 0, UTC), datetime(2016, 4, 28, 21, 0, 0, 0, UTC))` absolute in iso strings, e.g. `("2016-04-28T20:00:00.000Z", "2016-04-28T20:01:00.000Z")` Mixtures of relative and absolute are not allowed

**Parameters**

- **start** (*int | timedelta | datetime | str*) – Start time
- **end** (*int | timedelta | datetime | str*) – End time

**Returns** TimeInterval or RelativeTimeInterval object

`hyperstream.time_interval.profile (ob)`

Comment out this function to be able to use the line\_profiler module. e.g. call: `kernprof -l scripts/deploy_summariser.py --loglevel=10 python -m line_profiler deploy_summariser.py.lprof > deploy_summariser.py.summary` :param ob: object :return: object

## 1.10 hyperstream.version module

### 1.11 Module contents



## 2.1 Submodules

## 2.2 tests.helpers module

```
class tests.helpers.MqttClient
    Bases: object

    last_messages = {}

    on_connect (client, userdata, flags, rc)

    on_message (client, userdata, msg)

tests.helpers.assert_all_close (a, b, tolerance)
tests.helpers.assert_dict_equal (a, b)
tests.helpers.create_plate (hs, plate_id, tag, parent_plate=None)
tests.helpers.delete_meta_data (hs, tag, values, parent='root')
tests.helpers.delete_plate (hs, plate_id)
tests.helpers.get_meta_data (hs, tag)
tests.helpers.insert_meta_data (hs, tag, values, parent='root')
tests.helpers.is_close (a, b, tolerance)
tests.helpers.mosquitto_is_running()
tests.helpers.resource_manager (*args, **kws)
tests.helpers.setup()
tests.helpers.teardown()
```

## 2.3 tests.test\_time\_interval module

```
class tests.test_time_interval.HyperStreamTimeIntervalTests (methodName='runTest')
    Bases: unittest.case.TestCase
    test_constructors()
    test_relative_time_interval()
    test_time_interval()
```

## 2.4 tests.test\_tool\_channel module

## 2.5 Module contents

Running the tests:

Run the following command

```
>>> nosetests
```

Note that for the MQTT logging test to succeed, you will need to have an MQTT broker running (e.g. Mosquitto). For example:

```
` docker run -ti -p 1883:1883 -p 9001:9001 toke/mosquitto `
```

or on OSX you will need pidof and mosquitto:

```
` brew install pidof brew install mosquitto brew services start mosquitto `
```



## CHAPTER 3

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