

# Continuity Reactor HTTP REST API

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# Introduction

The Continuity Reactor has an HTTP interface for a multitude of purposes:

- **Stream:** sending data events to a Stream, or to inspect the contents of a Stream.
- **Data:** interacting with Datasets (currently limited to Tables).
- **Query:** sending ad-hoc queries to Reactor Datasets.
- **Procedure:** sending calls to a stored Procedure.
- **Reactor:** deploying and managing Applications.
- **Logs:** retrieving Application logs.
- **Metrics:** retrieving metrics for system and user Applications (user-defined metrics).
- **Monitor:** checking the status of various Reactor services.

**Note:** The HTTP interface binds to port 10000. This port cannot be changed.

## Conventions

In this API, *client* refers to an external application that is calling the Continuity Reactor using the HTTP interface.

In this API, *Application* refers to a user Application that has been deployed into the Continuity Reactor.

All URLs referenced in this API have this base:

```
http://<gateway>:10000/v2
```

where `<gateway>` is the URL of the Continuity Reactor. The base URL is represented as:

```
<base-url>
```

For example:

```
PUT <base-url>/streams/<new-stream-id>
```

means

```
PUT http://<gateway>:10000/v2/streams/<new-stream-id>
```

Text that are variables that you are to replace is indicated by a series of angle brackets (`<` `>`). For example:

```
PUT <base-url>/streams/<new-stream-id>
```

indicates that—in addition to the `<base-url>`—the text `<new-stream-id>` is a variable and that you are to replace it with your value, perhaps in this case *mystream*:

```
PUT <base-url>/streams/mystream
```

## Status Codes

Common status codes returned for all HTTP calls:

| Code | Description           | Explanation  |
|------|-----------------------|--|
| 200  | OK                    | The request returned successfully  |
| 400  | Bad Request           | The request had a combination of parameters that is not recognized                 |
| 401  | Unauthorized          | The request did not contain an authentication token                                |
| 403  | Forbidden             | The request was authenticated but the client does not have permission              |
| 404  | Not Found             | The request did not address any of the known URIs                                  |
| 405  | Method Not Allowed    | A request was received with a method not supported for the URI                     |
| 409  | Conflict              | A request could not be completed due to a conflict with the current resource state |
| 500  | Internal Server Error | An internal error occurred while processing the request                            |
| 501  | Not Implemented       | A request contained a query that is not supported by this API                      |

**Note:** These returned status codes are not necessarily included in the descriptions of the API, but a request may return any of these.

## SSL Required for Sandboxed Continuity Reactor

When you interact with a Sandboxed Continuity Reactor, the Continuity HTTP APIs require that you use SSL for the connection and that you authenticate your request by sending your API key in an HTTP header:

```
X-Continuity-APIKey: <api-key>
```

| Parameter | Description   |
|-----------|---|
| <api-key> | Continuity Reactor API key, obtained from an account at <a href="#">Continuity Accounts</a> |

## Working with Reactor Security

When working with a Reactor cluster with security enabled (`security.enabled=true` in `continuity-site.xml`), all calls to the HTTP APIs must be authenticated. Clients must first obtain an access token from the authentication server (see the "Security" section of the guide). In order to authenticate, all client requests must supply this access token in the `Authorization` header of the request:

```
Authorization: Bearer wohng8Xae7thahfohshahphaeNeeM5ie
```

For Reactor-issued access tokens, the authentication scheme must always be `Bearer`.



# Stream HTTP API

This interface supports creating Streams, sending events to a Stream, and reading single events from a Stream.

Streams may have multiple consumers (for example, multiple Flows), each of which may be a group of different agents (for example, multiple instances of a Flowlet).

In order to read events from a Stream, a client application must first obtain a consumer (group) id, which is then passed to subsequent read requests.

## Creating a Stream

A Stream can be created with an HTTP PUT method to the URL:

```
PUT <base-url>/streams/<new-stream-id>
```

| Parameter       | Description                      |
|-----------------|----------------------------------|
| <new-stream-id> | Name of the Stream to be created |

## HTTP Responses

| Status Codes | Description   |
|--------------|---|
| 200 OK       | The event either successfully created a Stream or the Stream already exists |

## Example

|             |   |
|-------------|---|
| HTTP Method | PUT <base-url>/streams/mystream           |
| Description | Create a new Stream named <i>mystream</i> |

## Comments

- The <new-stream-id> should only contain ASCII letters, digits and hyphens.
- If the Stream already exists, no error is returned, and the existing Stream remains in place.

## Sending Events to a Stream

An event can be sent to a Stream by sending an HTTP POST method to the URL of the Stream:

```
POST <base-url>/streams/<stream-id>
```

| Parameter   | Description                |
|-------------|----------------------------|
| <stream-id> | Name of an existing Stream |

## HTTP Responses

| Status Codes  | Description                         |
|---------------|-------------------------------------|
| 200 OK        | The event was successfully received |
| 404 Not Found | The Stream does not exist           |

**Note:** The response will always have an empty body

## Example

|             |  |
|-------------|--|
| HTTP Method | POST <base-url>/streams/mystream                           |
| Description | Send an event to the existing Stream named <i>mystream</i> |

## Comments

- The body of the request must contain the event in binary form.
- You can pass headers for the event as HTTP headers by prefixing them with the *stream-id*:

```
<stream-id>.<property>:<string value>
```

After receiving the request, the HTTP handler transforms it into a Stream event:

1. The body of the event is an identical copy of the bytes found in the body of the HTTP post request.
2. If the request contains any headers prefixed with the *stream-id*, the *stream-id* prefix is stripped from the header name and the header is added to the event.

## Reading Events from a Stream: Getting a Consumer-ID

Get a *Consumer-ID* for a Stream by sending an HTTP POST method to the URL:

```
POST <base-url>/streams/<stream-id>/consumer-id
```

| Parameter   | Description                |
|-------------|----------------------------|
| <stream-id> | Name of an existing Stream |

### HTTP Responses

| Status Codes  | Description   |
|---------------|---|
| 200 OK        | The event was successfully received and a new <code>consumer-id</code> was returned |
| 404 Not Found | The Stream does not exist   |

### Example

|             |   |
|-------------|---|
| HTTP Method | POST <base-url>/streams/mystream/consumer-id                      |
| Description | Request a <i>Consumer-ID</i> for the Stream named <i>mystream</i> |

### Comments

- Streams may have multiple consumers (for example, multiple Flows), each of which may be a group of different agents (for example, multiple instances of a Flowlet).
- In order to read events from a Stream, a client application must first obtain a consumer (group) id, which is then passed to subsequent read requests.
- The *Consumer-ID* is returned in a response header and—for convenience—also in the body of the response:

```
X-Continuity-ConsumerId: <consumer-id>
```

Once you have the *Consumer-ID*, single events can be read from the Stream.

## Reading Events from a Stream: Using the Consumer-ID

A read is performed as an HTTP POST method to the URL:

```
POST <base-url>/streams/<stream-id>/dequeue
```

| Parameter   | Description                |
|-------------|----------------------------|
| <stream-id> | Name of an existing Stream |

The request must pass the `Consumer-ID` in a header of the form:

```
X-Continuity-ConsumerId: <consumer-id>
```

### HTTP Responses

| Status Codes   | Description  |
|----------------|--|
| 200 OK         | The event was successfully received and the result of the read was returned  |
| 204 No Content | The Stream exists but it is either empty or the given <code>Consumer-ID</code> has read all the events in the Stream |
| 404 Not Found  | The Stream does not exist  |

### Example

|             |   |
|-------------|---|
| HTTP Method | POST <base-url>/streams/mystream/dequeue                          |
| Description | Read the next event from an existing Stream named <i>mystream</i> |

### Comments

The read will always return the next event from the Stream that was inserted first and has not been read yet (first-in, first-out or FIFO semantics). If the Stream has never been read from before, the first event will be read.

For example, in order to read the third event that was sent to a Stream, two previous reads have to be performed after receiving the `Consumer-ID`. You can always start reading from the first event by getting a new `Consumer-ID`.

The response will contain the binary body of the event in its body and a header for each header of the Stream event, analogous to how you send headers when posting an event to the Stream:

```
<stream-id>.<property>:<value>
```

## Truncating a Stream

Truncation means the deletion of all events that were written to the Stream. This is permanent and cannot be undone. A Stream can be truncated with an HTTP POST method to the URL:

```
POST <base-url>/streams/<stream-id>/truncate
```

| Parameter   | Description                |
|-------------|----------------------------|
| <stream-id> | Name of an existing Stream |

## HTTP Responses

| Status Codes  | Description                           |
|---------------|---------------------------------------|
| 200 OK        | The Stream was successfully truncated |
| 404 Not Found | The Stream <stream-id> does not exist |

## Example

|             |   |
|-------------|---|
| HTTP Method | POST <base-url>/streams/mystream/truncate             |
| Description | Delete all events in the Stream named <i>mystream</i> |

## Setting Time-To-Live Property of a Stream

The Time-To-Live (TTL) property governs how long an event is valid for consumption since it was written to the Stream. The default TTL for all Streams is infinite, meaning that events will never expire. The TTL property of a Stream can be changed with an HTTP PUT method to the URL:

```
PUT <base-url>/streams/<stream-id>/config
```

| Parameter   | Description                |
|-------------|----------------------------|
| <stream-id> | Name of an existing Stream |

The new TTL value is passed in the request body as:

```
{ "ttl" : <ttl-in-seconds> }
```

| Parameter        | Description  |
|------------------|--|
| <ttl-in-seconds> | Number of seconds that an event will be valid for since ingested |

## HTTP Responses

| Status Codes    | Description                                 |
|-----------------|---|
| 200 OK          | The stream TTL was changed successfully     |
| 400 Bad Request | The TTL value is not a non-negative integer |
| 404 Not Found   | The Stream does not exist                   |

## Example

|             |  |
|-------------|--|
| HTTP Method | PUT <base-url>/streams/mystream/config<br>with the new TTL value as a JSON string in the body:<br><pre>{ "ttl" : 86400 }</pre> |
| Description | Change the TTL property of the Stream named <i>mystream</i> to 1 day   |

## Reading Multiple Events

Reading multiple events is not supported directly by the Stream HTTP API, but the command-line tool `stream-client` demonstrates how to view *all*, the *first N*, or the *last N* events in the Stream.

For more information, see the Stream Command Line Client `stream-client` in the `/bin` directory of the Continuuity Reactor SDK distribution.

For usage and documentation of options, run at the command line:

```
$ stream-client --help
```

## Dataset HTTP API

The Dataset API allows you to interact with [Continuity Reactor Datasets](#) through HTTP. You can list, create, delete, and truncate Datasets.

### Listing all Datasets

You can list all Datasets in the Continuity Reactor by issuing an HTTP GET request to the URL:

```
GET <base-url>/data/datasets
```

The response body will contain a JSON-formatted list of the existing Datasets:

```
{
  "name": "continuity.user.purchases",
  "type": "com.continuity.api.dataset.lib.ObjectStore",
  "properties": {
    "schema": "...",
    "type": "..."
  },
  "datasetSpecs": {
    ...
  }
}
```

### Creating a Dataset

You can create a Dataset by issuing an HTTP POST request to the URL:

```
PUT <base-url>/data/datasets/<dataset-name>
```

with the name of the type as a header:

```
X-Continuity-Type-Name: <type-name>
```

| Parameter      | Description             |
|----------------|-------------------------|
| <dataset-name> | Name of the new Dataset |
| <type-name>    | Type of the new Dataset |

### HTTP Responses

| Status Codes  | Description                                |
|---------------|--|
| 200 OK        | Requested Dataset was successfully created |
| 404 Not Found | Requested Dataset type was not found       |
| 409 Conflict  | Dataset with the same name already exists  |

### Example

|              |  |
|--------------|--|
| HTTP Request | PUT <base-url>/data/datasets/mydataset   |
| Header       | X-Continuity-Type-Name: myDatasetType  |
| Description  | Creates a Dataset named "mydataset" of the type "myDatasetType"; the myDatasetType should be a Dataset type that's already been deployed in a Dataset module |

## Deleting a Dataset

You can delete a Dataset by issuing an HTTP DELETE request to the URL:

```
DELETE <base-url>/data/datasets/<dataset-name>
```

### HTTP Responses

| Status Codes  | Description                                     |
|---------------|---|
| 200 OK        | Dataset was successfully deleted                |
| 404 Not Found | Dataset named <dataset-name> could not be found |

### Example

|              |   |
|--------------|---|
| HTTP Request | DELETE <base-url>/data/datasets/mydataset |
| Description  | Deletes the Dataset named "mydataset"     |



## Deleting all Datasets

You can delete all Datasets by issuing an HTTP DELETE request to the URL:

```
DELETE <base-url>/data/unrecoverable/datasets
```

### *HTTP Responses*

| Status Codes | Description                            |
|--------------|--|
| 200 OK       | All Datasets were successfully deleted |

## Truncating a Dataset

You can truncate a Dataset by issuing an HTTP POST request to the URL:

```
POST <base-url>/data/datasets/<dataset-name>/admin/truncate
```

This will clear the existing data from the Dataset. This cannot be undone.

### *HTTP Responses*

| Status Codes | Description                        |
|--------------|------------------------------------|
| 200 OK       | Dataset was successfully truncated |

# Dataset Module HTTP API

The Dataset Module API allows you to interact with [Continuity Reactor Dataset Modules](#) through HTTP. You can list, add, and delete Dataset modules.

## Listing all Dataset Modules

To list all modules, issue an HTTP GET request to the URL:

```
GET <base-url>/data/modules
```

The response will be a JSON String representing a list of `DatasetModuleMeta` objects:

```
[
  {
    "name": "core",
    "className": "com.continuity.data2.dataset2.lib.table.CoreDatasetsModule",
    "types": [
      "table",
      "com.continuity.api.dataset.table.Table",
      "keyValueType",
      "com.continuity.api.dataset.lib.KeyValueType",
      "objectStore",
      "com.continuity.api.dataset.lib.ObjectStore",
      "indexedObjectStore",
      "com.continuity.api.dataset.lib.IndexedObjectStore",
      "indexedTable",
      "com.continuity.api.dataset.lib.IndexedTable",
      "multiObjectStore",
      "com.continuity.api.dataset.lib.MultiObjectStore",
      "timeseriesTable",
      "com.continuity.api.dataset.lib.TimeseriesTable"
    ],
    "usesModules": [
      "orderedTable-leveldb"
    ],
    "usedByModules": [
    ]
  },
  {
    "name": "orderedTable-leveldb",
    "className": "com.continuity.data2.dataset2.module.lib.leveldb.LevelDBOrderedTableModule",
    "types": [
      "orderedTable",
      "com.continuity.api.dataset.table.OrderedTable"
    ],
    "usesModules": [
    ],
    "usedByModules": [
      "core"
    ]
  }
]
```

## Adding a Dataset Module

To add a module, issue an HTTP POST request to the URL:

```
PUT <base-url>/data/modules/<module-name>
```

with the class name of the Dataset Module as a header:

```
X-Continuity-Class-Name: <class-name>
```

with a jar containing the class implementing `DatasetModule` and all its dependencies in the body of the request.

| Parameter     | Description   |
|---------------|---|
| <module-name> | Name of the new module  |
| <class-name>  | Class name of the class implementing <code>DatasetModule</code> |

## HTTP Responses

| Status Codes    | Description  |
|-----------------|--|
| 200 OK          | The event was successfully received and the module was either created or already exists                |
| 400 Bad Request | The Dataset module jar was not provided in the body of the request                                     |
| 409 Conflict    | Either a Dataset module with the same name or one of the types declared by this module, already exists |

## Example

|             |  |
|-------------|--|
| HTTP Method | POST <base-url>/data/modules/my-module   |
| Headers     | X-Continuity-Class-Name: com.example.dataset.MyModule  |
| Body        | Contents a jar file containing the class <code>MyModule</code> along with other supporting class files and resources |
| Description | Adds a Dataset module named <i>my-module</i> , with the class name <code>com.example.dataset.MyModule</code>         |

## Deleting a Dataset Module

To delete a module, issue an HTTP DELETE request to the URL:

```
DELETE <base-url>/data/modules/<module-name>
```

### *HTTP Responses*

| Status Codes  | Description   |
|---------------|---|
| 200 OK        | Module was successfully deleted   |
| 409 Conflict  | Module with provided <module-name> cannot be deleted because either there's another module that depends on it or there is an existing Dataset of the type that is declared by this module |
| 404 Not Found | Module with provided <module-name> could not be found   |

## Deleting all Dataset Modules

To delete all modules, issue an HTTP DELETE request to the URL:

```
DELETE <base-url>/data/modules
```

### *HTTP Responses*

| Status Codes | Description  |
|--------------|--|
| 200 OK       | Dataset modules were successfully deleted  |
| 409 Conflict | Dataset modules cannot be deleted because there are existing Datasets that use the types declared by these modules |

## Dataset Type HTTP API

The Dataset Type API allows you to interact with [Continuuity Reactor Dataset Types](#) through HTTP. You can list all Dataset types and get information about each type. Dataset types are declared by the Dataset modules added to Continuuity Reactor. To delete a Dataset type, you delete the Dataset module that contains the type as described under [Deleting a Dataset Module](#).

### Listing all Dataset Types

To list all types provided by the existing modules, issue an HTTP GET request to the URL:

```
GET <base-url>/data/types
```

The response will be a JSON array containing JSON objects representing the Dataset types in the format described below under [Getting a Dataset Type](#).

#### *Example*

|             |                           |
|-------------|---------------------------|
| HTTP Method | GET <base-url>/data/types |
| Description | List all Dataset types    |

### Getting a Dataset Type

To get detailed information about a single type, issue an HTTP GET request to the URL:

```
GET <base-url>/data/types/<type-name>
```

| Parameter   | Description              |
|-------------|--------------------------|
| <type-name> | Name of the Dataset type |

The response will be a JSON String representing a Dataset type metadata along with a list of Dataset modules it depends on:

```
{
  "name": "table",
  "modules": [
    {
      "name": "orderedTable-leveldb",
      "className": "com.continuity.data2.dataset2.module.lib.leveldb.LevelDBOrderedTableModule",
      "types": [
        "orderedTable",
        "com.continuity.api.dataset.table.OrderedTable"
      ],
      "usesModules": [
      ],
      "usedByModules": [
        "core"
      ]
    },
    {
      "name": "core",
      "className": "com.continuity.data2.dataset2.lib.table.CoreDatasetsModule",
      "types": [
        "table",
        "com.continuity.api.dataset.table.Table",
        "keyValueTable",
        "com.continuity.api.dataset.lib.KeyValueTable",
        "objectStore",
        "com.continuity.api.dataset.lib.ObjectStore",
        "indexedObjectStore",
        "com.continuity.api.dataset.lib.IndexedObjectStore",
        "indexedTable",
        "com.continuity.api.dataset.lib.IndexedTable",
        "multiObjectStore",
        "com.continuity.api.dataset.lib.MultiObjectStore",
        "timeseriesTable",
        "com.continuity.api.dataset.lib.TimeseriesTable"
      ],
      "usesModules": [
        "orderedTable-leveldb"
      ],
      "usedByModules": [
      ]
    }
  ]
}
```

## Data HTTP API (Deprecated)

The Data API allows you to interact with Continuity Reactor Tables (the core Datasets) through HTTP. You can create Tables, truncate Tables, and read, write, modify, or delete data.

For Datasets other than Tables, you can truncate the Dataset using this API.

### Creating a new Table

To create a new table, issue an HTTP PUT method to the URL:

```
PUT <base-url>/tables/<table-name>
```

| Parameter    | Description                     |
|--------------|---------------------------------|
| <table-name> | Name of the Table to be created |

### HTTP Responses

| Status Codes | Description  |
|--------------|--|
| 200 OK       | The event was successfully received and the Table was either created or already exists |
| 409 Conflict | A Dataset of a different type already exists with the given name                       |

### Example

|             |   |
|-------------|---|
| HTTP Method | PUT <base-url>/tables/streams/mytable   |
| Description | Create a new Table named <i>mytable</i> |

### Comments

This will create a Table with the name given by <table-name>. Table names should only contain ASCII letters, digits and hyphens. If a Table with the same name already exists, no error is returned, and the existing Table remains in place.

However, if a Dataset of a different type exists with the same name—for example, a key/value Table or KeyValueTable—this call will return a 409Conflict error.

## Writing Data to a Table

To write to a table, send an HTTP PUT method to the table's URI:

```
PUT <base-url>/tables/<table-name>/rows/<row-key>
```

| Parameter    | Description                        |
|--------------|------------------------------------|
| <table-name> | Name of the Table to be written to |
| <row-key>    | Row identifier                     |

## HTTP Responses

| Status Codes    | Description   |
|-----------------|---|
| 200 OK          | The event was successfully received and the Table was successfully written to             |
| 400 Bad Request | The JSON String map is not well-formed or cannot be parsed as a map from String to String |
| 404 Not Found   | A Table with the given name does not exist  |

## Example

|             |   |
|-------------|---|
| HTTP Method | PUT <base-url>/tables/mytable/rows/status   |
| Description | Write to the existing Table named <i>mytable</i> in a row identified as <i>status</i> |

## Comments

In the body of the request, you must specify the columns and values that you want to write to the Table as a JSON String map. For example:

```
{ "x": "y", "y": "a", "z": "1" }
```

This writes three columns named *x*, *y*, and *z* with values *y*, *a*, and *1*, respectively.



## Reading Data from a Table

To read data from a Table, address the row that you want to read directly in an HTTP GET method to the table's URI:

```
GET <base-url>/tables/<table-name>/rows/<row-key>[?<column-identifier>]
```

| Parameter            | Description   |
|----------------------|---|
| <table-name>         | Name of the Table to be read from   |
| <row-key>            | Row identifier  |
| <column-identifiers> | An optional combination of attributes and values such as:<br>start=<column-id>   stop=<column-id>   columns=<column-id>,<column-id> |

## HTTP Responses

| Status Codes    | Description  |
|-----------------|--|
| 200 OK          | The event was successfully received and the Table was successfully read from |
| 400 Bad Request | The column list is not well-formed or cannot be parsed                       |
| 404 Not Found   | A Table with the given name does not exist                                   |

## Example

|             |  |
|-------------|--|
| HTTP Method | GET <base-url>/tables/mytable/rows/status  |
| Description | Read from an existing Table named <i>mytable</i> , a row identified as <i>status</i> |

## Comments

The response will be a JSON String representing a map from column name to value. For example, reading the row that was written in the [Writing Data to a Table](#), the response is:

```
{ "x": "y", "y": "a", "z": "1" }
```

If you are only interested in selected columns, you can specify a list of columns explicitly or give a range of columns.

For example:

To return only columns *x* and *y*:

```
GET ... /rows/<row-key>?columns=x,y
```

To return all columns equal to or greater than (inclusive) *c5*:

```
GET ... /rows/<row-key>?start=c5
```

To return all columns less than (exclusive, not including) *c5*:

```
GET ... /rows/<row-key>?stop=c5
```

To return all columns equal to or greater than (inclusive) *c2* and less than (exclusive, not including) *c5*:

```
GET ... /rows/<row-key>?start=c2&stop=c5
```

## Increment Data in a Table

You can perform an atomic increment of cells of a Table's row, and receive back the incremented values, by issue an HTTP POST method to the row's URL:

```
POST <base-url>/tables/<table-name>/rows/<row-key>/increment
```

| Parameter    | Description                       |
|--------------|-----------------------------------|
| <table-name> | Name of the Table to be read from |
| <row-key>    | Row identifier of row to be read  |

### HTTP Responses

| Status Codes    | Description  |
|-----------------|--|
| 200 OK          | The event successfully incremented the row of the Table  |
| 400 Bad Request | The JSON String is not well-formed; or cannot be parsed as a map from a String to a Long; or one of the existing column values is not an 8-byte long value |
| 404 Not Found   | A table with the given name does not exist   |

### Example

|             |  |
|-------------|--|
| HTTP Method | POST <base-url>/streams/mytable/rows/status/increment                                    |
| Description | To increment the columns of <i>mytable</i> , in a row identified as <i>status</i> , by 1 |

### Comments

In the body of the method, you must specify the columns and values that you want to increment them by as a JSON map from Strings to Long numbers, such as:

```
{ "x": 1, "y": 7 }
```

This HTTP call has the same effect as the corresponding Java Table Increment method.

If successful, the response contains a JSON String map from the column keys to the incremented values.

For example, if the existing value of column *x* was 4, and column *y* did not exist, then the response would be:

```
{ "x":5, "y":7 }
```

Column *y* is newly created.

## Delete Data from a Table

To delete from a table, submit an HTTP DELETE method:

```
DELETE <base-url>/tables/<table-name>/rows/<row-key>[?<column-identifier>]
```

| Parameter            | Description  |
|----------------------|--|
| <table-name>         | Name of the Table to be deleted from   |
| <row-key>            | Row identifier   |
| <column-identifiers> | An optional combination of attributes and values such as:<br><div>start=&lt;column-id&gt;   stop=&lt;column-id&gt;   columns=&lt;column-id&gt;,&lt;column-id&gt;</div> |

### HTTP Responses

| Status Codes  | Description  |
|---------------|--|
| 200 OK        | The event successfully deleted the data of the Table |
| 404 Not Found | A table with the given name does not exist           |

### Example

|             |   |
|-------------|---|
| HTTP Method | DELETE <base-url>/tables/mytable/rows/status  |
| Description | Deletes from an existing Table named <i>mytable</i> , a row identified as <i>status</i> |

### Comments

Similarly to [Reading Data from a Table](#), explicitly list the columns that you want to delete by adding a parameter of the form `?columns=<column-key>,...>`. See the examples under [Reading Data from a Table](#).

## Deleting Data from a Dataset

To clear a Dataset of all data, submit an HTTP POST request:

```
POST <base-url>/datasets/<dataset-name>/truncate
```

| Parameter      | Description                         |
|----------------|-------------------------------------|
| <dataset-name> | Name of the Dataset to be truncated |

### HTTP Responses

| Status Codes  | Description  |
|---------------|--|
| 200 OK        | The event successfully deleted the data of the Dataset |
| 404 Not Found | A Dataset with the given name does not exist           |

### Example

|             |  |
|-------------|--|
| HTTP Method | POST <base-url>/datasets/mydataset/truncate                            |
| Description | Delete all of the data from an existing Dataset named <i>mydataset</i> |

### Comments

Note that this works not only for Tables but with other Datasets, including user-defined Custom Datasets.

## Encoding of Keys and Values

The URLs and JSON bodies of your HTTP requests contain row keys, column keys and values, all of which are binary byte Arrays in the Java API.

You need to encode these binary keys and values as Strings in the URL and the JSON body (the exception is the [Increment Data in a Table](#) method, which always interprets values as long integers).

The encoding parameter of the URL specifies the encoding used in both the URL and the JSON body.

For example, if you append a parameter `encoding=hex` to the request URL, then all keys and values are interpreted as hexadecimal strings, and the returned JSON from read requests also has keys and values encoded as hexadecimal string.

Be aware that the same encoding applies to all keys and values involved in a request.

For example, suppose you incremented table *counters*, row *a*, column *x* by 42:

```
POST <base-url>/tables/counters/rows/a/increment {"x":42}
```

Now the value of column *x* is the 8-byte number 42. If you query for the value of this column:

```
GET <base-url>/tables/counters/rows/a?columns=x
```

The returned JSON String map will contain a non-printable string for the value of column *x*:

```
{"x": "\u0000\u0000\u0000\u0000\u0000\u0000\u0000\u0000*"} 
```

Note the Unicode escapes in the string, and the asterisk at the end (which is the character at code point 42).

To make this legible, you can specify hexadecimal notation in your request; that will require that you also encode the row key (*a*, encoded as *61*) and the column key (*x*, encoded as *78*) in your request as hexadecimal:

```
GET <base-url>/tables/counters/rows/61?columns=78&encoding=hex
```

The response now contains both the column key and the value as hexadecimal strings:

```
{"78": "000000000000002a"}
```

The supported encodings are:

| Encoding                     | Description   |
|------------------------------|---|
| <code>encoding=ascii</code>  | Only ASCII characters are supported and are mapped to bytes one-to-one (Default)  |
| <code>encoding=hex</code>    | Hexadecimal strings. Example: the ASCII string <code>a:b</code> is represented as <code>613A62</code>   |
| <code>encoding=url</code>    | URL encoding (also known as %-encoding or percent-encoding). URL-safe characters use ASCII-encoding, while other bytes values are escaped using a % sign. Example: the hexadecimal value <code>613A62</code> (ASCII string <code>a:b</code> ) is represented as the string <code>a%3Ab</code> . |
| <code>encoding=base64</code> | URL-safe Base-64 encoding without padding. For more information, see <a href="#">Internet RFC 2045</a> . Example: the hexadecimal value <code>613A62</code> is represented as the string <code>YTpi</code> .  |

If you specify an encoding that is not supported, or you specify keys or values that cannot be decoded using that encoding, the request will return HTTP code 400 *Bad Request*.

## Counter Values

Your Table values may frequently be counters (numbers), whereas the row and column keys might not be numbers.

In such cases, it is more convenient to represent your Table values as numeric strings, by specifying `counter=true`. For example:

```
GET <base-url>/tables/counters/rows/a?columns=x&counter=true
```

The response now contains the column key as text and the row value as a numeric string:

```
{ "x" : "42" }
```

Note that you can also specify the `counter=true` parameter when writing to a Table. This allows you to specify values as numeric strings while using a different encoding for row and column keys.

## Query HTTP API

This interface supports submitting SQL queries over Datasets. Executing a query is asynchronous:

- first, **submit** the query;
- then poll for the query's **status** until it is finished;
- once finished, retrieve the **result schema** and the **results**;
- finally, **close the query** to free the resources that it holds.

### Submitting a Query

To submit a SQL query, post the query string to the `queries` URL:

```
POST <base-url>/data/queries
```

The body of the request must contain a JSON string of the form:

```
{
  "query": "<SQL-query-string>"
}
```

where `<SQL-query-string>` is the actual SQL query.

### HTTP Responses

| Status Codes    | Description  |
|-----------------|--|
| 200 OK          | The query execution was successfully initiated, and the body will contain the query-handle used to identify the query in subsequent requests |
| 400 Bad Request | The query is not well-formed or contains an error, such as a nonexistent table name.   |

### Comments

If the query execution was successfully initiated, the body will contain a handle used to identify the query in subsequent requests:

```
{ "handle": "<query-handle>" }
```



## Status of a Query

The status of a query is obtained using a HTTP GET request to the query's URL:

```
GET <base-url>/data/queries/<query-handle>
```

### HTTP Responses

| Status Codes  | Description  |
|---------------|--|
| 200 OK        | The query exists and the body contains its status  |
| 404 Not Found | The query handle does not match any current query. |

### Comments

If the query exists, the body will contain the status of its execution and whether the query has a results set:

```
{
  "status": "<status-code>",
  "hasResults": <boolean>
}
```

Status codes include `INITIALIZED`, `RUNNING`, `FINISHED`, `CANCELED`, `CLOSED`, `ERROR`, `UNKNOWN`, and `PENDING`.

## Obtaining the Result Schema

If the query's status is `FINISHED` and it has results, you can obtain the schema of the results:

```
GET <base-url>/data/queries/<query-handle>/schema
```

### HTTP Responses

| Status Codes  | Description   |
|---------------|---|
| 200 OK        | The query was successfully received and the query schema was returned in the body |
| 404 Not Found | The query handle does not match any current query                                 |

### Comments

The query's result schema is returned in a JSON body as a list of columns, each given by its name, type and position; if the query has no result set, this list is empty:

```
[
  { "name": "<name>", "type": "<type>", "position": <int> },
  ...
]
```

The type of each column is a data type as defined in the [Hive language manual](#).

## Retrieving Query Results

Query results can be retrieved in batches after the query is finished, optionally specifying the batch size in the body of the request:

```
POST <base-url>/data/queries/<query-handle>/next
```

The body of the request can contain a JSON string specifying the batch size:

```
{
  "size":<int>
}
```

If the batch size is not specified, it defaults to 20.

## HTTP Responses

| Status Codes  | Description  |
|---------------|--|
| 200 OK        | The event was successfully received and the result of the query was returned in the body |
| 404 Not Found | The query handle does not match any current query  |

## Comments

The results are returned in a JSON body as a list of columns, each given as a structure containing a list of column values.:

```
[
  { "columns": [ <value_1>, <value_2>, ..., ] },
  ...
]
```

The value at each position has the type that was returned in the result schema for that position. For example, if the returned type was `INT`, then the value will be an integer literal, whereas for `STRING` or `VARCHAR` the value will be a string literal.

Repeat the query to retrieve subsequent results. If all results of the query have already been retrieved, then the returned list is empty.

## Closing a Query

The query can be closed by issuing an HTTP DELETE against its URL:

```
DELETE <base-url>/data/queries/<query-handle>
```

This frees all resources that are held by this query.

### ***HTTP Responses***

| Status Codes    | Description   |
|-----------------|---|
| 200 OK          | The query was closed  |
| 400 Bad Request | The query was not in a state that could be closed; either wait until it is finished, or cancel it |
| 404 Not Found   | The query handle does not match any current query   |

## Canceling a Query

Execution of a query can be canceled before it is finished with an HTTP POST:

```
POST <base-url>/data/queries/<query-handle>/cancel
```

After this, the query can only be closed.

### ***HTTP Responses***

| Status Codes    | Description                                       |
|-----------------|---|
| 200 OK          | The query was canceled                            |
| 400 Bad Request | The query was not in a state that can be canceled |
| 404 Not Found   | The query handle does not match any current query |

# Procedure HTTP API

This interface supports sending calls to the methods of an Application's Procedures.

## Executing Procedures

To call a method in an Application's Procedure, send the method name as part of the request URL and the arguments as a JSON string in the body of the request.

The request is an HTTP POST:

```
POST <base-url>/apps/<app-id>/procedures/<procedure-id>/methods/<method-id>
```

| Parameter      | Description                          |
|----------------|--------------------------------------|
| <app-id>       | Name of the Application being called |
| <procedure-id> | Name of the Procedure being called   |
| <method-id>    | Name of the method being called      |

## HTTP Responses

| Status Codes    | Description  |
|-----------------|--|
| 200 OK          | The event successfully called the method, and the body contains the results        |
| 400 Bad Request | The Application, Procedure and method exist, but the arguments are not as expected |
| 404 Not Found   | The Application, Procedure, or method does not exist                               |

## Example

|             |   |
|-------------|---|
| HTTP Method | POST <base-url>/apps/WordCount/procedures/RetrieveCounts/methods/getCount   |
| Description | <p>Call the <code>getCount()</code> method of the <i>RetrieveCounts</i> Procedure in the <i>WordCount</i> Application with the arguments as a JSON string in the body:</p> <pre>{ "word": "a" }</pre> |

# Reactor Client HTTP API

Use the Reactor Client HTTP API to deploy or delete Applications and manage the life cycle of Flows, Procedures and MapReduce jobs.

## Deploy an Application

To deploy an Application from your local file system, submit an HTTP POST request:

```
POST <base-url>/apps
```

with the name of the JAR file as a header:

```
X-Archive-Name: <JAR filename>
```

and its content as the body of the request:

```
<JAR binary content>
```

Invoke the same command to update an Application to a newer version. However, be sure to stop all of its Flows, Procedures and MapReduce jobs before updating the Application.

To list all of the deployed applications, issue an HTTP GET request:

```
GET <base-url>/apps
```

This will return a JSON String map that lists each Application with its name and description.

## Delete an Application

To delete an Application together with all of its Flows, Procedures and MapReduce jobs, submit an HTTP DELETE:

```
DELETE <base-url>/apps/<application-name>
```

| Parameter          | Description                           |
|--------------------|---------------------------------------|
| <application-name> | Name of the Application to be deleted |

Note that the <application-name> in this URL is the name of the Application as configured by the Application Specification, and not necessarily the same as the name of the JAR file that was used to deploy the Application. Note also that this does not delete the Streams and Datasets associated with the Application because they belong to your account, not the Application.

## Start, Stop, Status, and Runtime Arguments

After an Application is deployed, you can start and stop its Flows, Procedures, MapReduce jobs, Workflows, and Custom Services, and query for their status using HTTP POST and GET methods:

```
POST <base-url>/apps/<app-id>/<element-type>/<element-id>/<operation>
GET  <base-url>/apps/<app-id>/<element-type>/<element-id>/status
```

| Parameter      | Description   |
|----------------|---|
| <app-id>       | Name of the Application being called  |
| <element-type> | One of flows, procedures, mapreduce, workflows Or services  |
| <element-id>   | Name of the element ( <i>Flow, Procedure, MapReduce, Workflow, or Custom Service</i> ) being called |
| <operation>    | One of start Or stop  |

### Examples

|             |  |
|-------------|--|
| HTTP Method | POST <base-url>/apps/HelloWorld/flows/WhoFlow/start              |
| Description | Start a Flow <i>WhoFlow</i> in the Application <i>HelloWorld</i> |

|             |  |
|-------------|--|
| HTTP Method | POST <base-url>/apps/WordCount/procedures/RetrieveCounts/stop                |
| Description | Stop the Procedure <i>RetrieveCounts</i> in the Application <i>WordCount</i> |

|             |  |
|-------------|--|
| HTTP Method | GET <base-url>/apps/HelloWorld/flows/WhoFlow/status                            |
| Description | Get the status of the Flow <i>WhoFlow</i> in the Application <i>HelloWorld</i> |

When starting an element, you can optionally specify runtime arguments as a JSON map in the request body:

```
POST <base-url>/apps/HelloWorld/flows/WhoFlow/start
```

with the arguments as a JSON string in the body:

```
{ "foo": "bar", "this": "that" }
```

The Continuuity Reactor will use these these runtime arguments only for this single invocation of the element. To save the runtime arguments so that the Reactor will use them every time you start the element, issue an HTTP PUT with the parameter `runtimeargs`:

```
PUT <base-url>/apps/HelloWorld/flows/WhoFlow/runtimeargs
```

with the arguments as a JSON string in the body:

```
{ "foo": "bar", "this": "that" }
```

To retrieve the runtime arguments saved for an Application's element, issue an HTTP GET request to the element's URL using the same parameter `runtimeargs`:

```
GET <base-url>/apps/HelloWorld/flows/WhoFlow/runtimeargs
```

This will return the saved runtime arguments in JSON format.

## Container Information

To find out the address of an element's container host and the container's debug port, you can query the Reactor for a Procedure or Flow's live info via an HTTP GET method:

```
GET <base-url>/apps/<app-id>/<element-type>/live-info
```

| Parameter      | Description   |
|----------------|---|
| <app-id>       | Name of the Application being called  |
| <element-type> | One of <i>flows</i> , <i>procedures</i> or <i>services</i>                      |
| <element-id>   | Name of the element ( <i>Flow</i> , <i>Procedure</i> or <i>Custom Service</i> ) |

Example:

```
GET <base-url>/apps/WordCount/flows/WordCounter/live-info
```

The response is formatted in JSON; an example of this is shown in the [Continuity Reactor Testing and Debugging Guide](#).

To find out the address of a Service's container host and the container's debug port, you can query the Reactor for the live info of a Service's Twill Runnable via an HTTP GET method:

```
GET <base-url>/apps/<app-id>/services/<service-id>/runnables/<runnable-id>/live-info
```

| Parameter     | Description                             |
|---------------|---|
| <app-id>      | Name of the Application being called    |
| <service-id>  | Name of the Custom Service being called |
| <runnable-id> | Name of the Twill Runnable being called |

Example:

```
GET <base-url>/apps/WordCount/services/CounterService/runnables/CountRunnable/live-info
```

The response is formatted in JSON.

# Scale

## Scaling Flowlets

You can query and set the number of instances executing a given Flowlet by using the `instances` parameter with HTTP GET and PUT methods:

```
GET <base-url>/apps/<app-id>/flows/<flow-id>/flowlets/<flowlet-id>/instances
PUT <base-url>/apps/<app-id>/flows/<flow-id>/flowlets/<flowlet-id>/instances
```

with the arguments as a JSON string in the body:

```
{ "instances" : <quantity> }
```

| Parameter    | Description                          |
|--------------|--------------------------------------|
| <app-id>     | Name of the Application being called |
| <flow-id>    | Name of the Flow                     |
| <flowlet-id> | Name of the Flowlet                  |
| <quantity>   | Number of instances to be used       |

## Examples

|             |  |
|-------------|--|
| HTTP Method | GET <base-url>/apps/HelloWorld/flows/WhoFlow/flowlets/saver/ instances   |
| Description | Find out the number of instances of the Flowlet <i>saver</i> in the Flow <i>WhoFlow</i> of the Application <i>HelloWorld</i>                                 |
| HTTP Method | PUT <base-url>/apps/HelloWorld/flows/WhoFlow/flowlets/saver/ instances<br>with the arguments as a JSON string in the body:<br><pre>{ "instances" : 2 }</pre> |
| Description | Change the number of instances of the Flowlet <i>saver</i> in the Flow <i>WhoFlow</i> of the Application <i>HelloWorld</i>                                   |



## Scaling Procedures

In a similar way to [Scaling Flowlets](#), you can query or change the number of instances of a Procedure by using the `instances` parameter with HTTP GET and PUT methods:

```
GET <base-url>/apps/<app-id>/procedures/<procedure-id>/instances
PUT <base-url>/apps/<app-id>/procedures/<procedure-id>/instances
```

with the arguments as a JSON string in the body:

```
{ "instances" : <quantity> }
```

| Parameter      | Description                    |
|----------------|--------------------------------|
| <app-id>       | Name of the Application        |
| <procedure-id> | Name of the Procedure          |
| <quantity>     | Number of instances to be used |

## Example

|             |  |
|-------------|--|
| HTTP Method | GET <base-url>/apps/HelloWorld/procedures/Greeting/instances instances                                 |
| Description | Find out the number of instances of the Procedure <i>Greeting</i> in the Application <i>HelloWorld</i> |

## Scaling Services

You can query or change the number of instances of a Service's runnable by using the `instances` parameter with HTTP GET and PUT methods:

```
GET <base-url>/apps/<app-id>/services/<service-id>/runnables/<runnable-id>/instances
PUT <base-url>/apps/<app-id>/services/<service-id>/runnables/<runnable-id>/instances
```

with the arguments as a JSON string in the body:

```
{ "instances" : <quantity> }
```

| Parameter     | Description                    |
|---------------|--------------------------------|
| <app-id>      | Name of the Application        |
| <service-id>  | Name of the Service            |
| <runnable-id> | Name of the Twill Runnable     |
| <quantity>    | Number of instances to be used |

## Example

|             |  |
|-------------|--|
| HTTP Method | GET <base-url>/apps/HelloWorld/services/WhoService/runnables/WhoRunnable /instances                        |
| Description | Retreive the number of instances of the Twill Runnable <i>WhoRunnable</i> of the Service <i>WhoService</i> |

## Run History and Schedule

To see the history of all runs of an element, issue an HTTP GET to the element's URL with `history` parameter. This will return a JSON list of all completed runs, each with a start time, end time and termination status:

```
GET <base-url>/apps/<app-id>/flows/<flow-id>/history
```

| Parameter | Description             |
|-----------|-------------------------|
| <app-id>  | Name of the Application |
| <flow-id> | Name of the Flow        |

### Example

|             |   |
|-------------|---|
| HTTP Method | GET <base-url>/apps/HelloWorld/flows/WhoFlow/history  |
| Description | Retrieve the history of the Flow <i>WhoFlow</i> of the Application <i>HelloWorld</i>  |
| Returns     | { "runid": "...", "start": 1382567447, "end": 1382567492, "status": "STOPPED" },<br>{ "runid": "...", "start": 1382567383, "end": 1382567397, "status": "STOPPED" } |

The *runid* field is a UUID that uniquely identifies a run within the Continuity Reactor, with the start and end times in seconds since the start of the Epoch (midnight 1/1/1970).

For Services, you can retrieve the history of a Twill Runnable using:

```
GET <base-url>/apps/<app-id>/services/<service-id>/runnables/<runnable-id>/history
```

### Example

|             |   |
|-------------|---|
| HTTP Method | GET <base-url>/apps/HelloWorld/services/WhoService/runnables/WhoRunnable/history  |
| Description | Retrieve the history of the Runnable <i>WhoRunnable</i> of the Service <i>WhoService</i> of the Application <i>HelloWorld</i>                                       |
| Returns     | { "runid": "...", "start": 1382567447, "end": 1382567492, "status": "STOPPED" },<br>{ "runid": "...", "start": 1382567383, "end": 1382567397, "status": "STOPPED" } |

For Workflows, you can also retrieve:

- the schedules defined for a workflow (using the parameter `schedules`):

```
GET <base-url>/apps/<app-id>/workflows/<workflow-id>/schedules
```

- the next time that the workflow is scheduled to run (using the parameter `nextruntime`):

```
GET <base-url>/apps/<app-id>/workflows/<workflow-id>/nextruntime
```

## Promote

To promote an Application from your local Continuity Reactor to your Sandbox Continuity Reactor, send a POST request with the host name of your Sandbox in the request body. You must include the API key for the Sandbox in the request header.

### Example

Promote the Application *HelloWorld* from your Local Reactor to your Sandbox:

```
POST <base-url>/apps/HelloWorld/promote
```

with the API Key in the header:

```
X-Continuity-APIKey: <api-key> {"hostname":"<sandbox>.continuity.net"}
```

| Parameter | Description   |
|-----------|---|
| <api-key> | Continuity Reactor API key, obtained from an account at <a href="#">Continuity Accounts</a> |
| <sandbox> | Sandbox located on continuity.net   |

# Logging HTTP API

## Downloading Logs

You can download the logs that are emitted by any of the *Flows*, *Procedures*, or *MapReduce* jobs running in the Continuity Reactor. To do that, send an HTTP GET request:

```
GET <base-url>/apps/<app-id>/<element-type>/<element-id>/logs?start=<ts>&stop=<ts>
```

| Parameter      | Description   |
|----------------|---|
| <app-id>       | Name of the Application being called  |
| <element-type> | One of flows, procedures, Or mapreduce  |
| <element-id>   | Name of the element ( <i>Flow</i> , <i>Procedure</i> , <i>MapReduce</i> job) being called |
| <ts>           | <i>Start</i> and <i>stop</i> times, given as seconds since the start of the Epoch.        |

### Example

|             |  |
|-------------|--|
| HTTP Method | GET <base-url>/apps/CountTokens/flows/CountTokensFlow/<br>logs?start=1382576400&stop=1382576700  |
| Description | Return the logs for all the events from the Flow <i>CountTokensFlow</i> of the <i>CountTokens</i> Application, beginning Thu, 24 Oct 2013 01:00:00 GMT and ending Thu, 24 Oct 2013 01:05:00 GMT (five minutes later) |

You can download the logs that are emitted by the Twill Runnable of a Service in a Reactor Application by sending an HTTP GET request:

```
GET <base-url>/apps/<app-id>/services/<service-id>/runnables/<runnable-id>/logs?start=<ts>&stop=<ts>
```

| Parameter     | Description  |
|---------------|--|
| <app-id>      | Name of the Application being called   |
| <service-id>  | Name of the Service being called   |
| <runnable-id> | Name of the Twill Runnable being called  |
| <ts>          | <i>Start</i> and <i>stop</i> times, given as seconds since the start of the Epoch. |

### Example

|             |   |
|-------------|---|
| HTTP Method | GET <base-url>/apps/CountTokens/services/CountTokensService/runnables/CountTokensRunnable/<br>logs?start=1382576400&stop=1382576700   |
| Description | Return the logs for all the events of the Runnable <i>CountTokensRunnable</i> from the Service <i>CountTokensService</i> of the <i>CountTokens</i> Application, beginning Thu, 24 Oct 2013 01:00:00 GMT and ending Thu, 24 Oct 2013 01:05:00 GMT (five minutes later) |

## Comments

The output is formatted as HTML-embeddable text; that is, characters that have a special meaning in HTML will be escaped. A line of the log may look like this:

```
2013-10-23 18:03:09,793 - INFO [FlowletProcessDriver-source-0-  
executor:c.c.e.c.StreamSource@-1] - source: Emitting line: this is an & character
```

Note how the context of the log line shows the name of the Flowlet (*source*), its instance number (0) as well as the original line in the Application code. The character & is escaped as & character; if you don't desire this escaping, you can turn it off by adding the parameter `&escape=false` to the request URL.

# Metrics HTTP API

As Applications process data, the Continuity Reactor collects metrics about the Application's behavior and performance. Some of these metrics are the same for every Application—how many events are processed, how many data operations are performed, etc.—and are thus called system or Reactor metrics.

Other metrics are user-defined and differ from Application to Application. For details on how to add metrics to your Application, see the section on User-Defined Metrics in the Continuity Reactor Operations Guide.

## Metrics Requests

The general form of a metrics request is:

```
GET <base-url>/metrics/<scope>/<context>/<metric>?<time-range>
```

| Parameter    | Description  |
|--------------|--|
| <scope>      | Either <code>reactor</code> (system metrics) or <code>user</code> (user-defined metrics)               |
| <context>    | Hierarchy of context; see <a href="#">Available Contexts</a>   |
| <metric>     | Metric being queried; see <a href="#">Available Metrics</a>  |
| <time-range> | A <a href="#">Time Range</a> or <code>aggregate=true</code> for all since the Application was deployed |

## Examples

|             |  |
|-------------|--|
| HTTP Method | GET <base-url>/metrics/reactor/apps/HelloWorld/flows/WhoFlow/flowlets/saver/process.bytes?aggregate=true |
| Description | Using a <i>System</i> metric, <i>process.bytes</i>   |

|             |   |
|-------------|---|
| HTTP Method | GET <base-url>/metrics/user/apps/HelloWorld/flows/WhoFlow/flowlets/saver/names.bytes?aggregate=true |
| Description | Using a <i>User-Defined</i> metric, <i>names.bytes</i>  |

|             |   |
|-------------|---|
| HTTP Method | GET <base-url>/metrics/user/apps/HelloWorld/services/WhoService/runnables/WhoRun/names.bytes?aggregate=true |
| Description | Using a <i>User-Defined</i> metric, <i>names.bytes</i> in a Service's Twill Runnable                        |

## Comments

The scope must be either `reactor` for system metrics or `user` for user-defined metrics.

System metrics are either Application metrics (about Applications and their Flows, Procedures, MapReduce and WorkFlows) or they are Data metrics (relating to Streams or Datasets).

User metrics are always in the Application context.

For example, to retrieve the number of input data objects ("events") processed by a Flowlet named *splitter*, in the Flow *CountRandomFlow* of the Application *CountRandom*, over the last 5 seconds, you can issue an HTTP GET method:

```
GET <base-url>/metrics/reactor/apps/CountRandom/flows/CountRandomFlow/flowlets/splitter/process.events?start=now-5s&count=5
```

This returns a JSON response that has one entry for every second in the requested time interval. It will have values only for the times where the metric was actually emitted (shown here "pretty-printed", unlike the actual responses):

```
HTTP/1.1 200 OK
Content-Type: application/json
{"start":1382637108,"end":1382637112,"data":[
{"time":1382637108,"value":6868},
{"time":1382637109,"value":6895},
{"time":1382637110,"value":6856},
{"time":1382637111,"value":6816},
{"time":1382637112,"value":6765}]}
```

If you want the number of input objects processed across all Flowlets of a Flow, you address the metrics API at the Flow context:

```
GET <base-url>/metrics/reactor/apps/CountRandom/flows/
    CountRandomFlow/process.events?start=now-5s&count=5
```

Similarly, you can address the context of all flows of an Application, an entire Application, or the entire Reactor:

```
GET <base-url>/metrics/reactor/apps/CountRandom/
    flows/process.events?start=now-5s&count=5
GET <base-url>/metrics/reactor/apps/CountRandom/
    process.events?start=now-5s&count=5
GET <base-url>/metrics/reactor/process.events?start=now-5s&count=5
```

To request user-defined metrics instead of system metrics, specify `user` instead of `reactor` in the URL and specify the user-defined metric at the end of the request.

For example, to request a user-defined metric for the *HelloWorld* Application's *WhoFlow* Flow:

```
GET <base-url>/metrics/user/apps/HelloWorld/flows/
    WhoFlow/flowlets/saver/names.bytes?aggregate=true
```

To retrieve multiple metrics at once, instead of a GET, issue an HTTP POST, with a JSON list as the request body that enumerates the name and attributes for each metrics. For example:

```
POST <base-url>/metrics
```

with the arguments as a JSON string in the body:

```
Content-Type: application/json
[ "/reactor/collect.events?aggregate=true",
  "/reactor/apps/HelloWorld/process.events?start=1380323712&count=6000" ]
```

If the context of the requested metric or metric itself doesn't exist the system returns status 200 (OK) with JSON formed as per above description and with values being zeroes.



## Time Range

The time range of a metric query can be specified in various ways:

| Time Range                                       | Description  |
|--|--|
| <code>start=now-30s&amp;end=now</code>           | The last 30 seconds. The begin time is given in seconds relative to the current time. You can apply simple math, using <code>now</code> for the current time, <code>s</code> for seconds, <code>m</code> for minutes, <code>h</code> for hours and <code>d</code> for days. For example: <code>now-5d-12h</code> is 5 days and 12 hours ago. |
| <code>start=1385625600&amp;end=1385629200</code> | From Thu, 28 Nov 2013 08:00:00 GMT to Thu, 28 Nov 2013 09:00:00 GMT, both given as since the start of the Epoch  |
| <code>start=1385625600&amp;count=3600</code>     | The same as before, but with the count given as a number of seconds  |

Instead of getting the values for each second of a time range, you can also retrieve the aggregate of a metric over time. The following request will return the total number of input objects processed since the Application *CountRandom* was deployed, assuming that the Reactor has not been stopped or restarted (you cannot specify a time range for aggregates):

```
GET <base-url>/metrics/reactor/apps/CountRandom/process.events?aggregate=true
```

## Available Contexts

The context of a metric is typically enclosed into a hierarchy of contexts. For example, the Flowlet context is enclosed in the Flow context, which in turn is enclosed in the Application context. A metric can always be queried (and aggregated) relative to any enclosing context. These are the available Application contexts of the Continuity Reactor:

| System Metric                               | Context  |
|---|--|
| One Flowlet of a Flow                       | /apps/<app-id>/flows/<flow-id>/flowlets/<flowlet-id>         |
| All Flowlets of a Flow                      | /apps/<app-id>/flows/<flow-id>                               |
| All Flowlets of all Flows of an Application | /apps/<app-id>/flows   |
| One Procedure                               | /apps/<app-id>/procedures/<procedure-id>                     |
| All Procedures of an Application            | /apps/<app-id>/procedures                                    |
| All Mappers of a MapReduce                  | /apps/<app-id>/mapreduce/<mapreduce-id>/mappers              |
| All Reducers of a MapReduce                 | /apps/<app-id>/mapreduce/<mapreduce-id>/reducers             |
| One MapReduce                               | /apps/<app-id>/mapreduce/<mapreduce-id>                      |
| All MapReduce of an Application             | /apps/<app-id>/mapreduce                                     |
| One Twill Runnable                          | /apps/<app-id>/services/<service-id>/runnables/<runnable-id> |
| One Service                                 | /apps/<app-id>/services/<service-id>                         |
| All Services of an Application              | /apps/<app-id>/services                                      |
| All elements of an Application              | /apps/<app-id>   |
| All elements of all Applications            | /  |

Stream metrics are only available at the Stream level and the only available context is:

| Stream Metric   | Context              |
|-----------------|----------------------|
| A single Stream | /streams/<stream-id> |

Dataset metrics are available at the Dataset level, but they can also be queried down to the Flowlet, Procedure, Mapper, or Reducer level:

| Dataset Metric  | Context  |
|---|--|
| A single Dataset in the context of a single Flowlet       | /datasets/<dataset-id>/apps/<app-id>/flows/<flow-id>/flowlets/<flowlet-id> |
| A single Dataset in the context of a single Flow          | /datasets/<dataset-id>/apps/<app-id>/flows/<flow-id>                       |
| A single Dataset in the context of a specific Application | /datasets/<dataset-id>/<any application context>                           |
| A single Dataset across all Applications                  | /datasets/<dataset-id>   |
| All Datasets across all Applications                      | /  |

## Available Metrics

For Continuity Reactor metrics, the available metrics depend on the context. User-defined metrics will be available at whatever context that they are emitted from.

These metrics are available in the Flowlet context:

| Flowlet Metric                        | Description  |
|---------------------------------------|--|
| <code>process.busyness</code>         | A number from 0 to 100 indicating how “busy” the Flowlet is; note that you cannot aggregate over this metric |
| <code>process.errors</code>           | Number of errors while processing  |
| <code>process.events.processed</code> | Number of events/data objects processed  |
| <code>process.events.in</code>        | Number of events read in by the Flowlet  |
| <code>process.events.out</code>       | Number of events emitted by the Flowlet  |
| <code>store.bytes</code>              | Number of bytes written to Datasets  |
| <code>store.ops</code>                | Operations (writes and read) performed on Datasets   |
| <code>store.reads</code>              | Read operations performed on Datasets  |
| <code>store.writes</code>             | Write operations performed on Datasets   |

These metrics are available in the Mappers and Reducers context:

| Mappers and Reducers Metric      | Description   |
|----------------------------------|---|
| <code>process.completion</code>  | A number from 0 to 100 indicating the progress of the Map or Reduce phase |
| <code>process.entries.in</code>  | Number of entries read in by the Map or Reduce phase                      |
| <code>process.entries.out</code> | Number of entries written out by the Map or Reduce phase                  |

These metrics are available in the Procedures context:

| Procedures Metric           | Description                              |
|-----------------------------|--|
| <code>query.requests</code> | Number of requests made to the Procedure |
| <code>query.failures</code> | Number of failures seen by the Procedure |

These metrics are available in the Streams context:

| Streams Metric              | Description                              |
|-----------------------------|--|
| <code>collect.events</code> | Number of events collected by the Stream |
| <code>collect.bytes</code>  | Number of bytes collected by the Stream  |

These metrics are available in the Datasets context:

| Datasets Metric           | Description                             |
|---------------------------|---|
| <code>store.bytes</code>  | Number of bytes written                 |
| <code>store.ops</code>    | Operations (reads and writes) performed |
| <code>store.reads</code>  | Read operations performed               |
| <code>store.writes</code> | Write operations performed              |

# Monitor HTTP API

Reactor internally uses a variety of System Services that are critical to its functionality. This section describes the REST APIs that can be used to see into System Services.

## Details of All Available System Services

For the detailed information of all available System Services, use:

```
GET <base-url>/system/services
```

### *HTTP Responses*

| Status Codes | Description   |
|--------------|---|
| 200 OK       | The event successfully called the method, and the body contains the results |

## Checking Status of All Reactor System Services

To check the status of all the System Services, use:

```
GET <base-url>/system/services/status
```

### *HTTP Responses*

| Status Codes | Description   |
|--------------|---|
| 200 OK       | The event successfully called the method, and the body contains the results |

## Checking Status of a Specific Reactor System Service

To check the status of a specific System Service, use:

```
GET <base-url>/system/services/<service-name>/status
```

The status of these Reactor System Services can be checked:

| Service           | Service-Name      | Description of the Service   |
|-------------------|-------------------|--|
| Metrics           | metrics           | Service that handles metrics related HTTP requests                 |
| Transaction       | transaction       | Service handling transactions                                      |
| Streams           | streams           | Service handling Stream management                                 |
| App Fabric        | appfabric         | Service handling Application Fabric requests                       |
| Log Saver         | log.saver         | Service aggregating all system and application logs                |
| Metrics Processor | metrics.processor | Service that aggregates all system and application metrics         |
| Dataset Executor  | dataset.executor  | Service that handles all data-related HTTP requests                |
| Explore Service   | explore.service   | Service that handles all HTTP requests for ad-hoc data exploration |

Note that the Service status checks are more useful when the Reactor is running in a distributed cluster mode.

### Example

|             |   |
|-------------|---|
| HTTP Method | GET <base-url>/system/services/metrics/status |
| Description | Returns the status of the Metrics Service     |

### HTTP Responses

| Status Codes  | Description                                    |
|---------------|--|
| 200 OK        | The service is up and running                  |
| 404 Not Found | The service is either not running or not found |

## Scaling System Services

The number of instances for system services can be queried and changed by using these commands:

```
GET <base-url>/system/services/<service-name>/instances
PUT <base-url>/system/services/<service-name>/instances
```

with the arguments as a JSON string in the body:

```
{ "instances" : <quantity> }
```

| Parameter     | Description                    |
|---------------|--------------------------------|
| <system-name> | Name of the system service     |
| <quantity>    | Number of instances to be used |

### Examples

|             |  |
|-------------|--|
| HTTP Method | GET <base-url>/system/services/metrics/instances instances   |
| Description | Determine the number of instances being used for the metrics HTTP service  |
| HTTP Method | PUT <base-url>/system/services/metrics/instances instances<br>with the arguments as a JSON string in the body:<br><pre>{ "instances" : 2 }</pre> |
| Description | Sets the number of instances of the metrics HTTP service to 2  |