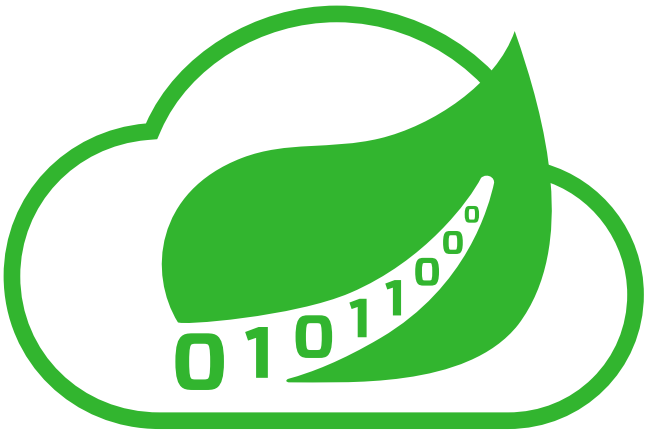

Spring Cloud Data Flow Server for Kubernetes

1.0.0.RC1

Table of Contents

Part I. Introduction

1. Introducing Spring Cloud Data Flow for Kubernetes

This project provides support for orchestrating long-running (*streaming*) and short-lived (*task/batch*) data microservices to Kubernetes.

2. Spring Cloud Data Flow

Spring Cloud Data Flow is a cloud-native orchestration service for composable data microservices on modern runtimes. With Spring Cloud Data Flow, developers can create and orchestrate data pipelines for common use cases such as data ingest, real-time analytics, and data import/export.

The Spring Cloud Data Flow architecture consists of a server that deploys Streams and Tasks. Streams are defined using a DSL or visually through the browser based designer UI. Streams are based on the Spring Cloud Stream programming model while Tasks are based on the Spring Cloud Task programming model. The sections below describe more information about creating your own custom Streams and Tasks

For more details about the core architecture components and the supported features, please review Spring Cloud Data Flow's core reference guide. There're several samples available for reference.

3. Spring Cloud Stream

Spring Cloud Stream is a framework for building message-driven microservice applications. Spring Cloud Stream builds upon Spring Boot to create standalone, production-grade Spring applications, and uses Spring Integration to provide connectivity to message brokers. It provides opinionated configuration of middleware from several vendors, introducing the concepts of persistent publish-subscribe semantics, consumer groups, and partitions.

For more details about the core framework components and the supported features, please review Spring Cloud Stream's reference guide.

There's a rich ecosystem of Spring Cloud Stream Application-Starters that can be used either as standalone data microservice applications or in Spring Cloud Data Flow. For convenience, we have generated RabbitMQ and Apache Kafka variants of these application-starters that are available for use from Maven Repo and Docker Hub as maven artifacts and docker images, respectively.

Do you have a requirement to develop custom applications? No problem. Refer to this guide to create custom stream applications. There're several samples available for reference.

4. Spring Cloud Task

Spring Cloud Task makes it easy to create short-lived microservices. We provide capabilities that allow short-lived JVM processes to be executed on demand in a production environment.

For more details about the core framework components and the supported features, please review Spring Cloud Task's reference guide.

There's a rich ecosystem of Spring Cloud Task Application-Starters that can be used either as standalone data microservice applications or in Spring Cloud Data Flow. For convenience, the generated application-starters are available for use from Maven Repo. There are several samples available for reference.

Part II. Getting Started

5. Deploying Streams on Kubernetes

In this getting started guide, the Data Flow Server is deployed to the Kubernetes cluster. This means that we need to make available an RDBMS service for stream and task repositories, app registry plus a transport option of either Kafka or Rabbit MQ.

1. Deploy a Kubernetes cluster.

   The Kubernetes Getting Started guide lets you choose among many deployment options so you can pick one that you are most comfortable using. We have successfully used the Vagrant option from a downloaded Kubernetes release.

   Of note, the docker-compose-kubernetes is not among those options, but it was also used by the developers of this project to run a local Kubernetes cluster using Docker Compose.

   The rest of this getting started guide assumes that you have a working Kubernetes cluster and a `kubectl` command line.

2. Create a Kafka service on the Kubernetes cluster.

   The Kafka service will be used for messaging between modules in the stream. You can instead use Rabbit MQ, but, in order to simplify, we only show the Kafka configurations in this guide. There are sample replication controller and service YAML files in the `spring-cloud-dataflow-server-kubernetes` repository that you can use as a starting point as they have the required metadata set for service discovery by the modules.

   ```
   $ git clone https://github.com/spring-cloud/spring-cloud-dataflow-server-kubernetes
   $ cd spring-cloud-dataflow-server-kubernetes
   $ kubectl create -f src/etc/kubernetes/kafka-controller.yml
   $ kubectl create -f src/etc/kubernetes/kafka-service.yml
   ```

   You can use the command `kubectl get pods` to verify that the controller and service is running. Use the command `kubectl get services` to check on the state of the service. Use the commands `kubectl delete svc kafka` and `kubectl delete rc kafka` to clean up afterwards.

3. Create a MySQL service on the Kubernetes cluster.

   We are using MySQL for this guide, but you could use Postgres or H2 database instead. We include JDBC drivers for all three of these databases, you would just have to adjust the database URL and driver class name settings.

   Before creating the MySQL service we need to create a persistent disk and modify the password in the config file. To create a persistent disk you can use the following command:

   ```
   $ gcloud compute disks create mysql-disk --size 200 --type pd-standard
   ```

   Modify the password in the `src/etc/kubernetes/mysql-controller.yml` file inside the `spring-cloud-dataflow-server-kubernetes` repository. Then run the following commands to start the database service:

   ```
   $ kubectl create -f src/etc/kubernetes/mysql-controller.yml
   $ kubectl create -f src/etc/kubernetes/mysql-service.yml
   ```

   Again, you can use the command `kubectl get pods` to verify that the controller is running. Note that it can take a minute or so until there is an external IP address for the MySQL server. Use the

command `kubectl get services` to check on the state of the service and look for when there is a value under the EXTERNAL_IP column. Use the commands `kubectl delete svc mysql` and `kubectl delete rc mysql` to clean up afterwards. Use the EXTERNAL_IP address to connect to the database and create a `test` database that we can use for our testing. Use your favorit SQL developer tool for this:

```
CREATE DATABASE test;
```

4. Determine the location of your Kubernetes Master URL, for example:

```
$ kubectl cluster-info

Kubernetes master is running at https://10.245.1.2

   ...other output omitted...
```

5. Update configuration files with values needed to connect to Kubernetes and MySQL.

   The Data Flow Server uses the fabric8 Java client library to connect to the Kubernetes cluster. We are using environment variables to set the values needed when deploying the Data Flow server to Kubernetes. The settings are specified in the `src/etc/kubernetes/scdf-controller.yml` file. Modify the `<<URL-for-Kubernetes-master>>` setting to match your output from the command above. Also modify `<<mysql-username>>`, `<<mysql-password>>` and DB schema name to match what you used when creating the service.

   This approach supports using one Data Flow Server instance per Kubernetes namespace.

6. Deploy the Spring Cloud Data Flow Server for Kubernetes using the Docker image and the configuration settings you just modified.

```
$ kubectl create -f src/etc/kubernetes/scdf-controller.yml
$ kubectl create -f src/etc/kubernetes/scdf-service.yml
```

Note

We haven't tuned the memory use of the OOTB apps yet, so to be on the safe side we are increasing the memory for the pods by providing the following property: `spring.cloud.deployer.kubernetes.memory=640Mi`

Use the `kubectl get svc` command to locate the EXTERNAL_IP address assigned to `scdf`, we use that to connect from the shell.

```
$ kubectl get svc
NAME         CLUSTER-IP       EXTERNAL-IP       PORT(S)    AGE
kafka        10.103.248.211   <none>            9092/TCP   14d
kubernetes   10.103.240.1     <none>            443/TCP    16d
mysql        10.103.251.179   104.154.246.220   3306/TCP   10d
scdf         10.103.246.82    130.211.203.246   9393/TCP   4m
zk           10.103.243.29    <none>            2181/TCP   14d
```

7. Download and run the Spring Cloud Data Flow shell.

```
$ wget http://repo.spring.io/milestone/org/springframework/cloud/spring-cloud-dataflow-
shell/1.0.0.RC1/spring-cloud-dataflow-shell-1.0.0.RC1.jar

$ java -jar spring-cloud-dataflow-shell-1.0.0.RC1.jar
```

Configure the Data Flow server URI with the following command (use the IP address from previous step and at the moment we are using port 9393):

```
  ____                              ____ _                __
 / ___| _ __  _ __(_)_ __   __ _   / ___| | ___  _   _  __| |
 \___ \| '_ \| '__| | '_ \ / _` | | |   | |/ _ \| | | |/ _` |
  ___) | |_) | |  | | | | | (_| | | |___| | (_) | |_| | (_| |
 |____/| .__/|_|  |_|_| |_|\__, |  \____|_|\___/ \__,_|\__,_|
  ____ |_|    _          __|___/                 __________
 |  _ \  __ _| |_ __ _  |  ___| | _____      __  \ \ \ \ \ \
 | | | |/ _` | __/ _` | | |_  | |/ _ \ \ /\ / /   \ \ \ \ \ \
 | |_| | (_| | || (_| | |  _| | | (_) \ V  V /    / / / / / /
 |____/ \__,_|\__\__,_| |_|   |_|\___/ \_/\_/    /_/_/_/_/_/

1.0.0.BUILD-SNAPSHOT

Welcome to the Spring Cloud Data Flow shell. For assistance hit TAB or type "help".
server-unknown:>dataflow config server --uri http://130.211.203.246:9393
Successfully targeted http://130.211.203.246:9393
dataflow:>
```

8. Register the Kafka version of the `time` and `log` apps using the shell and also register the `timestamp` app.

```
dataflow:>app register --type source --name time --uri docker:springcloudstream/time-source-
kafka:latest
dataflow:>app register --type sink --name log --uri docker:springcloudstream/log-sink-kafka:latest
dataflow:>app register --type task --name timestamp --uri docker:springcloudtask/timestamp-
task:latest
```

9. Alternatively, if you would like to register all out-of-the-box stream applications built with the Kafka binder in bulk, you can with the following command. For more details, review how to register applications.

```
dataflow:>app import --uri http://bit.ly/stream-applications-kafka-docker
```

10. Deploy a simple stream in the shell

```
dataflow:>stream create --name ticktock --definition "time | log" --deploy
```

You can use the command `kubectl get pods` to check on the state of the pods corresponding to this stream. We can run this from the shell by running it as an OS command by adding a "!" before the command.

```
dataflow:>! kubectl get pods
command is:kubectl get pods
NAME                  READY     STATUS    RESTARTS   AGE
kafka-d207a           1/1       Running   0          50m
ticktock-log-qnk72    1/1       Running   0          2m
ticktock-time-r65cn   1/1       Running   0          2m
```

Look at the logs for the pod deployed for the log sink.

```
$ kubectl logs -f ticktock-log-qnk72
...
2015-12-28 18:50:02.897  INFO 1 --- [           main] o.s.c.s.module.log.LogSinkApplication    :
 Started LogSinkApplication in 10.973 seconds (JVM running for 50.055)
2015-12-28 18:50:08.561  INFO 1 --- [hannel-adapter1] log.sink                                 :
 2015-12-28 18:50:08
2015-12-28 18:50:09.556  INFO 1 --- [hannel-adapter1] log.sink                                 :
 2015-12-28 18:50:09
2015-12-28 18:50:10.557  INFO 1 --- [hannel-adapter1] log.sink                                 :
 2015-12-28 18:50:10
2015-12-28 18:50:11.558  INFO 1 --- [hannel-adapter1] log.sink                                 :
 2015-12-28 18:50:11
```

Note

If you need to specify any of the app specific configuration properties then you must use "long-form" of them including the app specific prefix like `--jdbc.tableName=TEST_DATA`. This is due to the server not being able to access the metadata for the Docker based starter apps. You will also not see the configuration properties listed when using the `app info` command or in the Dashboard GUI.

Note

If you need to be able to connect from outside of the Kubernetes cluster to an app that you deploy, like the `http-source`, then you can provide a deployment property of `spring.cloud.deployer.kubernetes.createLoadBalancer=true` for the app module to specify that you want to have a LoadBalancer with an external IP address created for your app's service.

To register the `http-source` and use it in a stream where you can post data to it, you can use the following commands:

```
dataflow:>app register --type source --name http --uri docker:springcloudstream/http-source-
kafka:latest
dataflow:>stream create --name test --definition "http | log"
dataflow:>stream deploy test --properties
 "app.http.spring.cloud.deployer.kubernetes.createLoadBalancer=true"
```

Now, look up the external IP address for the `http` app (it can sometimes take a minute or two for the external IP to get assigned):

```
dataflow:>! kubectl get service
command is:kubectl get service
NAME         CLUSTER-IP       EXTERNAL-IP      PORT(S)    AGE
kafka        10.103.240.92    <none>           9092/TCP   7m
kubernetes   10.103.240.1     <none>           443/TCP    4h
test-http    10.103.251.157   130.211.200.96   8080/TCP   58s
test-log     10.103.240.28    <none>           8080/TCP   59s
zk           10.103.247.25    <none>           2181/TCP   7m
```

Next, post some data to the `test-http` app:

```
dataflow:>http post --target http://130.211.200.96:8080 --data "Hello"
```

Finally, look at the logs for the `test-log` pod:

```
dataflow:>! kubectl get pods
command is:kubectl get pods
NAME              READY     STATUS            RESTARTS   AGE
kafka-o20qq       1/1       Running           0          9m
test-http-9obkq   1/1       Running           0          2m
test-log-ysiz3    1/1       Running           0          2m
dataflow:>! kubectl logs test-log-ysiz3
command is:kubectl logs test-log-ysiz3
...
2016-04-27 16:54:29.789  INFO 1 --- [           main] o.s.c.s.b.k.KafkaMessageChannelBinder$3  :
 started inbound.test.http.test
2016-04-27 16:54:29.799  INFO 1 --- [           main] o.s.c.support.DefaultLifecycleProcessor  :
 Starting beans in phase 0
2016-04-27 16:54:29.799  INFO 1 --- [           main] o.s.c.support.DefaultLifecycleProcessor  :
 Starting beans in phase 2147482647
2016-04-27 16:54:29.895  INFO 1 --- [           main] s.b.c.e.t.TomcatEmbeddedServletContainer :
 Tomcat started on port(s): 8080 (http)
2016-04-27 16:54:29.896  INFO 1 --- [  kafka-binder-] log.sink                                 :
 Hello
```

A useful command to help in troubleshooting issues, such as a container that has a fatal error starting up, add the options `--previous` to view last terminated container log. You can also get more detailed information about the pods by using the `kubctl describe` like:

```
kubectl describe pods/ticktock-log-qnk72
```

11. Destroy the stream

```
dataflow:>stream destroy --name ticktock
```

12. Create a task and launch it

Let's create a simple task definition and launch it.

```
dataflow:>task create task1 --definition "timestamp"
dataflow:>task launch task1
```

We can now list the tasks and executions using these commands:

```
dataflow:>task list
########################################
#Task Name#Task Definition#Task Status#
########################################
#task1    #timestamp      #running    #
########################################

dataflow:>task execution list
#############################################################################################
#Task Name#ID#         Start Time         #          End Time          #Exit Code#
#############################################################################################
#task1    #1 #Fri Jun 03 18:12:05 EDT 2016#Fri Jun 03 18:12:05 EDT 2016#0        #
#############################################################################################
```

13. Destroy the task

```
dataflow:>task destroy --name task1
```

Part III. Streams

In this section you will learn all about Streams and how to use them with Spring Cloud Data Flow.

6. Introduction

In Spring Cloud Data Flow, a basic stream defines the ingestion of event driven data from a *source* to a *sink* that passes through any number of *processors*. Streams are composed of spring-cloud-stream applications and the deployment of stream definitions is done via the Data Flow Server (REST API). The Getting Started section shows you how to start these servers and how to start and use the Spring Cloud Data Flow shell.

A high level DSL is used to create stream definitions. The DSL to define a stream that has an http source and a file sink (with no processors) is shown below

```
http | file
```

The DSL mimics a UNIX pipes and filters syntax. Default values for ports and filenames are used in this example but can be overridden using `--` options, such as

```
http --server.port=8091 | file --directory=/tmp/httpdata/
```

To create these stream definitions you use the shell or make an HTTP POST request to the Spring Cloud Data Flow Server. More details can be found in the sections below.

7. Stream DSL

In the examples above, we connected a source to a sink using the pipe symbol `|`. You can also pass properties to the source and sink configurations. The property names will depend on the individual app implementations, but as an example, the `http` source app exposes a `server.port` setting which allows you to change the data ingestion port from the default value. To create the stream using port 8000, we would use

```
dataflow:> stream create --definition "http --server.port=8000 | log" --name myhttpstream
```

The shell provides tab completion for application properties and also the shell command `app info` provides some additional documentation.

8. Register a Stream App

Register a Stream App with the App Registry using the Spring Cloud Data Flow Shell `app register` command. You must provide a unique name, application type, and a URI that can be resolved to the app artifact. For the type, specify "source", "processor", or "sink". Here are a few examples:

```
dataflow:>app register --name mysource --type source --uri maven://com.example:mysource:0.0.1-SNAPSHOT

dataflow:>app register --name myprocessor --type processor --uri file:///Users/example/
myprocessor-1.2.3.jar

dataflow:>app register --name mysink --type sink --uri http://example.com/mysink-2.0.1.jar
```

When providing a URI with the `maven` scheme, the format should conform to the following:

```
maven://<groupId>:<artifactId>[:<extension>[:<classifier>]]:<version>
```

For example, if you would like to register the snapshot versions of the `http` and `log` applications built with the RabbitMQ binder, you could do the following:

```
dataflow:>app register --name http --type source --uri maven://
org.springframework.cloud.stream.app:http-source-rabbit:1.0.0.BUILD-SNAPSHOT
dataflow:>app register --name log --type sink --uri maven://org.springframework.cloud.stream.app:http-
log-rabbit:1.0.0.BUILD-SNAPSHOT
```

If you would like to register multiple apps at one time, you can store them in a properties file where the keys are formatted as `<type>.<name>` and the values are the URIs.

For example, if you would like to register the snapshot versions of the `http` and `log` applications built with the RabbitMQ binder, you could have the following in a properties file [*eg: stream-apps.properties*]:

```
source.http=maven://org.springframework.cloud.stream.app:http-source-rabbit:1.0.0.BUILD-SNAPSHOT
sink.log=maven://org.springframework.cloud.stream.app:log-sink-rabbit:1.0.0.BUILD-SNAPSHOT
```

Then to import the apps in bulk, use the `app import` command and provide the location of the properties file via `--uri`:

```
dataflow:>app import --uri file:///<YOUR_FILE_LOCATION>/stream-apps.properties
```

For convenience, we have the static files with application-URIs (for both maven and docker) available for all the out-of-the-box Stream and Task app-starters. You can point to this file and import all the application-URIs in bulk. Otherwise, as explained in previous paragraphs, you can register them individually or have your own custom property file with only the required application-URIs in it. It is recommended, however, to have a "focused" list of desired application-URIs in a custom property file.

List of available static property files:

- Maven based Stream Applications with RabbitMQ Binder: bit.ly/stream-applications-rabbit-maven
- Maven based Stream Applications with Kafka Binder: bit.ly/stream-applications-kafka-maven
- Maven based Task Applications: bit.ly/task-applications-maven
- Docker based Stream Applications with RabbitMQ Binder: bit.ly/stream-applications-rabbit-docker
- Docker based Stream Applications with Kafka Binder: bit.ly/stream-applications-kafka-docker
- Docker based Task Applications: bit.ly/task-applications-docker

For example, if you would like to register all out-of-the-box stream applications built with the RabbitMQ binder in bulk, you can with the following command.

```
dataflow:>app import --uri http://bit.ly/stream-applications-rabbit-maven
```

You can also pass the `--local` option (which is TRUE by default) to indicate whether the properties file location should be resolved within the shell process itself. If the location should be resolved from the Data Flow Server process, specify `--local false`.

When using either `app register` or `app import`, if a stream app is already registered with the provided name and type, it will not be overridden by default. If you would like to override the pre-existing stream app, then include the `--force` option.

Note

In some cases the Resource is resolved on the server side, whereas in others the URI will be passed to a runtime container instance where it is resolved. Consult the specific documentation of each Data Flow Server for more detail.

8.1 Whitelisting application properties

Stream applications are Spring Boot applications which are aware of many common application properties, e.g. `server.port` but also families of properties such as those with the prefix `spring.jmx` and `logging`. When creating your own application it is desirable to whitelist properties so that the shell and the UI can display them first as primary properties when presenting options via TAB completion or in drop-down boxes.

To whitelist application properties create a file named `spring-configuration-metadata-whitelist.properties` in the `META-INF` resource directory. There are two property keys that can be used inside this file. The first key is named `configuration-properties.classes`. The value is a comma separated list of fully qualified `@ConfigurationProperty` class names. The second key is `configuration-properties.names` whose value is a comma separated list of property names. This can contain the full name of property, such as `server.port` or a partial name to whitelist a category of property names, e.g. `spring.jmx`.

The Spring Cloud Stream application starters are a good place to look for examples of usage. Here is a simple example of the file source's `spring-configuration-metadata-whitelist.properties` file

```
configuration.classes=org.springframework.cloud.stream.app.file.sink.FileSinkProperties
```

If for some reason we also wanted to add `file.prefix` to this file, it would look like

```
configuration.classes=org.springframework.cloud.stream.app.file.sink.FileSinkProperties
configuration-properties.names=server.port
```

9. Creating a Stream

The Spring Cloud Data Flow Server exposes a full RESTful API for managing the lifecycle of stream definitions, but the easiest way to use is it is via the Spring Cloud Data Flow shell. Start the shell as described in the Getting Started section.

New streams are created by posting stream definitions. The definitions are built from a simple DSL. For example, let's walk through what happens if we execute the following shell command:

```
dataflow:> stream create --definition "time | log" --name ticktock
```

This defines a stream named `ticktock` based off the DSL expression `time | log`. The DSL uses the "pipe" symbol `|`, to connect a source to a sink.

Then to deploy the stream execute the following shell command (or alternatively add the `--deploy` flag when creating the stream so that this step is not needed):

```
dataflow:> stream deploy --name ticktock
```

The Data Flow Server resolves `time` and `log` to maven coordinates and uses those to launch the `time` and `log` applications of the stream.

```
2016-06-01 09:41:21.728  INFO 79016 --- [nio-9393-exec-6] o.s.c.d.spi.local.LocalAppDeployer       :
 deploying app ticktock.log instance 0
   Logs will be in /var/folders/wn/8jxm_tbd1vj28c8vj37n900m0000gn/T/spring-cloud-
dataflow-912434582726479179/ticktock-1464788481708/ticktock.log
2016-06-01 09:41:21.914  INFO 79016 --- [nio-9393-exec-6] o.s.c.d.spi.local.LocalAppDeployer       :
 deploying app ticktock.time instance 0
   Logs will be in /var/folders/wn/8jxm_tbd1vj28c8vj37n900m0000gn/T/spring-cloud-
dataflow-912434582726479179/ticktock-1464788481910/ticktock.time
```

In this example, the time source simply sends the current time as a message each second, and the log sink outputs it using the logging framework. You can tail the `stdout` log (which has an "_<instance>" suffix). The log files are located within the directory displayed in the Data Flow Server's log output, as shown above.

```
$ tail -f /var/folders/wn/8jxm_tbd1vj28c8vj37n900m0000gn/T/spring-cloud-dataflow-912434582726479179/
ticktock-1464788481708/ticktock.log/stdout_0.log
2016-06-01 09:45:11.250  INFO 79194 --- [  kafka-binder-] log.sink    : 06/01/16 09:45:11
2016-06-01 09:45:12.250  INFO 79194 --- [  kafka-binder-] log.sink    : 06/01/16 09:45:12
2016-06-01 09:45:13.251  INFO 79194 --- [  kafka-binder-] log.sink    : 06/01/16 09:45:13
```

If you would like to have multiple instances of an application in the stream, you can include a property with the deploy command:

```
dataflow:> stream deploy --name ticktock --properties "app.time.count=3"
```

Important

See Chapter 16, *Using Labels in a Stream*.

10. Destroying a Stream

You can delete a stream by issuing the `stream destroy` command from the shell:

```
dataflow:> stream destroy --name ticktock
```

If the stream was deployed, it will be undeployed before the stream definition is deleted.

11. Deploying and Undeploying Streams

Often you will want to stop a stream, but retain the name and definition for future use. In that case you can `undeploy` the stream by name and issue the `deploy` command at a later time to restart it.

```
dataflow:> stream undeploy --name ticktock
dataflow:> stream deploy --name ticktock
```

12. Other Source and Sink Application Types

Let's try something a bit more complicated and swap out the `time` source for something else. Another supported source type is `http`, which accepts data for ingestion over HTTP POSTs. Note that the `http` source accepts data on a different port from the Data Flow Server (default 8080). By default the port is randomly assigned.

To create a stream using an `http` source, but still using the same `log` sink, we would change the original command above to

```
dataflow:> stream create --definition "http | log" --name myhttpstream --deploy
```

which will produce the following output from the server

```
2016-06-01 09:47:58.920  INFO 79016 --- [io-9393-exec-10] o.s.c.d.spi.local.LocalAppDeployer       :
 deploying app myhttpstream.log instance 0
   Logs will be in /var/folders/wn/8jxm_tbd1vj28c8vj37n900m0000gn/T/spring-cloud-
dataflow-912434582726479179/myhttpstream-1464788878747/myhttpstream.log
2016-06-01 09:48:06.396  INFO 79016 --- [io-9393-exec-10] o.s.c.d.spi.local.LocalAppDeployer       :
 deploying app myhttpstream.http instance 0
   Logs will be in /var/folders/wn/8jxm_tbd1vj28c8vj37n900m0000gn/T/spring-cloud-
dataflow-912434582726479179/myhttpstream-1464788886383/myhttpstream.http
```

Note that we don't see any other output this time until we actually post some data (using a shell command). In order to see the randomly assigned port on which the http source is listening, execute:

```
dataflow:> runtime apps
```

You should see that the corresponding http source has a `url` property containing the host and port information on which it is listening. You are now ready to post to that url, e.g.:

```
dataflow:> http post --target http://localhost:1234 --data "hello"
dataflow:> http post --target http://localhost:1234 --data "goodbye"
```

and the stream will then funnel the data from the http source to the output log implemented by the log sink

```
2016-06-01 09:50:22.121  INFO 79654 --- [  kafka-binder-] log.sink    : hello
2016-06-01 09:50:26.810  INFO 79654 --- [  kafka-binder-] log.sink    : goodbye
```

Of course, we could also change the sink implementation. You could pipe the output to a file (`file`), to hadoop (`hdfs`) or to any of the other sink apps which are available. You can also define your own apps.

13. Simple Stream Processing

As an example of a simple processing step, we can transform the payload of the HTTP posted data to upper case using the stream definitions

```
http | transform --expression=payload.toUpperCase() | log
```

To create this stream enter the following command in the shell

```
dataflow:> stream create --definition "http | transform --expression=payload.toUpperCase() | log" --name
 mystream --deploy
```

Posting some data (using a shell command)

```
dataflow:> http post --target http://localhost:1234 --data "hello"
```

Will result in an uppercased 'HELLO' in the log

```
2016-06-01 09:54:37.749  INFO 80083 --- [  kafka-binder-] log.sink    : HELLO
```

14. Stateful Stream Processing

To demonstrate the data partitioning functionality, let's deploy the following stream with Kafka as the binder.

```
dataflow:>stream create --name words --definition "http --server.port=9900 | splitter --
expression=payload.split(' ') | log"
Created new stream 'words'

dataflow:>stream deploy words --properties
 "app.splitter.producer.partitionKeyExpression=payload,app.log.count=2"
Deployed stream 'words'

dataflow:>http post --target http://localhost:9900 --data "How much wood would a woodchuck chuck if a
 woodchuck could chuck wood"
> POST (text/plain;Charset=UTF-8) http://localhost:9900 How much wood would a woodchuck chuck if a
 woodchuck could chuck wood
> 202 ACCEPTED
```

You'll see the following in the server logs.

```
2016-06-05 18:33:24.982  INFO 58039 --- [nio-9393-exec-9] o.s.c.d.spi.local.LocalAppDeployer       :
 deploying app words.log instance 0
   Logs will be in /var/folders/c3/ctx7_rns6x30tq7rb76wzqwr0000gp/T/spring-cloud-
dataflow-694182453710731989/words-1465176804970/words.log
2016-06-05 18:33:24.988  INFO 58039 --- [nio-9393-exec-9] o.s.c.d.spi.local.LocalAppDeployer       :
 deploying app words.log instance 1
   Logs will be in /var/folders/c3/ctx7_rns6x30tq7rb76wzqwr0000gp/T/spring-cloud-
dataflow-694182453710731989/words-1465176804970/words.log
```

Review the `words.log instance 0` logs:

```
2016-06-05 18:35:47.047  INFO 58638 --- [  kafka-binder-] log.sink                                 : How
2016-06-05 18:35:47.066  INFO 58638 --- [  kafka-binder-] log.sink                                 :
 chuck
2016-06-05 18:35:47.066  INFO 58638 --- [  kafka-binder-] log.sink                                 :
 chuck
```

Review the `words.log instance 1` logs:

```
2016-06-05 18:35:47.047  INFO 58639 --- [  kafka-binder-] log.sink                                 :
 much
2016-06-05 18:35:47.066  INFO 58639 --- [  kafka-binder-] log.sink                                 :
 wood
2016-06-05 18:35:47.066  INFO 58639 --- [  kafka-binder-] log.sink                                 :
 would
2016-06-05 18:35:47.066  INFO 58639 --- [  kafka-binder-] log.sink                                 : a
2016-06-05 18:35:47.066  INFO 58639 --- [  kafka-binder-] log.sink                                 :
 woodchuck
2016-06-05 18:35:47.067  INFO 58639 --- [  kafka-binder-] log.sink                                 : if
2016-06-05 18:35:47.067  INFO 58639 --- [  kafka-binder-] log.sink                                 : a
2016-06-05 18:35:47.067  INFO 58639 --- [  kafka-binder-] log.sink                                 :
 woodchuck
2016-06-05 18:35:47.067  INFO 58639 --- [  kafka-binder-] log.sink                                 :
 could
2016-06-05 18:35:47.067  INFO 58639 --- [  kafka-binder-] log.sink                                 :
 wood
```

This shows that payload splits that contain the same word are routed to the same application instance.

15. Tap a Stream

Taps can be created at various producer endpoints in a stream. For a stream like this:

```
stream create --definition "http | step1: transform --expression=payload.toUpperCase() | step2:
 transform --expression=payload+'!' | log" --name mainstream --deploy
```

taps can be created at the output of `http`, `step1` and `step2`.

To create a stream that acts as a 'tap' on another stream requires to specify the `source destination` name for the tap stream. The syntax for source destination name is:

```
`:<stream-name>.<label/app-name>`
```

To create a tap at the output of `http` in the stream above, the source destination name is `mainstream.http` To create a tap at the output of the first transform app in the stream above, the source destination name is `mainstream.step1`

The tap stream DSL looks like this:

```
stream create --definition ":mainstream.http > counter" --name tap_at_http --deploy

stream create --definition ":mainstream.step1 > jdbc" --name tap_at_step1_transformer --deploy
```

Note the colon (:) prefix before the destination names. The colon allows the parser to recognize this as a destination name instead of an app name.

16. Using Labels in a Stream

When a stream is comprised of multiple apps with the same name, they must be qualified with labels:

```
stream create --definition "http | firstLabel: transform --expression=payload.toUpperCase() |
 secondLabel: transform --expression=payload+'!' | log" --name myStreamWithLabels --deploy
```

17. Explicit Broker Destinations in a Stream

One can connect to a specific destination name located in the broker (Rabbit, Kafka etc.,) either at the `source` or at the `sink` position.

The following stream has the destination name at the `source` position:

```
stream create --definition ":myDestination > log" --name ingest_from_broker --deploy
```

This stream receives messages from the destination `myDestination` located at the broker and connects it to the `log` app.

The following stream has the destination name at the `sink` position:

```
stream create --definition "http > :myDestination" --name ingest_to_broker --deploy
```

This stream sends the messages from the `http` app to the destination `myDestination` located at the broker.

From the above streams, notice that the `http` and `log` apps are interacting with each other via the broker (through the destination `myDestination`) rather than having a pipe directly between `http` and `log` within a single stream.

It is also possible to connect two different destinations (`source` and `sink` positions) at the broker in a stream.

```
stream create --definition ":destination1 > :destination2" --name bridge_destinations --deploy
```

In the above stream, both the destinations (`destination1` and `destination2`) are located in the broker. The messages flow from the source destination to the sink destination via a `bridge` app that connects them.

18. Directed Graphs in a Stream

If directed graphs are needed instead of the simple linear streams described above, two features are relevant.

First, named destinations may be used as a way to combine the output from multiple streams or for multiple consumers to share the output from a single stream. This can be done using the DSL syntax `http > :mydestination` or `:mydestination > log`.

Second, you may need to determine the output channel of a stream based on some information that is only known at runtime. In that case, a router may be used in the sink position of a stream definition. For more information, refer to the Router Sink starter's README.

18.1 Common application properties

In addition to configuration via DSL, Spring Cloud Data Flow provides a mechanism for setting common properties to all the streaming applications that are launched by it. This can be done by adding properties prefixed with `spring.cloud.dataflow.applicationProperties.stream` when starting the server. When doing so, the server will pass all the properties, without the prefix, to the instances it launches.

For example, all the launched applications can be configured to use a specific Kafka broker by launching the configuration server with the following options:

```
--
spring.cloud.dataflow.applicationProperties.stream.spring.cloud.stream.kafka.binder.brokers=192.168.1.100:9092
--
spring.cloud.dataflow.applicationProperties.stream.spring.cloud.stream.kafka.binder.zkNodes=192.168.1.100:2181
```

This will cause the properties `stream.spring.cloud.stream.kafka.binder.brokers` and `spring.cloud.stream.kafka.binder.zkNodes` to be passed to all the launched applications.

Note

Properties configured using this mechanism have lower precedence than stream deployment properties. They will be overridden if a property with the same key is specified at stream deployment time (e.g. `app.http.spring.cloud.stream.kafka.binder.brokers` will override the common property).

Part IV. Tasks

This section goes into more detail about how you can work with Spring Cloud Tasks. It covers topics such as creating and running task applications.

If you're just starting out with Spring Cloud Data Flow, you should probably read the *Getting Started* guide before diving into this section.

19. Introducing Spring Cloud Task

A task executes a process on demand. In this case a task is a Spring Boot application that is annotated with `@EnableTask`. Hence a user launches a task that performs a certain process, and once complete the task ends. An example of a task would be a boot application that exports data from a JDBC repository to an HDFS instance. Tasks record the start time and the end time as well as the boot exit code in a relational database. The task implementation is based on the Spring Cloud Task project.

20. The Lifecycle of a task

Before we dive deeper into the details of creating Tasks, we need to understand the typical lifecycle for tasks in the context of Spring Cloud Data Flow:

1. Register a Task App
2. Create a Task Definition
3. Launch a Task
4. Task Execution
5. Destroy a Task Definition

20.1 Registering a Task Application

Register a Task App with the App Registry using the Spring Cloud Data Flow Shell `app register` command. You must provide a unique name and a URI that can be resolved to the app artifact. For the type, specify "task". Here are a few examples:

```
dataflow:>app register --name task1 --type task --uri maven://com.example:mytask:1.0.2

dataflow:>app register --name task2 --type task --uri file:///Users/example/mytask-1.0.2.jar

dataflow:>app register --name task3 --type task --uri http://example.com/mytask-1.0.2.jar
```

When providing a URI with the `maven` scheme, the format should conform to the following:

```
maven://<groupId>:<artifactId>[:<extension>[:<classifier>]]:<version>
```

If you would like to register multiple apps at one time, you can store them in a properties file where the keys are formatted as `<type>.<name>` and the values are the URIs. For example, this would be a valid properties file:

```
task.foo=file:///tmp/foo.jar
task.bar=file:///tmp/bar.jar
```

Then use the `app import` command and provide the location of the properties file via `--uri`:

```
app import --uri file:///tmp/task-apps.properties
```

You can also pass the `--local` option (which is TRUE by default) to indicate whether the properties file location should be resolved within the shell process itself. If the location should be resolved from the Data Flow Server process, specify `--local false`.

When using either `app register` or `app import`, if a task app is already registered with the provided name, it will not be overridden by default. If you would like to override the pre-existing task app, then include the `--force` option.

Note

In some cases the Resource is resolved on the server side, whereas in others the URI will be passed to a runtime container instance where it is resolved. Consult the specific documentation of each Data Flow Server for more detail.

20.2 Creating a Task

Create a Task Definition from a Task App by providing a definition name as well as properties that apply to the task execution. Creating a task definition can be done via the restful API or the shell. To create a task definition using the shell, use the `task create` command to create the task definition. For example:

```
dataflow:>task create mytask --definition "timestamp --format=\"yyyy\""
 Created new task 'mytask'
```

A listing of the current task definitions can be obtained via the restful API or the shell. To get the task definition list using the shell, use the `task list` command.

20.3 Launching a Task

An adhoc task can be launched via the restful API or via the shell. To launch an ad-hoc task via the shell use the `task launch` command. For Example:

```
dataflow:>task launch mytask
 Launched task 'mytask'
```

20.4 Reviewing Task Executions

Once the task is launched the state of the task is stored in a relational DB. The state includes:

- Task Name
- Start Time
- End Time
- Exit Code
- Exit Message
- Last Updated Time
- Parameters

A user can check the status of their task executions via the restful API or by the shell. To display the latest task executions via the shell use the `task execution list` command.

To get a list of task executions for just one task definition, add `--name` and the task definition name, for example `task execution list --name foo`. To retrieve full details for a task execution use the `task display` command with the id of the task execution , for example `task display --id 549`.

20.5 Destroying a Task

Destroying a Task Definition will remove the definition from the definition repository. This can be done via the restful API or via the shell. To destroy a task via the shell use the `task destroy` command. For Example:

```
dataflow:>task destroy mytask
 Destroyed task 'mytask'
```

The task execution information for previously launched tasks for the definition will remain in the task repository.

Note: This will not stop any currently executing tasks for this definition, this just removes the definition.

21. Task Repository

Out of the box Spring Cloud Data Flow offers an embedded instance of the H2 database. The H2 is good for development purposes but is not recommended for production use.

21.1 Configuring the Task Execution Repository

To add a driver for the database that will store the Task Execution information, a dependency for the driver will need to be added to a maven pom file and the Spring Cloud Data Flow will need to be rebuilt. Since Spring Cloud Data Flow is comprised of an SPI for each environment it supports, please review the SPI's documentation on which POM should be updated to add the dependency and how to build. This document will cover how to setup the dependency for local SPI.

Local

1. Open the spring-cloud-dataflow-server-local/pom.xml in your IDE.
2. In the `dependencies` section add the dependency for the database driver required. In the sample below postgresql has been chosen.

```
<dependencies>
...
    <dependency>
        <groupId>org.postgresql</groupId>
        <artifactId>postgresql</artifactId>
    </dependency>
...
</dependencies>
```

3. Save the changed pom.xml
4. Build the application as described here: Building Spring Cloud Data Flow

21.2 Datasource

To configure the datasource Add the following properties to the dataflow-server.yml or via environment variables:

a. spring.datasource.url

b. spring.datasource.username

c. spring.datasource.password

d. spring.datasource.driver-class-name

For example adding postgres would look something like this:

- Environment variables:

```
export spring_datasource_url=jdbc:postgresql://localhost:5432/mydb
export spring_datasource_username=myuser
export spring_datasource_password=mypass
export spring_datasource_driver-class-name="org.postgresql.Driver"
```

- dataflow-server.yml

```
spring:
  datasource:
    url: jdbc:postgresql://localhost:5432/mydb
    username: myuser
    password: mypass
    driver-class-name:org.postgresql.Driver
```

22. Subscribing to Task/Batch Events

You can also tap into various task/batch events when the task is launched. If the task is enabled to generate task and/or batch events (with the additional dependencies `spring-cloud-task-stream` and `spring-cloud-stream-binder-kafka`, in the case of Kafka as the binder), those events are published during the task lifecycle. By default, the destination names for those published events on the broker (rabbit, kafka etc.,) are the event names themselves (for instance: `task-events`, `job-execution-events` etc.,).

```
dataflow:>task create myTask --definition “myBatchJob"
dataflow:>task launch myTask
dataflow:>stream create task-event-subscriber1 --definition ":task-events > log" --deploy
```

You can control the destination name for those events by specifying explicit names when launching the task such as:

```
dataflow:>task launch myTask --properties "spring.cloud.stream.bindings.task-
events.destination=myTaskEvents"
dataflow:>stream create task-event-subscriber2 --definition ":myTaskEvents > log" --deploy
```

The default Task/Batch event and destination names on the broker are enumerated below:

Table 22.1. Task/Batch Event Destinations

Event	**Destination**
Task events	`task-events`
Job Execution events	`job-execution-events`
Step Execution events	`step-execution-events`
Item Read events	`item-read-events`
Item Process events	`item-process-events`
Item Write events	`item-write-events`
Skip events	`skip-events`

Part V. Dashboard

This section describe how to use the Dashboard of Spring Cloud Data Flow.

23. Introduction

Spring Cloud Data Flow provides a browser-based GUI which currently has 6 sections:

- **Apps** Lists all available applications and provides the control to register/unregister them
- **Runtime** Provides the Data Flow cluster view with the list of all running applications
- **Streams** Deploy/undeploy Stream Definitions
- **Tasks** List, create, launch and destroy Task Definitions
- **Jobs** Perform Batch Job related functions
- **Analytics** Create data visualizations for the various analytics applications

Upon starting Spring Cloud Data Flow, the Dashboard is available at:

`http://<host>:<port>/dashboard`

For example: http://localhost:9393/dashboard

If you have enabled https, then it will be located at `https://localhost:9393/dashboard`. If you have enabled security, a login form is available at `http://localhost:9393/dashboard/#/login`.

Note: The default Dashboard server port is 9393

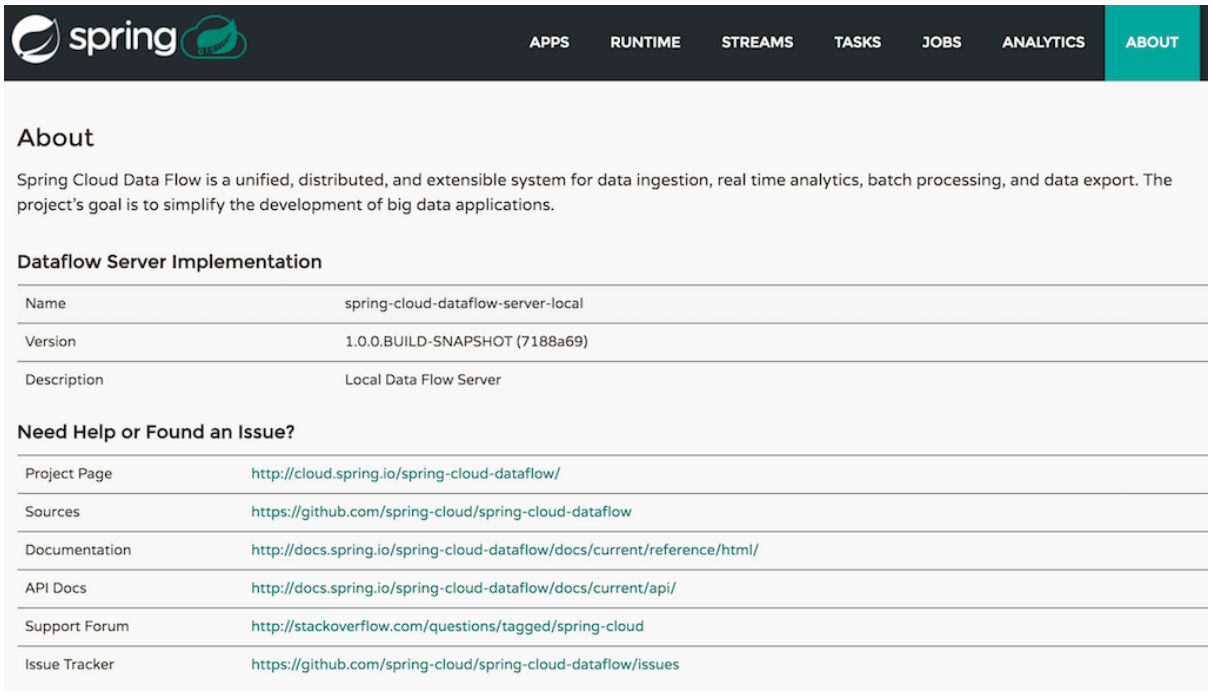

Figure 23.1. The Spring Cloud Data Flow Dashboard

24. Apps

The *Apps* section of the Dashboard lists all the available applications and provides the control to register/unregister them (if applicable). By clicking on the magnifying glass, you will get a listing of available definition properties.

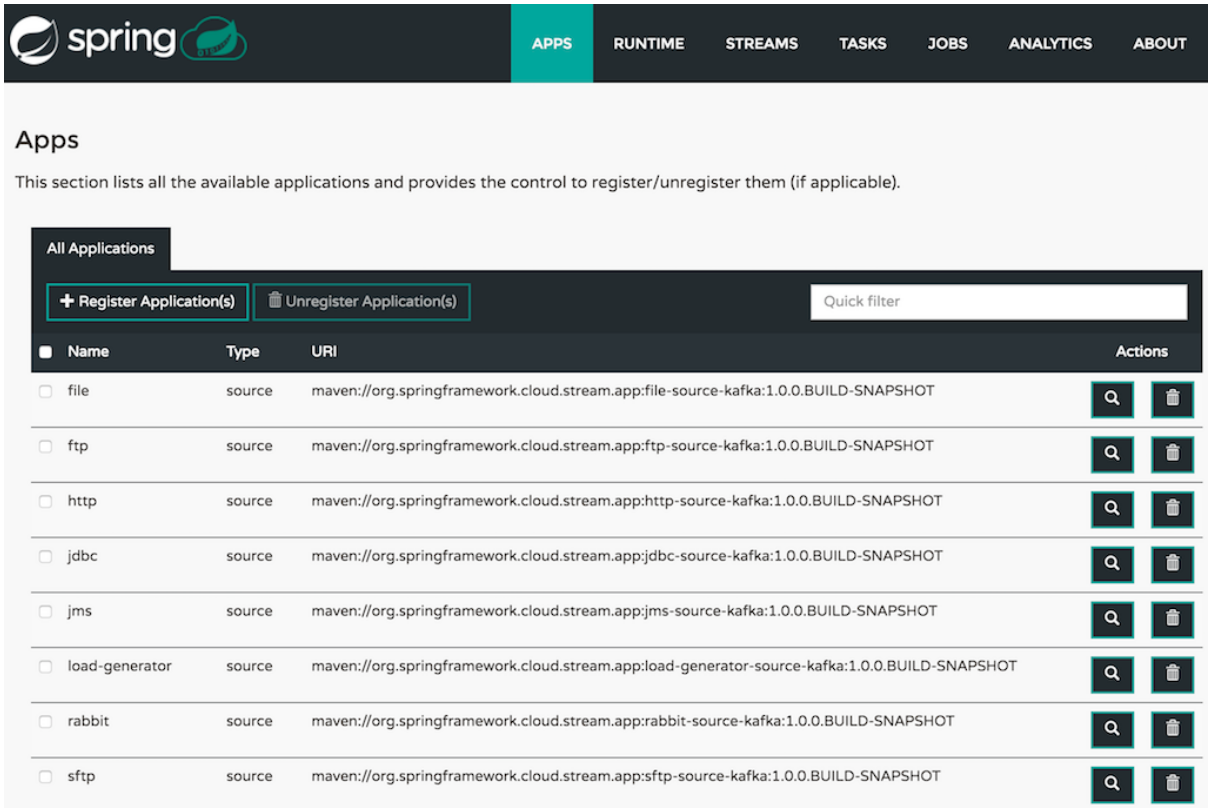

Figure 24.1. List of Available Applications

25. Runtime

The *Runtime* section of the Dashboard application shows the Spring Cloud Data Flow cluster view with the list of all running applications. For each runtime app the state of the deployment and the number of deployed instances is shown. A list of the used deployment properties is available by clicking on the app id.

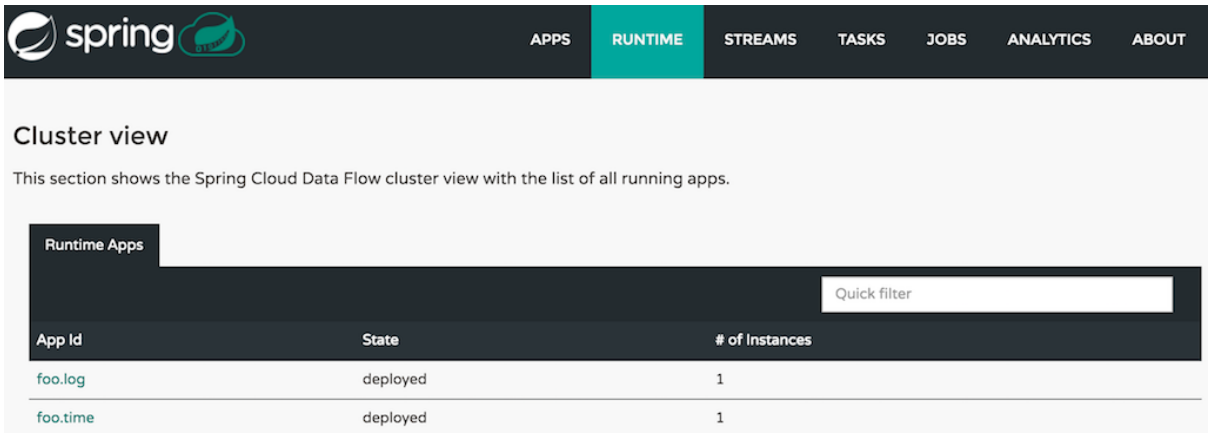

Figure 25.1. List of Running Applications

26. Streams

The *Streams* section of the Dashboard provides the *Definitions* tab that provides a listing of Stream definitions. There you have the option to **deploy** or **undeploy** those stream definitions. Additionally you can remove the definition by clicking on **destroy**.

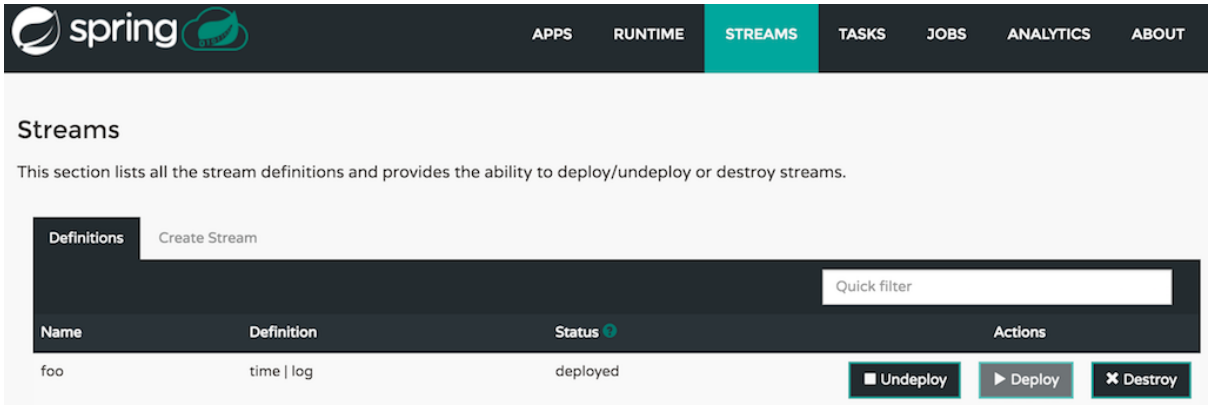

Figure 26.1. List of Stream Definitions

27. Create Stream

The *Create Stream* section of the Dashboard includes the Spring Flo designer tab that provides the canvas application, offering a interactive graphical interface for creating data pipelines.

In this tab, you can:

- Create, manage, and visualize stream pipelines using DSL, a graphical canvas, or both
- Write pipelines via DSL with content-assist and auto-complete
- Use auto-adjustment and grid-layout capabilities in the GUI for simpler and interactive organization of pipelines

Watch this screencast that highlights some of the "Flo for Spring Cloud Data Flow" capabilities. Spring Flo wiki includes more detailed content on core Flo capabilities.

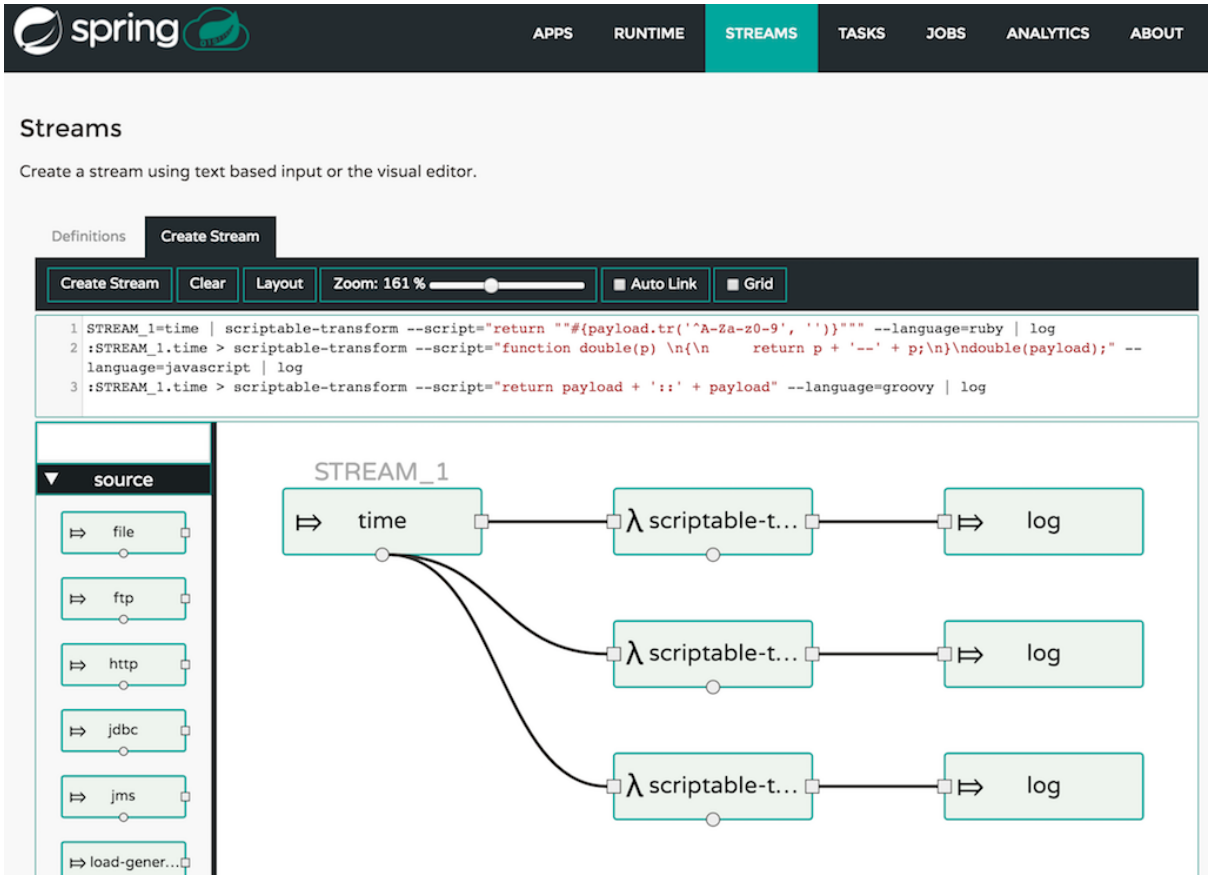

Figure 27.1. Flo for Spring Cloud Data Flow

28. Tasks

The *Tasks* section of the Dashboard currently has three tabs:

- Apps
- Definitions
- Executions

28.1 Apps

Apps encapsulate a unit of work into a reusable component. Within the Data Flow runtime environment *Apps* allow users to create definitions for *Streams* as well as *Tasks*. Consequently, the *Apps* tab within the *Tasks* section allows users to create *Task* definitions.

Note: You will also use this tab to create Batch Jobs.

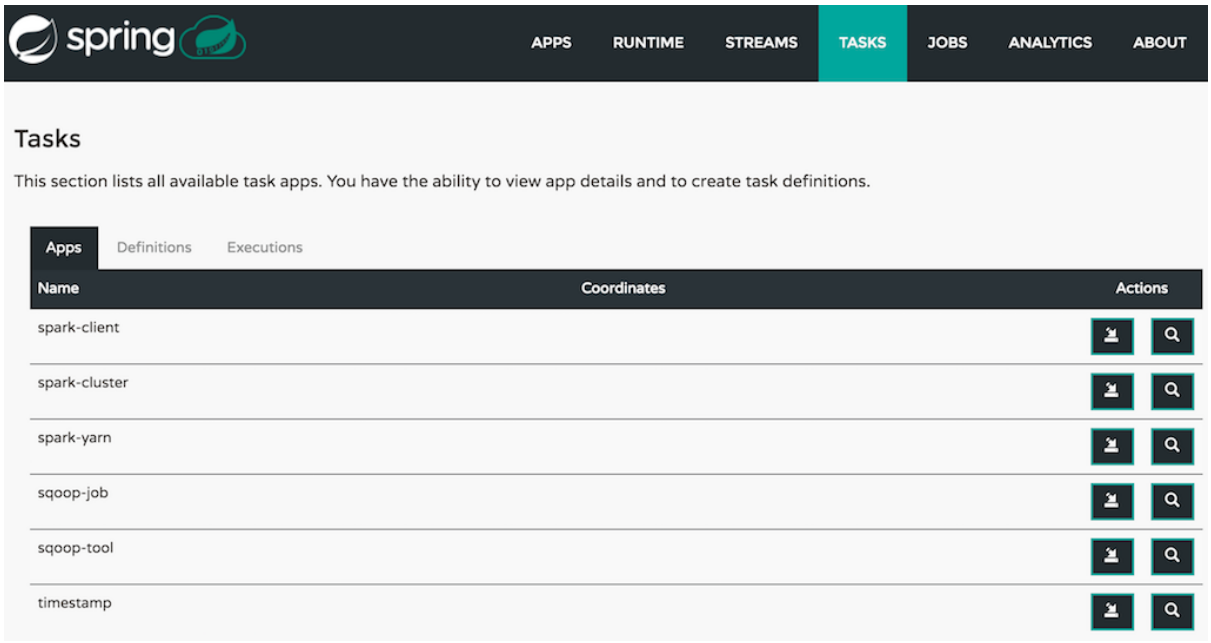

Figure 28.1. List of Task Apps

On this screen you can perform the following actions:

- View details such as the task app options.
- Create a Task Definition from the respective App.

Create a Task Definition from a selected Task App

On this screen you can create a new Task Definition. As a minimum you must provide a name for the new definition. You will also have the option to specify various properties that are used during the deployment of the app.

Note: Each parameter is only included if the *Include* checkbox is selected.

View Task App Details

On this page you can view the details of a selected task app, including the list of available options (properties) for that app.

28.2 Definitions

This page lists the Data Flow Task definitions and provides actions to **launch** or **destroy** those tasks.

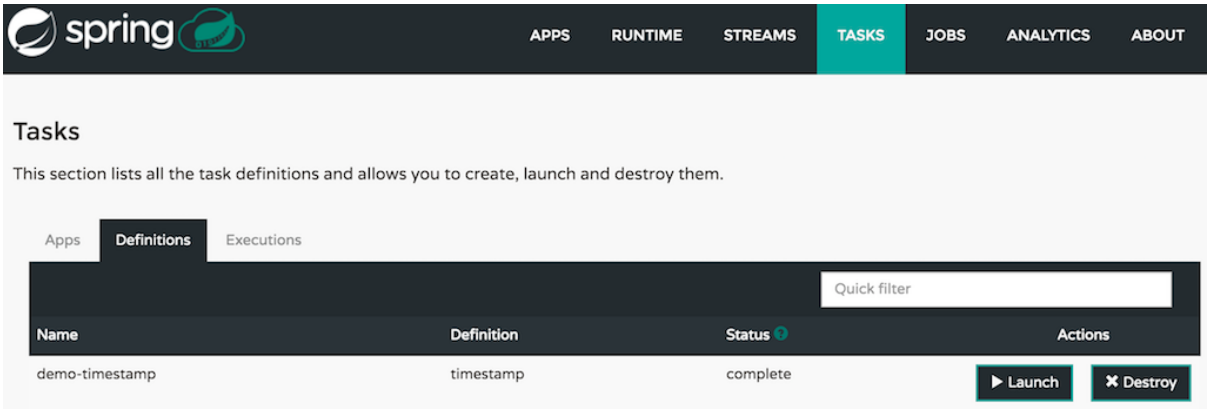

Figure 28.2. List of Task Definitions

Launching Tasks

Once the task definition is created, they can be launched through the Dashboard as well. Navigate to the **Definitions** tab. Select the Task you want to launch by pressing `Launch`.

On the following screen, you can define one or more Task parameters by entering:

- Parameter Key
- Parameter Value

Task parameters are not typed.

28.3 Executions

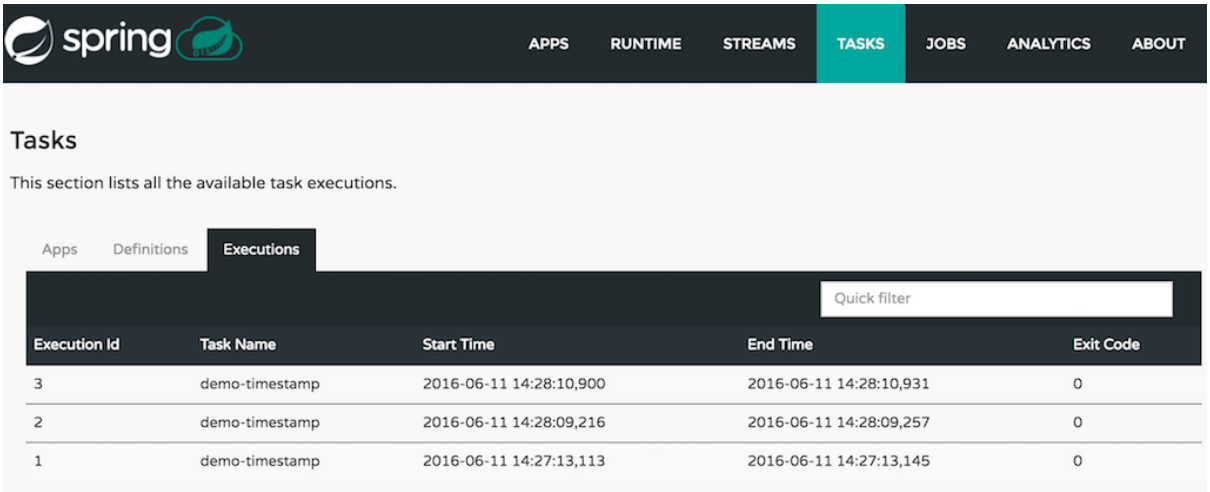

Figure 28.3. List of Task Executions

29. Jobs

The *Jobs* section of the Dashboard allows you to inspect **Batch Jobs**. The main section of the screen provides a list of Job Executions. **Batch Jobs** are **Tasks** that were executing one or more **Batch Job**. As such each Job Execution has a back reference to the **Task Execution Id** (Task Id).

In case of a failed job, you can also restart the task. When dealing with long-running Batch Jobs, you can also request to stop it.

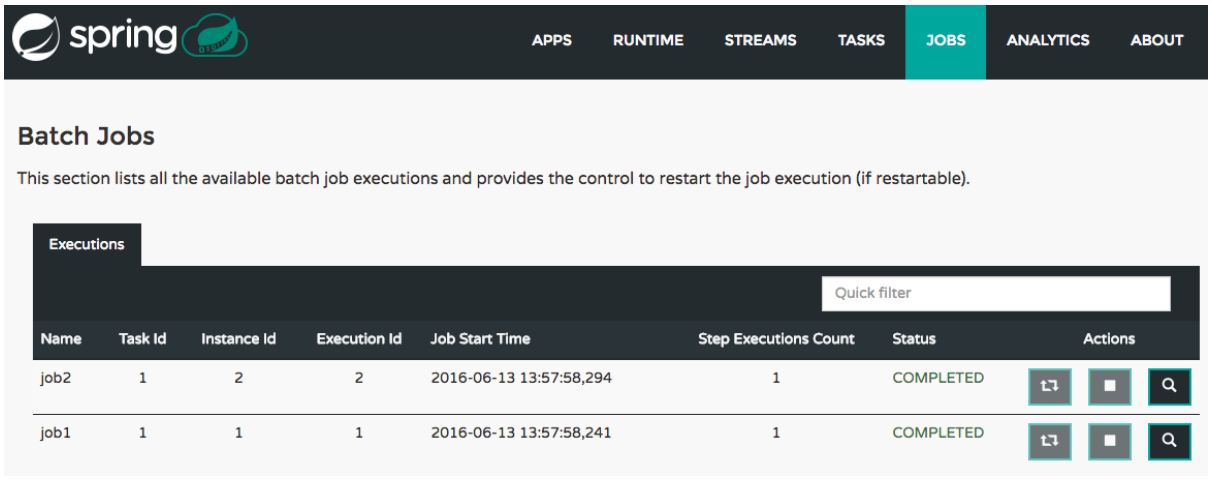

Figure 29.1. List of Job Executions

29.1 List job executions

This page lists the Batch Job Executions and provides the option to **restart** or **stop** a specific job execution, provided the operation is available. Furthermore, you have the option to view the Job execution details.

The list of Job Executions also shows the state of the underlying Job Definition. Thus, if the underlying definition has been deleted, *deleted* will be shown.

Job execution details

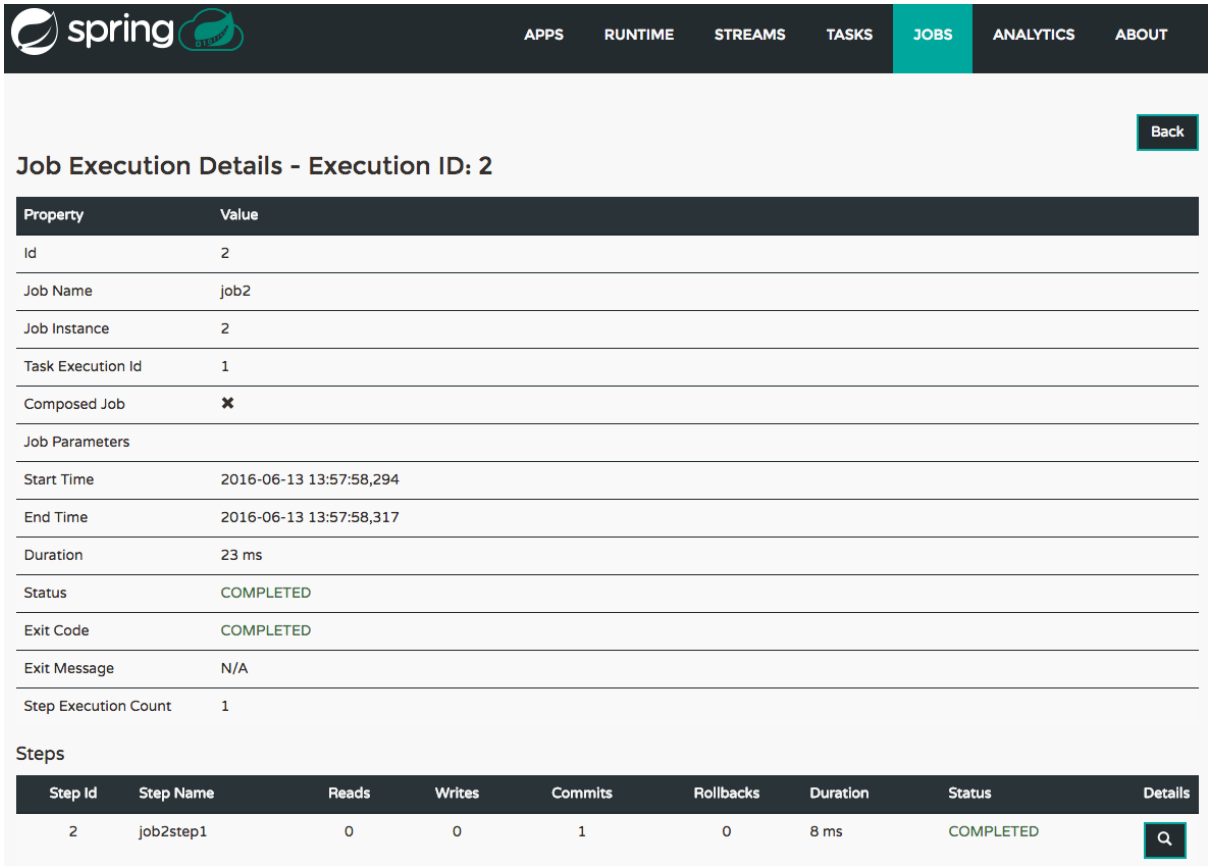

Figure 29.2. Job Execution Details

The Job Execution Details screen also contains a list of the executed steps. You can further drill into the *Step Execution Details* by clicking onto the magnifying glass.

Step execution details

On the top of the page, you will see progress indicator the respective step, with the option to refresh the indicator. Furthermore, a link is provided to view the *step execution history*.

The Step Execution details screen provides a complete list of all Step Execution Context key/value pairs.

Important

In case of exceptions, the *Exit Description* field will contain additional error information. Please be aware, though, that this field can only have a maximum of **2500 characters**. Therefore, in case of long exception stacktraces, trimming of error messages may occur. In that case, please refer to the server log files for further details.

Step Execution Progress

On this screen, you can see a progress bar indicator in regards to the execution of the current step. Under the **Step Execution History**, you can also view various metrics associated with the selected step such as **duration**, **read counts**, **write counts** etc.

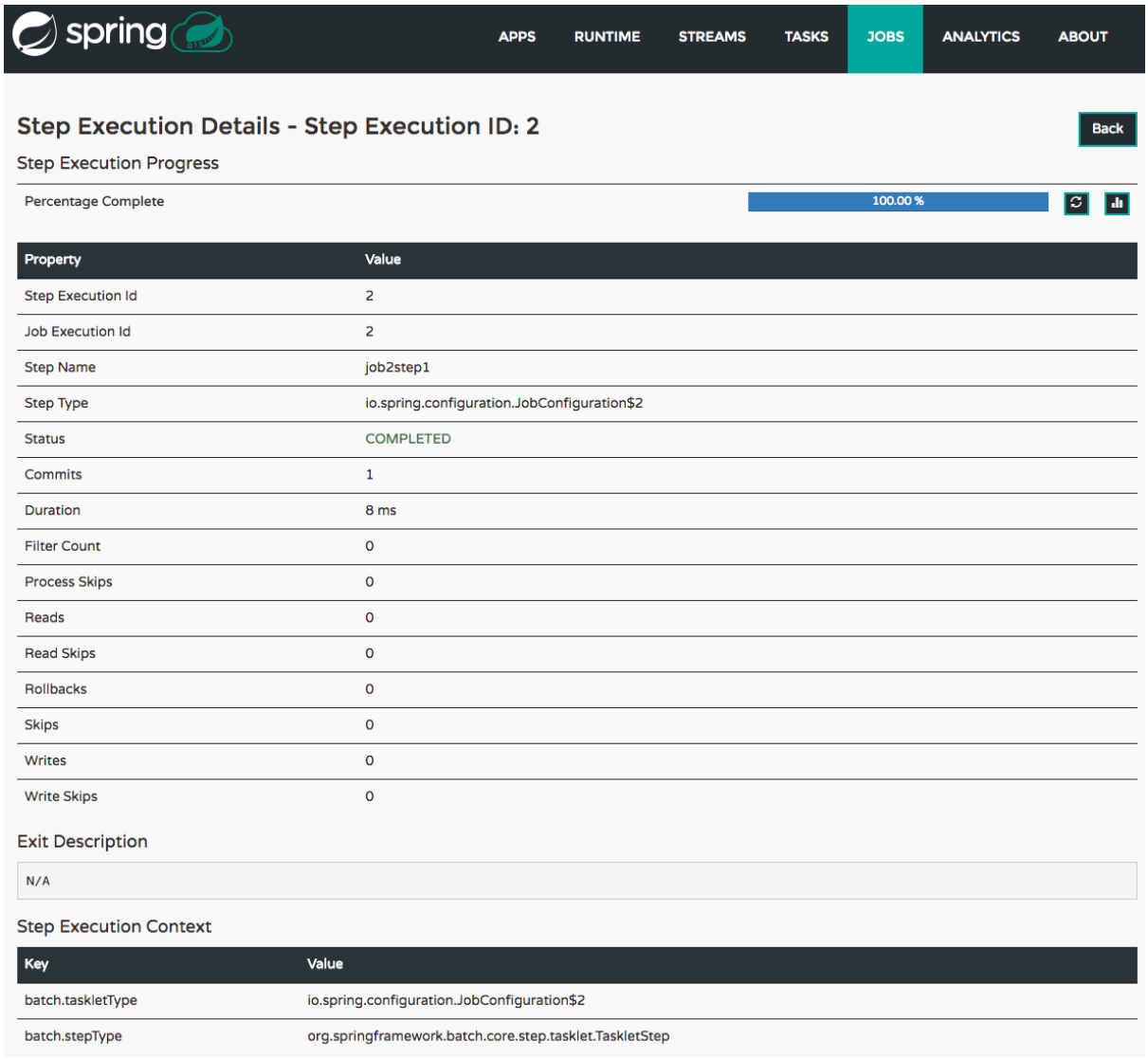

Figure 29.3. Step Execution History

30. Analytics

The *Analytics* section of the Dashboard provided data visualization capabilities for the various analytics applications available in *Spring Cloud Data Flow*:

- Counters
- Field-Value Counters

For example, if you have created the `springtweets` stream and the corresponding counter in the Counter chapter, you can now easily create the corresponding graph from within the **Dashboard** tab:

1. Under `Metric Type`, select `Counters` from the select box
2. Under `Stream`, select `tweetcount`
3. Under `Visualization`, select the desired chart option, `Bar Chart`

Using the icons to the right, you can add additional charts to the Dashboard, re-arange the order of created dashboards or remove data visualizations.

Part VI. Server Implementation

31. Server Properties

The Spring Data Flow Kubernetes Server has several properties you can configure that let you control the default values to set the `cpu` and `memory` requirements for the pods. The configuration is controlled by configuration properties under the `spring.cloud.deployer.kubernetes` prefix. For example you might declare the following section in an `application.properties` file or pass them as command line arguments when starting the Server.

```
spring.cloud.deployer.kubernetes.memory=512Mi
spring.cloud.deployer.kubernetes.cpu=500m
```

See KubernetesAppDeployerProperties for more of the supported options.

Data Flow Server properties that are common across all of the Data Flow Server implementations that concern maven repository settings can also be set in a similar manner. See the section on Common Data Flow Server Properties for more information.

Part VII. Appendices

Appendix A. Building

To build the source you will need to install JDK 1.7.

The build uses the Maven wrapper so you don't have to install a specific version of Maven. To enable the tests for Redis you should run the server before bulding. See below for more information on how run Redis.

The main build command is

```
$ ./mvnw clean install
```

You can also add '-DskipTests' if you like, to avoid running the tests.

Note

You can also install Maven (>=3.3.3) yourself and run the `mvn` command in place of `./mvnw` in the examples below. If you do that you also might need to add `-P spring` if your local Maven settings do not contain repository declarations for spring pre-release artifacts.

Note

Be aware that you might need to increase the amount of memory available to Maven by setting a `MAVEN_OPTS` environment variable with a value like `-Xmx512m -XX:MaxPermSize=128m`. We try to cover this in the `.mvn` configuration, so if you find you have to do it to make a build succeed, please raise a ticket to get the settings added to source control.

The projects that require middleware generally include a `docker-compose.yml`, so consider using Docker Compose to run the middeware servers in Docker containers. See the README in the scripts demo repository for specific instructions about the common cases of mongo, rabbit and redis.

A.1 Documentation

There is a "full" profile that will generate documentation. You can build just the documentation by executing

```
$ ./mvnw clean package -DskipTests -P full -pl {project-artifactId} -am
```

A.2 Working with the code

If you don't have an IDE preference we would recommend that you use Spring Tools Suite or Eclipse when working with the code. We use the m2eclipe eclipse plugin for maven support. Other IDEs and tools should also work without issue.

Importing into eclipse with m2eclipse

We recommend the m2eclipe eclipse plugin when working with eclipse. If you don't already have m2eclipse installed it is available from the "eclipse marketplace".

Unfortunately m2e does not yet support Maven 3.3, so once the projects are imported into Eclipse you will also need to tell m2eclipse to use the `.settings.xml` file for the projects. If you do not do this you may see many different errors related to the POMs in the projects. Open your Eclipse preferences,

expand the Maven preferences, and select User Settings. In the User Settings field click Browse and navigate to the Spring Cloud project you imported selecting the `.settings.xml` file in that project. Click Apply and then OK to save the preference changes.

Note

Alternatively you can copy the repository settings from `.settings.xml` into your own `~/.m2/settings.xml`.

Importing into eclipse without m2eclipse

If you prefer not to use m2eclipse you can generate eclipse project metadata using the following command:

```
$ ./mvnw eclipse:eclipse
```

The generated eclipse projects can be imported by selecting `import existing projects` from the `file` menu.

Appendix B. Contributing

Spring Cloud is released under the non-restrictive Apache 2.0 license, and follows a very standard Github development process, using Github tracker for issues and merging pull requests into master. If you want to contribute even something trivial please do not hesitate, but follow the guidelines below.

B.1 Sign the Contributor License Agreement

Before we accept a non-trivial patch or pull request we will need you to sign the contributor's agreement. Signing the contributor's agreement does not grant anyone commit rights to the main repository, but it does mean that we can accept your contributions, and you will get an author credit if we do. Active contributors might be asked to join the core team, and given the ability to merge pull requests.

B.2 Code Conventions and Housekeeping

None of these is essential for a pull request, but they will all help. They can also be added after the original pull request but before a merge.

- Use the Spring Framework code format conventions. If you use Eclipse you can import formatter settings using the `eclipse-code-formatter.xml` file from the Spring Cloud Build project. If using IntelliJ, you can use the Eclipse Code Formatter Plugin to import the same file.
- Make sure all new `.java` files to have a simple Javadoc class comment with at least an `@author` tag identifying you, and preferably at least a paragraph on what the class is for.
- Add the ASF license header comment to all new `.java` files (copy from existing files in the project)
- Add yourself as an `@author` to the .java files that you modify substantially (more than cosmetic changes).
- Add some Javadocs and, if you change the namespace, some XSD doc elements.
- A few unit tests would help a lot as well — someone has to do it.
- If no-one else is using your branch, please rebase it against the current master (or other target branch in the main project).
- When writing a commit message please follow these conventions, if you are fixing an existing issue please add `Fixes gh-XXXX` at the end of the commit message (where XXXX is the issue number).