Writing Streaming Queries Against Apache Kafka® Using KSQL (Local)

This tutorial demonstrates a simple workflow using KSQL to write streaming queries against messages in Kafka.

To get started, you must start a Kafka cluster, including ZooKeeper and a Kafka broker. KSQL will then query messages from this Kafka cluster. KSQL is installed in the Confluent Platform by default.

Prerequisites:

- Confluent Platform is installed and running. This installation includes a Kafka broker, KSQL, Control Center, ZooKeeper, Schema Registry, REST Proxy, and Kafka Connect.
- If you installed Confluent Platform via TAR or ZIP, navigate into the installation directory. The paths and commands used throughout this tutorial assume that your are in this installation directory.
- Java: Minimum version 1.8. Install Oracle Java JRE or JDK >= 1.8 on your local machine

Create Topics and Produce Data

Create and produce data to the Kafka topics `pageviews` and `users`. These steps use the KSQL datagen that is included Confluent Platform.

1. Create the `pageviews` topic and produce data using the data generator. The following example continuously generates data with a value in DELIMITED format.

```
2. $ <path-to-confluent>/bin/ksql-datagen quickstart=pageviews format=delimited topic=pageviews maxInterval=500
```

3. Produce Kafka data to the `users` topic using the data generator. The following example continuously generates data with a value in JSON format.

```
4. $ <path-to-confluent>/bin/ksql-datagen quickstart=users format=json topic=users maxInterval=100
```

Tip

You can also produce Kafka data using the `kafka-console-producer` CLI provided with Confluent Platform.

Launch the KSQL CLI

To launch the CLI, run the following command. It will route the CLI logs to the `./ksql_logs` directory, relative to your current directory. By default, the CLI will look for a KSQL Server running at `http://localhost:8088`.

```
$ LOG_DIR=./ksql_logs <path-to-confluent>/bin/ksql
```

Important

By default KSQL attempts to store its logs in a directory called `logs` that is relative to the location of the `ksql` executable. For example, if `ksql` is installed at `/usr/local/bin/ksql`, then it would attempt to store its logs in `/usr/local/logs`. If you are running `ksql` from the default Confluent Platform location, `<path-to-confluent>/bin`, you must override this default behavior by using the `LOG_DIR` variable.

After KSQL is started, your terminal should resemble this.

```
                  ===========================================
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                  =  Streaming SQL Engine for Apache Kafka® =
                  ===========================================

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CLI v4.1.2, Server v4.1.2 located at http://localhost:8088

Having trouble? Type 'help' (case-insensitive) for a rundown of how things work!

ksql>
```
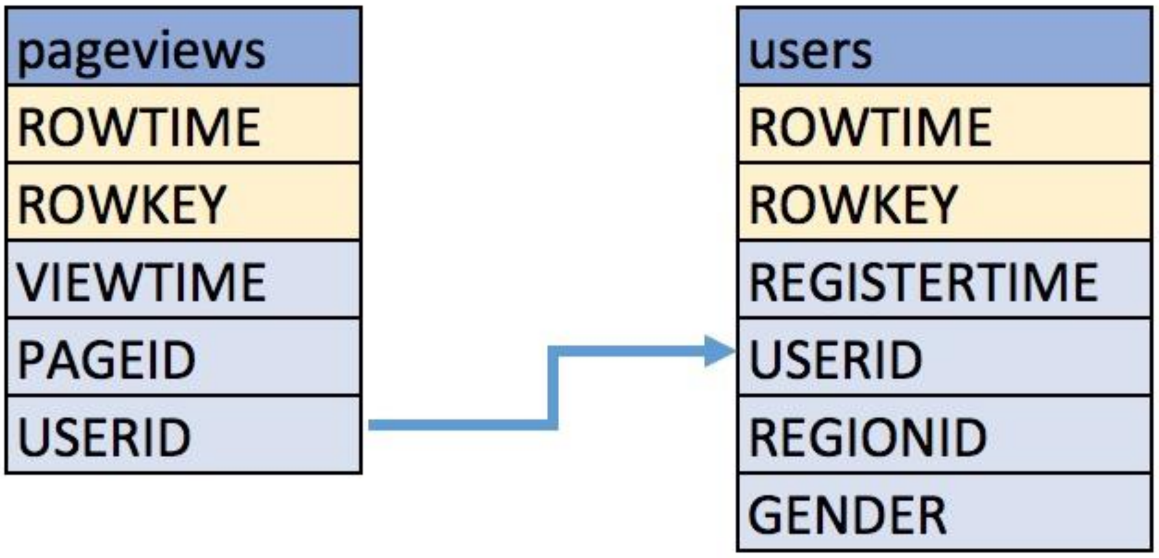

Create a Stream and Table

These examples query messages from Kafka topics called `pageviews` and `users` using the following schemas:



1. Create a stream `pageviews_original` from the Kafka topic `pageviews`, specifying the `value_format` of `DELIMITED`.

   Describe the new STREAM. Notice that KSQL created additional columns called `ROWTIME`, which corresponds to the Kafka message timestamp, and `ROWKEY`, which corresponds to the Kafka message key.

```
CREATE STREAM pageviews_original (viewtime bigint, userid varchar, pageid varchar) WITH
\
(kafka_topic='pageviews', value_format='DELIMITED');
```

   Your output should resemble:

```
 Message
---------------
 Stream created
---------------
```

Tip

You can run `DESCRIBE pageviews_original;` to describe the stream.

2. Create a table `users_original` from the Kafka topic `users`, specifying the `value_format` of `JSON`.

```
3.  CREATE TABLE users_original (registertime BIGINT, gender VARCHAR, regionid VARCHAR, use
    rid VARCHAR) WITH \
4.  (kafka_topic='users', value_format='JSON', key = 'userid');
```

   Your output should resemble:

```
 Message
---------------
 Table created
```

```
---------------
```

Tip

You can run `DESCRIBE users_original;` to describe the table.

5. Optional: Show all streams and tables.

```
ksql> SHOW STREAMS;

 Stream Name                | Kafka Topic                 | Format
-----------------------------------------------------------------
 PAGEVIEWS_ORIGINAL         | pageviews                   | DELIMITED

ksql> SHOW TABLES;

 Table Name         | Kafka Topic        | Format     | Windowed
--------------------------------------------------------------
 USERS_ORIGINAL     | users              | JSON       | false
```

Write Queries

These examples write queries using KSQL.

Note: By default KSQL reads the topics for streams and tables from the latest offset.

1. Use `SELECT` to create a query that returns data from a STREAM. This query includes the `LIMIT` keyword to limit the number of rows returned in the query result. Note that exact data output may vary because of the randomness of the data generation.

```
SELECT pageid FROM pageviews_original LIMIT 3;
```

Your output should resemble:

```
Page_24
Page_73
Page_78
LIMIT reached for the partition.
Query terminated
```

3. Create a persistent query by using the `CREATE STREAM` keywords to precede the `SELECT` statement. The results from this query are written to the `PAGEVIEWS_ENRICHED` Kafka topic. The following query enriches the `pageviews_original` STREAM by doing a `LEFT JOIN` with the `users_original` TABLE on the user ID.

```
CREATE STREAM pageviews_enriched AS SELECT users_original.userid AS userid, pageid, reg
ionid, gender \
5.  FROM pageviews_original LEFT JOIN users_original ON pageviews_original.userid = users_o
    riginal.userid;
```

Your output should resemble:

```
 Message
----------------------------
 Stream created and running
----------------------------
```

Tip

You can run `DESCRIBE pageviews_enriched;` to describe the stream.

6. Use `SELECT` to view query results as they come in. To stop viewing the query results, press `<ctrl-c>`. This stops printing to the console but it does not terminate the actual query. The query continues to run in the underlying KSQL application.

```
7.  SELECT * FROM pageviews_enriched;
```

Your output should resemble:

```
1519746861328 | User_4 | User_4 | Page_58 | Region_5 | OTHER
1519746861794 | User_9 | User_9 | Page_94 | Region_9 | MALE
1519746862164 | User_1 | User_1 | Page_90 | Region_7 | FEMALE
^CQuery terminated
```

8. Create a new persistent query where a condition limits the streams content, using `WHERE`. Results from this query are written to a Kafka topic called `PAGEVIEWS_FEMALE`.

```
9.  CREATE STREAM pageviews_female AS SELECT * FROM pageviews_enriched WHERE gender = 'FEMA
    LE';
```

Your output should resemble:

```
 Message
----------------------------
 Stream created and running
----------------------------
```

Tip

You can run `DESCRIBE pageviews_female;` to describe the stream.

10. Create a new persistent query where another condition is met, using `LIKE`. Results from this query are written to the `pageviews_enriched_r8_r9` Kafka topic.

```
11. CREATE STREAM pageviews_female_like_89 WITH (kafka_topic='pageviews_enriched_r8_r9', \
12. value_format='DELIMITED') AS SELECT * FROM pageviews_female WHERE regionid LIKE '%_8' OR regionid LIKE '%_9';
```

Your output should resemble:

```
 Message
----------------------------
 Stream created and running
----------------------------
```

13. Create a new persistent query that counts the pageviews for each region and gender combination in a tumbling window of 30 seconds when the count is greater than 1. Results from this query are written to the `PAGEVIEWS_REGIONS` Kafka topic in the Avro format. KSQL will register the Avro schema with the configured Schema Registry when it writes the first message to the `PAGEVIEWS_REGIONS` topic.

```
14. CREATE TABLE pageviews_regions WITH (value_format='avro') AS SELECT gender, regionid , COUNT(*) AS numusers \
15. FROM pageviews_enriched WINDOW TUMBLING (size 30 second) GROUP BY gender, regionid HAVING COUNT(*) > 1;
```

Your output should resemble:

```
 Message
---------------------------
 Table created and running
---------------------------
```

Tip

You can run `DESCRIBE pageviews_regions;` to describe the table.

16. Optional: View results from the above queries using `SELECT`.

```
17. SELECT gender, regionid, numusers FROM pageviews_regions LIMIT 5;
```

Your output should resemble:

```
FEMALE | Region_6 | 3
FEMALE | Region_1 | 4
FEMALE | Region_9 | 6
MALE | Region_8 | 2
OTHER | Region_5 | 4
LIMIT reached for the partition.
Query terminated
ksql>
```

18. Optional: Show all persistent queries.

```
19. SHOW QUERIES;
```

Your output should resemble:

```
Query ID                        | Kafka Topic               | Query String
--------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------
-------------------------
CTAS_PAGEVIEWS_REGIONS          | PAGEVIEWS_REGIONS         | CREATE TABLE pageviews_regio
ns WITH (value_format='avro') AS SELECT gender, regionid , COUNT(*) AS numusers FROM pa
geviews_female WINDOW TUMBLING (size 30 second) GROUP BY gender, regionid HAVING COUNT(
*) > 1;
CSAS_PAGEVIEWS_FEMALE           | PAGEVIEWS_FEMALE          | CREATE STREAM pageviews_fema
le AS SELECT users_original.userid AS userid, pageid, regionid, gender FROM pageviews_o
riginal LEFT JOIN users_original ON pageviews_original.userid = users_original.userid W
HERE gender = 'FEMALE';
CSAS_PAGEVIEWS_FEMALE_LIKE_89 | pageviews_enriched_r8_r9 | CREATE STREAM pageviews_fema
le_like_89 WITH (kafka_topic='pageviews_enriched_r8_r9', value_format='DELIMITED') AS S
ELECT * FROM pageviews_female WHERE regionid LIKE '%_8' OR regionid LIKE '%_9';
--------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------
-------------------------
```

Terminate and Exit

KSQL

Important: Queries will continuously run as KSQL applications until they are manually terminated. Exiting KSQL does not terminate persistent queries.

1. From the output of `SHOW QUERIES;` identify a query ID you would like to terminate. For example, if you wish to terminate query ID `CTAS_PAGEVIEWS_REGIONS`:

```
2.  TERMINATE CTAS_PAGEVIEWS_REGIONS;
```

3. Run the `exit` command to leave the KSQL CLI.

```
4.  ksql> exit
```

```
Exiting KSQL.
```