Hewlett Packard Enterprise

Integrating with Apache Kafka

HPE Vertica Analytic Database

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Contents

Kafka Integration Terms

Vertica integrates with Kafka through a number of components. To use Vertica with Kafka, you should be familiar with these terms.

Kafka Terminology

Kafka Term	Description
Broker	A Kafka server.
Topic	A feed of messages in a common category which streams into the same Vertica target tables.
Partition	Unit of parallelism within Kafka. Kafka splits a topic into multiple partitions, which can each be served in parallel to consumers such as a Vertica database. Within a partition, all messages are time ordered.
Offset	An index into a partition. This index is the position within an ordered queue of messages, not an index into an opaque byte stream.
Message	A unit of data within Kafka. The data is typically in JSON or AVRO format. Messages are loaded as rows into Vertica tables, and are uniquely identified by their topic, partition, and offset.

Data Loader Terminology

Data Loader Term	Description
Job scheduler	A tool for continuous loading of data from Kafka into Vertica.
Micro-batch	A pair of statements that: a) load data from all topics configured for this micro-batch into a Vertica target table;

Data Loader Term	Description
	and b) update the progress within the streams. Being an atomic transaction, the micro-batch will roll back if any part of these operations fail so that each message is loaded exactly once.
Frame	Duration of time in which the scheduler will attempt to load each configured topic once.
Stream	A feed of messages from Kafka that is identified by a topic and partition. The offset uniquely identifies the position within a particular topic-partition stream.
Lane	A thread within a job scheduler instance that issues micro-batches to perform the load. The number of lanes available is based on the PlannedConcurrency of the job scheduler's resource pool. Multiple lanes allow for parallelism of micro-batches during a frame.

How Vertica and Apache Kafka Work Together

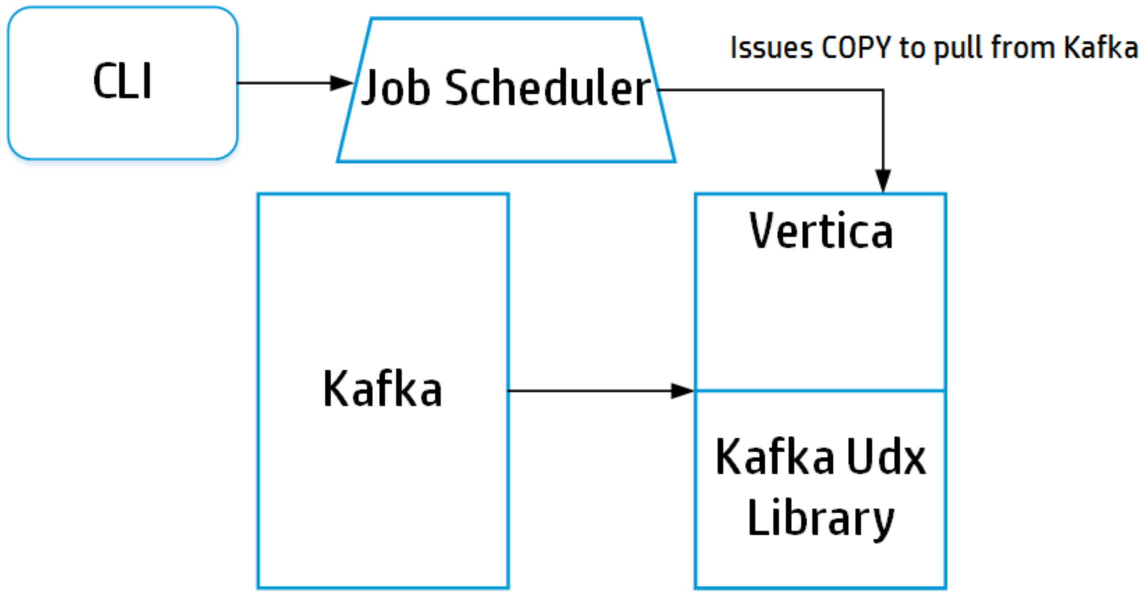
Vertica provides a high-performance loading mechanism for streaming data from an Apache Kafka message bus into your Vertica database.

Kafka is designed for a streaming use case (high volumes of data with low latency). In Vertica, you can achieve this streaming effect by running many COPY statements, each of which loads small amounts of data into your Vertica database. However, this process can become complex. Instead of writing complicated ETL processes and dispatching COPY statements manually, you can use the Kafka integration feature to automatically load data as it streams through Kafka.

The integration feature between Vertica and Kafka consists of:

- A UDL library that loads data from a Kafka message bus into Vertica
- A job scheduler that uses the UDL library to continuously consume data from Kafka with exactly-once semantics

This process contributes to low latency and minimal impact on the other processes on the database. You can think of Kafka as a temporary buffer between two systems: one that generates data, and your Vertica database, which consumes this data.



Kafka Job Scheduler

The Kafka *job scheduler* is a tool for continuous loading of data from Kafka into Vertica. The scheduler comes pre-packaged and installed with the Vertica rpm. The scheduler needs to make a JDBC connection to the target database, and requires Java 7.0 or later to run. You can use the scheduler from any node by running the vkconfig script:

/opt/vertica/packages/kafka/bin/vkconfig

Note: If you do not want the scheduler to use Vertica host resources, or if you want to limit user access to the Vertica nodes, install the RPM on the host but do not create a database.

What the Scheduler Does

A scheduler instance works by creating frames and issuing micro-batches that load data from Kafka into tables in your Vertica database. The scheduler loads all (enabled) Kafka topics to Vertica target tables during a single frame duration and continuously schedules frames as one completes.

You can add as many topics as you want to a single scheduler. Doing so allows the scheduler to collect all data from all these topics every single frame. This option is helpful if you have a large number of topics.

What Happens When You Create a Scheduler

When you create a new scheduler, three events occur:

- The script creates a new Vertica schema with a name you specify (default is kafka_config). You use this name to identify the scheduler during configuration.
- The script creates Kafka Schema Tables for the Vertica schema.
- The script creates the resource pool kafka_default_pool, if it does not already exist.

When the script creates the schema and associated tables, it sets the LOCKTIMEOUT configuration parameter to 0 for the session running the micro-batches. When LOCKTIMEOUT is 0, data loads continuously because the scheduler does not have to wait for a lock to be released.

The script creates the resource pool with defaults that benefit loading data from Kafka into Vertica. While you can alter this pool to your business needs, Hewlett Packard Enterprise strongly recommends following these guidelines:

- Leave the QUEUETIMEOUT parameter set to 0 (default for job scheduler resource pools) so that data loads continuously. If the scheduler has to wait for resources, it cannot progress, causing scheduling configurations to be compromised.
- Leave reflexive moveout turned on (this option is on automatically when you create a scheduler). With reflexive moveout turned on, the Tuple Mover automatically performs a moveout operation when data is committed so that your WOS always has space to load data.

Launching a Scheduler

To launch a scheduler, you must have a running Kafka instance in a place Vertica can access. Additionally, you must configure the scheduler and set up Kafka topics for streaming.

When you launch a scheduler, the scheduler collects data from Kafka topic or topics, starting at the specified offset. You can view the kafka_offsets table to see what the scheduler is doing at any given time.

To learn how to create, configure, and launch a scheduler, see Using Kafka with Vertica in this guide.

You can also choose to bypass the scheduler. For example, you might want to do a single load with a specific range of offsets. For more information, see Using COPY with Kafka in this guide.

Launching Multiple Schedulers for High Availability

For high availability, you can launch two or more identical schedulers that target the same configuration schema. You can differentiate these different schedulers using the `--instance-name` CLI option with the launch utility. The scheduler not in use remains in stand-by mode and can only perform scheduling if the active scheduler fails. In this case, the stand-by process will allow the stream to continue without interruption.

Using Kafka with Vertica

To begin using Kafka and Vertica, use the vkconfig script to complete the following tasks from your Vertica database:

- Create and Configure a Scheduler
- Create a Data Table
- Associate a Topic
- Edit a Topic
- Launch a Scheduler

Create and Configure Scheduler

Your first step to using Kafka with Vertica is to create a new scheduler. Create a new scheduler using the vkconfig script with the `scheduler` sub-utility and `--add` option:

```
/opt/vertica/packages/kafka/bin/vkconfig scheduler --add
```

The `--add` option is all that is required to add a scheduler with default options.

You can use additional configuration parameters to further customize your scheduler.

The following example shows how you can use the commands to:

- Create a scheduler called "myScheduler" with the --`config-schema` option.
- Grant privileges to run the scheduler to user1 with the `--operator` option. The dbadmin user must specify user1's additional privileges separately.

```
/opt/vertica/packages/kafka/bin/vkconfig scheduler --add --config-schema myScheduler --operator
user1
```

See the Scheduler Utility table in the Kafka Utility Options section of this guide for more information.

Create a Data Table

Before configuring a Kafka topic for streaming, create a target table in your Vertica database to store the data you capture. If you are not using flexible tables, you must verify that the data you are streaming matches the columns in your target table.

```
CREATE FLEX TABLE public.kafka_tgt();
```

You do not need to create a rejection table, which stores rejected messages, because the table is created automatically when you run the `topic` utility.

Associate a Topic

To associate a Kafka topic with a configured scheduler, use the `topic` sub-utility.

The following example shows how you can associate a Kafka topic, messages, and four of its partitions to the default "kafka_config" scheduler. After you launch the scheduler, data from the “messages” topic streams into the public.kafka_tgt table. Vertica stores any rejections in the public.kafka_rej table.

```
/opt/vertica/packages/kafka/bin/vkconfig topic --add --target public.kafka_tgt --rejection-table
public.kafka_rej --topic messages --num-partitions 4
```

See the Topic Utility table in the Kafka Utility Options section of this guide for more information about utility options.

Edit a Topic

Once you have created a topic, you can edit it using the `edit` sub-utility. You can edit all Kafka Utility Options using the `edit` sub-utility.

The following example shows how you can edit a topic to use a different target and number of partitions.

```
/opt/vertica/packages/kafka/bin/vkconfig topic --edit --topic test --target public.staging --num-
```

```
partitions 2
```

Launch a Scheduler

After you create a table and associate a topic, you are ready to launch the scheduler and start streaming data. Launch a configured scheduler by using the `launch` sub-utility.

The following example launches the default scheduler, kafka_config, and specifies a properties file, configFile.properties, which contains additional CLI options. To start a different scheduler, use the `--config-schema` parameter option.

```
/opt/vertica/packages/kafka/bin/vkconfig launch --conf configFile.properties
```

Important: Hewlett Packard Enterprise does not recommend specifying a password on the command line. Instead, put the password in a properties file.

See the Launch Utility table in the Kafka Utility Options section of this guide for more information.

Using COPY with Kafka

When a job scheduler instance loads data into a Vertica database, it issues COPY statements similar to the following:

```
=> COPY schema.target_table SOURCE KafkaSource (stream='topic1|1|1,topic2|2|2',
brokers='host1:9092,
                                                host2:9092',duration= INTERVAL'timeslice',stop_on_
eof=TRUE,
                                                eof_timeout= INTERVAL'timeslice')
        PARSER KafkaJSONParser(flatten_arrays=False, flatten_maps=False)
           REJECTED DATA AS TABLE schema.rejection_table TRICKLE;
```

The above statement is just an example; with the job scheduler you do not need to have in-depth knowledge of the COPY statement because the scheduler will issue them all for you.

When you use COPY TRICKLE, Hewlett Packard Enterprise recommends enabling the ReflexiveMoveout configuration parameter to trigger a Tuple Mover moveout task every time a commit occurs:

```
=> ALTER DATABASE dbname SET ReflexiveMoveout=1;
```

Most of the parameters in the preceding COPY statement apply to general Vertica COPY statements.

Using the job scheduler allows for a few additional User Defined Load (UDL) functions:

KafkaSource

The KafkaSource UDL pulls data in from a Kafka cluster. All Kafka parsers must use KafkaSource.

Parameter	Description
stream(required)	A comma-separated list of topic|partition|starting_offset triples from which Vertica loads data. The partition and starting_offset values are expressed as integers.
brokers	A comma-separated list of host:port pairs. Hewlett Packard Enterprise recommends running Kafka on a different machine thanVertica. **Default Value:** localhost:9092
duration	A timeslice of type INTERVAL that specifies the duration of the frame. After this specified amount of time, KafkaSource terminates the COPY statements. If this value is not set, you must set stop_on_eof instead.
stop_on_eof	Determines whether KafkaSource should terminate the COPY statement after it reaches the end of a file. If this value is not set, you must set duration instead. **Default Value:** FALSE
eof_timeout	A timeslice of type INTERVAL. If a COPY command does not receive any Kafka messages within the eof_timeout interval, Vertica responds by ending that COPY statement. This parameter applies only if stop_on_eof is TRUE.

KafkaParser

The KafkaParser does not take any parameters. The parser loads the data bytes into a regular Vertica table directly from Kafka. You can use this parser as a catch-all for unsupported formats.

KafkaJSONParser

The KafkaJSONParser parses JSON-formatted Kafka messages and loads them into a regular Vertica table or a Vertica flex table.

Parameter	Description
flatten_maps	Flattens all JSON maps if set to TRUE
flatten_arrays	Flattens JSON arrays if set to TRUE
start_point	Specifies the name of a key in the JSON load data at which to begin parsing. The parser ignores all data before the start_point value.The parser processes data after the first instance, and up to the second, ignoring any remaining data.
omit_empty_keys	If set to TRUE, omits any key from the load data that does not have a value set.
reject_on_duplicate	If set to TRUE, rejects data that contains duplicate key names.
reject_on_materialized_ type_error	When set to TRUE, rejects the data row if the data includes keys matching an existing materialized column and has a key that cannot be mapped into the materialized column's data type.
reject_on_empty_key	If set to TRUE, rejects any row containing a key without a value.

See Loading JSON Data in the core documentation for more information.

KafkaAVROParser

The KafkaAVROParser parses AVRO-formatted Kafka messages and loads them into a regular Vertica table or a Vertica flex table.

Parameter	Description
reject_on_materialized_ type_error	When set to TRUE, rejects the data row if it contains a materialized column value that cannot be mapped into the materialized column's data type.
flatten_maps	If set to TRUE, flattens all Avro maps.
flatten_arrays	If set to TRUE, flattens Avro arrays.
flatten_records	If set to TRUE, flattens all Avro records.
external_schema	Used to specify the schema of the Avro file as a JSON string. If this parameter is not specified, the parser

Parameter	Description
	assumes that each message has the schema on it.
codec	Used to specify the codec in which the Avro file was written. This parameter accepts "default" (Avro´s default) or "snappy" for snappy compression.
with_metadata	If set to TRUE, messages include Avro datum, schema, and object metadata. By default, the KafkaAvroParser parses messages without including schema and metadata. If you enable this parameter, write your messages using the Avro API and confirm they contain only Avro datum. The default value is FALSE.

See Loading Avro Data in the core documentation for more information.

Parsing Custom Formats

Vertica supports the supports the use of user-defined filters to manipulate data arriving from Kafka. You can apply these filters to data before you parse it. By default, data that flows from the KafkaSource does not contain message boundaries. The default Kafka parsers can parse this format. However, other user-defined and Vertica parsers require additional message processing. Filters provide the ability manipulate data using user-defined parsers.

Filters for Use with Kafka Data

Vertica includes the following filters:

- KafkaInsertDelimiters — Transforms the Kafka data stream by inserting a user-specified delimiter between each record. The delimiter can contain any characters and be of any length. This parser uses the following syntax:

  ```
  KafkaInsertDelimiters(delimiter = 'delimiter')
  ```

- KafkaInsertLengths — Transforms the Kafka data stream by inserting the length of the following record in bytes at the beginning of the record. Vertica writes lengths as 4-byte uint32 values in Big Endian network byte order. For example, a 100-byte record would be preceded by 0x00000064.

  ```
  KafkaInsertLengths()
  ```

Note: The Vertica provided filters are mutually exclusive. You cannot use both to process a Kafka data stream.

Vertica also supports the use of additional Vertica and user-defined filters. If you are using a Vertica filter, it must appear first in the filter list. Use a comma to delimit multiple filters. If you are using a non-Kafka parser, you must use at least one filter to prepare your content for that parser. If you do not provide a filter, the parser fails with the message:

```
Input is not from Kafka source.
```

Examples

The following example shows how you can delimit Kafka data streams from two hosts by the string `\n`. You can then use a CSV parser to parse the content.

```
=> COPY kafka_sources.target_table SOURCE KafkaSource (stream='topic1|1|1,topic2|2|2',
brokers='host1:9092,host2:9092',
                                                       duration= INTERVAL'timeslice')
    FILTER KafkaInsertDelimiters(delimiter = '\n')
       PARSER MyCsvParser(recordTerminator = '\n');
```

The following example shows how you can specify that a Vertica filter and a decryption filter process a single Kafka data stream. Using the length information the KafkaInsertLengths filter injects, the parser can identify each record and parse it individually.

```
=> COPY kafka_sources.target_table SOURCE KafkaSource (stream='topic1|1|1, brokers='host1:9092')
    FILTER KafkaInsertLengths() DecryptFilter(parameter=Key)
       PARSER ComplexParser(parameter = 'value');
```

Specifying Maximum Message Size

You can specify the maximum Kafka message size that the server can accept. Vertica uses the `message_max_bytes` parameter. This parameter functions identically to the `message.max.bytes` Kafka property. By default, it has a value of 1000000.

For more information, refer to the Kafka documentation.

From the Command Line

You can specify the the `message_max_bytes` parameter when you use Kafka scheduler.

The command takes the following form:

```
vkconfig launch --instance-name InstanceName -DKafkaSource.message_max_bytes value
```

The following example shows Kafka being launched with a `message_max_bytes` value of 2000000.

```
vkconfig launch --instance-name SchedulerInstance -DKafkaSource.message_max_bytes 2000000
```

From a Configuration File

You can include the `message_max_bytes` parameter in a configuration file. This option is best when you plan to use the same setting on a consistent basis. For more information on working with configuration files, refer to Kafka Utility Options.

The command takes the following form:

```
vkconfig topic--add --conf config.filename --message_max_bytes value
```

The following example shows the file properties being updated with a `message_max_bytes` value of 2000000.

```
vkconfig topic--add --conf config.properties --message_max_byes 2000000
```

Kafka Utility Options

The Kafka integration feature for Vertica consists of five utilities that you can customize:

- Kafka Cluster utility
- Scheduler utility
- Shutdown utility
- Topic utility
- Launch utility

Customize the various utilities with the vkconfig script, using a double dash (--) with the command-line options described in this section.

You can use the options in the Shared Utility Options table with any of the five utilities. Utility-specific options appear in their respective tables.

Shared Utility Options

Some utilities require you to specify additional options.

Option	Parameter	Description
`--config-schema`	*schema*	Identifier for the Vertica schema. This value is the same name as the scheduler. You use this name to identify the scheduler during configuration. **Default Value:** kafka_config
`--help`		Prints out a help menu listing available options with a description.
`--dbhost`	*host name*	The host name or IP address to which a Vertica node can connect. **Default Value:** localhost
`--dbport`	*port*	The port to use to connect to a Vertica database. **Default Value:** 5433
`--username`	*username*	The Vertica database user. **Default Value:** Current user
`--password`	*password*	Password for the database user.
`--jdbc-url`	*url*	A complete JDBC URL that overrides other database connection parameters.
`--conf`	*filename*	A properties file (.properties) that contains configuration details for the CLI command. The configuration file follows the standard java properties file format.

Option	Parameter	Description
		Using a properties file is helpful for options that do not change across CLI commands. Any additional options added at the command line override parameters set in the properties file. The configuration file supports all Kafka properties. For a list of properties, refer to kafka.apache.org/08/configuration.html.

Examples

Example 1: Display help for the scheduler utility:

```
/opt/vertica/packages/kafka/bin/vkconfig scheduler --help

PARAMETER     REQUIRED  #ARGS    DESCRIPTION
help          no        0        Outputs a help context for the given subutility.
conf          no        1        Allows the use of a properties file to associate parameter keys and
values enabling for easy reuse of command strings and a cleaner command string.
dbhost        no        1        The Vertica database hostname to connect to that contains the
metadata and configuration information. Default is 'localhost'
dbport        no        1        The port to connect to the Vertica database at the given hostname.
Default is '5433'.
.
.
.
```

Example 2: Use a property file to set some parameters in the topic utility, and then override the password in the file with another password:

```
#config.properties:
username=myuser
password=mypassword
dbhost=localhost
dbport=5433

/opt/vertica/packages/kafka/bin/vkconfig topic--add --conf config.properties --num-partitions 3
```

Kafka Cluster Utility Options

The Kafka Cluster utility enables you, as an administrator, to connect multiple Kafka clusters to a single Vertica database.

Option	Parameter	Description
`--add` `--remove` `--edit`		Adds, removes, or edits a Kafka cluster.
`--brokers`	*b1:port,b2:port…*	Identifies the brokers that you want to add, edit, or remove from a Kafka cluster. To identify multiple brokers, use a comma delimiter.

Note: Vertica does not validate broker lists or confirm that clusters are unique. Labeling the same Kafka cluster with multiple IDs can introduce duplicate data into your database.

Examples

Example 1: Adds multiple brokers to the Kafka cluster K_cluster_1:

```
/opt/vertica/packages/kafka/bin/vkconfig kafka-cluster --add --brokers localhost:8090,
localhost:8091 --cluster K_cluster_1
```

Example 2: Creates the topic kafkafeed and assigns it to the Kafka cluster K_cluster_2:

```
/opt/vertica/packages/kafka/bin/vkconfig topic --add --topic kafkafeed --cluster k_cluster_2
--target public.test_tgt --rejection-table public.test_rej --num-partitions 3
```

Example 3: Assigns the topic kafkainput to the existing Kafka cluster K_cluster_3:

```
/opt/vertica/packages/kafka/bin/vkconfig topic --edit --topic kafkainput --new-cluster k_cluster_3
```

Shutdown Utility Options

Use the shutdown utility to terminate all Vertica Kafka schedulers. Run this command before restarting the scheduler. Restarting the scheduler without terminating existing schedulers can produce unexpected behavior.

Examples

Example 1: Terminate all Vertica Kafka schedulers:

```
/opt/vertica/packages/kafka/bin/vkconfig shutdown
```

Scheduler Utility Options

Use the scheduler utility to add, edit, or remove a scheduler, defined by `config-schema`. All options specified after `--add`, `--remove`, or `--edit` act on the scheduler specified in `--config-schema` (or kafka_config if the `--config-schema` option is left out).

Option	Parameter	Description

`--add`
`--remove`
`--edit`
		Adds, removes, or edits a scheduler.

`--frame-duration`	HH:MM:SS	The interval of time that all individual frames will last with this scheduler. Hewlett Packard Enterprise recommends configuring the duration based on the amount of expected throughput and acceptable latency. **Default Value:** 00:00:10
`--config-refresh-interval`	HH:MM:SS	The interval of time that the scheduler runs before updating its cached metadata (such as changes made by using the `--edit` option). **Default Value:** 00:05:00
`--brokers`	*b1:port,b2:port…*	A comma-separated list of Kafka brokers and their respective network port numbers handling the Kafka instance. **Default Value:** localhost:9092
`--resource-pool`	*pool_name*	The resource pool to be used by all queries executed by this scheduler. **Default Value:** kafka_default_pool
`--new-topic-`	FAIR|START |END	Determines when during the frame that the newly added topic will run.

Option	Parameter	Description
`policy`		**Valid Values:** • FAIR: Takes the average length of time from the previous batches and schedules itself appropriately. • START: All new topics start at the beginning of the frame. The batch receives the minimal amount of time to run. • END: All new topics start at the end of the frame. The batch receives the maximum amount of time to run. **Default Value:** FAIR
`--eof-timeout`	HH:MM:SS	If a COPY command does not received any Kafka messages within the eof_timeout interval, Vertica responds by ending that COPY statement. **Default Value:** One tenth of the frame duration. See Using COPY with Kafka in this guide for information on how this value is used in the KafkaSource function.
`--operator`	*username*	Allows the dbadmin to grant privileges to a previously created Vertica user. This option gives the specified user all privileges on the scheduler instance, and EXECUTE privileges on the libkafka library and all its UDxs. Granting operator privileges gives the user the right to read data off any topic in any Kafka cluster that can be reached from the Vertica node. The dbadmin must grant the user separate permission for them to have write privileges on the Kafka target tables. To revoke privileges, use the `--remove` option with the `--operator` option.

Option	Parameter	Description
		If you omit the `--operator` syntax when removing an operator, this option removes the entire schema.
`--message_max_bytes`		The maximum message size, in bytes. **Default Value:** 1000000

Examples

Example 1: Give a user, Jim, privileges on the JimScheduler scheduler. Specify that youare making edits to the JimScheduler scheduler with the `--config-schema` option:

```
/opt/vertica/packages/kafka/bin/vkconfig scheduler --edit --config-schema JimScheduler --operator
Jim
```

Example 2: Edit the default scheduler (kafka_config) so that it stops issuing COPY statements after one second of inactivity:

```
/opt/vertica/packages/kafka/bin/vkconfig scheduler --edit --eof-timeout 00:00:01
```

Topic Utility Options

Use the topic utility to add, remove, or edit a topic. If you are adding a topic, you must specify both the topic and target using the `--topic` and `--target` options. If you are removing or editing a topic or target, you only need to specify the topic or target you want to modify. All additional options act on the topic or target you specify.

Option	Parameter	Description

`--add`
`--remove`
`--edit`
		Adds, removes, or edits a topic or target configuration.

`--target`	*schema.table_name*	The existing Vertica target table to add, remove, or edit from a scheduler configuration. **Important:** Avoid having columns with NOT NULL restrictions in your

Option	Parameter	Description
		target table. The scheduler stops loading data if it encounters a row that has a NULL value it needs to insert into a column with a NOT NULL restriction. If you must have a NOT NULL column, try to filter out all NULL values for that column in the streamed data before is it loaded by the scheduler.
`--topic`	*topic_name*	The Kafka topic to add, remove, or edit from a scheduler configuration.
`--rejection-table`	*table_name*	A name for the Vertica table where the scheduler stores rejected data. The scheduler automatically creates this table when you use the `--add` option. **Requires:** `--target option`
`--new-target`	*table_name*	Changes the Vertica target table associated with this schema to a new, already created table. All topics targeting the old target table target this new target table. **Requires:** `--edit` and `--target` options
`--new-topic`	*topic*	Changes all instances of this Kafka topic unless this option is used with the `--target` option. If used with the `--target` option, only the topics associated with the specified target are changed. **Requires:** `--edit` and `--topic` options
`--load-method`	AUTO|TRICKLE |DIRECT	The COPY load method to use for all loads with this scheduler. See the COPY statement for more information. **Default Value:**

Option	Parameter	Description
		TRICKLE
`--num-partitions`	*count*	Used to create all partitions from 0 to *n*–1. **Default Value:** 1 **Requires:** `--add` and `--topic` options You must keep this consistent with the number of partitions in the Kafka topic.
`--enabled`	TRUE|FALSE	Turns data collection for a target table on (TRUE) or off (FALSE). **Default Value:** TRUE **Requires:** `--target` option
`--parser`	parser	Vertica UDParser to use with a specified target. **Default Value:** KafkaParser **Requires:** `--target` option
`--parser-parameters`	*key=value, key=value*	Parameters for the UDParser. **Requires:** `--target` option
`--start-offset`	START|*num*	The Kafka topic offset where all partitions start. **Default Value:** START **Requires:** `--topic` option
`--target-columns`	*column_name, ...|column expression*	A column expression for the target table. This value can be a list of columns or a complete expression. **Requires:** `--target` option See the COPY statement Parameters in

Option	Parameter	Description
		the core documentation for a description of column expressions.
`--cluster`	*cluster_name*	Identifies the cluster that you want to edit.
`--new-cluster`	*cluster_name*	Changes the Vertica Kafka topic associated with this schema to an alternate, existing Kafka cluster. All topics referencing the old target topic now target this Kafka cluster. **Requires:**`--edit` and `--topic` options

Examples

Example 1: Specify that the existing target table, avroTarget, use the KafkaAVROParser:

```
/opt/vertica/packages/kafka/bin/vkconfig topic --edit --target avroTarget --parser KafkaAVROParser
```

Example 2: Change the topic associated with the myTarget target table:

```
/opt/vertica/packages/kafka/bin/vkconfig topic --edit --topic myTopic --target myTarget --new-topic
myTopic2
```

Launch Utility Options

Use the launch utility to assign a name to a scheduler instance.

Option	Parameter	Description
`--instance-name`	*name*	(Optional) Allows you to name the process running the scheduler. You can use this command when viewing the scheduler_history table, to find which instance is currently running.
`-DKafkaSource`	*parameter_name value*	The name of the Kafka property that you want to specify. Currently, this option supports only the `message_max_bytes` parameter.

Examples

Name this scheduler instance schedulerInstance:

```
/opt/vertica/packages/kafka/bin/vkconfig launch --instance-name SchedulerInstance
```

Kafka Function Reference

- KafkaExport

KafkaExport

Outputs rows that Vertica was unable to send to Kafka. If all of your messages have imported successfully, this function returns zero rows. You can use this function to copy failed messages to a secondary table for evaluation and reprocessing.

Syntax

```
KafkaExport(partitionColumn, keyColumn, valueColumn USING PARAMETERS
brokers='host', topic='topicname')
OVER () FROM table
```

Parameters

Argument	Description
partionColumn	Optional. The target partition for the export. If you do not specify a partition, Vertica uses the default Kafka partition. You can use the partition column to send messages to partitions that map to Vertica segments.
keyColumn	Optional. The user defined key value associated with the valueColumn.
valueColumn	Optional. The Kafka message itself.
brokers	A list of one or more Kafka brokers.
topic	The Kafka topic to which you are exporting.

Examples

```
=> SELECT KafkaExport(partion, messageId, message USING PARAMETERS brokers=:KafkaBroker,
topic='failure_test',
                      kafka_conf='message.max.bytes=64000')
     OVER (PARTITION BEST)
                FROM failure_test;
 partition |     key     |                    substr                    |        failure_reason
-----------+-------------+----------------------------------------------+-------------------------
      -123 | key1        | negative partition not allowed               | Local: Unknown partition
     54321 |             | nonexistant partition                        | Local: Unknown partition
         0 | normal key1 | normal value1                                | Broker: Message size too
large
         0 |             | aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa | Broker: Message size too
large
         0 | normal key2 | normal value2                                | Broker: Message size too
large
```

Kafka Schema Tables

Every time a new scheduler is added (`--add`), Vertica creates a new schema for that scheduler with the name you specify or the default "kafka_config". Each schema has the following tables:

Table	Description
kafka_clusters	Lists Kafka clusters and their component brokers.
kafka_events	Internal log table. kafka_events includes the log level, the target, topic, or partition information that relates to the log message, and any errors that occurred during micro-batch executions.
kafka_lock	Displays information on the current Kafka lock status, which allows only one scheduler to run at a time in this schema.
kafka_offsets	Controls the offset information for each <target_table, topic, partition> triple and stores information about the progress within the stream for each topic or partition.
kafka_scheduler	Holds the metadata related to the active scheduler for this schema.
kafka_scheduler_history	Shows the history of launched scheduler instances.

Table	Description
kafka_targets	Contains the metadata for all Vertica target tables, along with their respective rejection tables. Kafka_ targets also holds the COPY information necessary for the corresponding micro-batch. Because the target, not the Kafka topic, determine batches, each row in this table corresponds to a separate micro-batch.

Caution: Hewlett Packard Enterprise recommends that you do not alter these tables except in consultation with support.

kafka_clusters

Lists Kafka clusters and brokers.

Column	Data Type	Description
cluster	VARCHAR	A Kafka cluster.
brokers	VARCHAR	A comma-separated list of Kafka brokers associated with the Kafka cluster.

Examples

This example shows two Kafka clusters and their associated brokers.

```
=> SELECT * FROM kafka_config.kafka_clusters;

-[ RECORD 1 ]--+--------------------------
cluster        | Kafka_cluster1
brokers        | broker1:9092,broker2:9092

-[ RECORD 2 ]--+--------------------------
cluster        | Kafka_cluster2
brokers        | broker3:9092,broker4:9092
```

kafka_offsets

Controls the offset information for each <target, topic, partition> triple.

Column	Data Type	Description
transaction_id	INT	Vertica transaction id for the batch session.

Column	Data Type	Description
batch_create	TIMESTAMP	Time the scheduler created the batch.
batch_start	TIMESTAMP	Time the batch executed.
batch_end	TIMESTAMP	Time the batch ended execution.
timeslice	INTERVAL	Total amount of time allotted for the batch to execute.
target_schema	VARCHAR (128)	Schema name for the target table.
target_table	VARCHAR (128)	Name of the target table.
node_name	VARCHAR (128)	Vertica node that did the work for each <topic, target, partition> triple.
ktopic	VARCHAR (256)	Kafka topic.
kpartition	INT	Kafka partition.
start_offset	INT	Starting offset of the batch.
end_offset	INT	End offset of the batch.
num_messages	INT	Number of messages transferred from a Kafka topic partition to a Verticatarget table.
last_duration	INTERVAL	Length of time the entire batch took.
total_bytes	INT	Total bytes transferred from Kafka topic partition to Vertica target table.
reason	VARCHAR (256)	Explanation for why the batch ended. **Example:** End of stream or End of file

Examples

```
=> SELECT * FROM kafka_config.kafka_offsets;

-[ RECORD 1 ]--+---------------------------
transaction_id | 45035996274054029
batch_create   | 2015-09-17 12:30:15.629
```

```
batch_start    | 2015-09-17 12:30:15.639644
batch_end      | 2015-09-17 12:30:17.995045
timeslice      | 00:00:09.952
target_schema  | public
target_table   | kafka_flex2
node_name      |
ktopic         | test4
kpartition     | 0
start_offset   |
end_offset     | 119
num_messages   | 120
last_duration  | 00:00:01.031629
total_bytes    | 600000
reason         | END_OF_STREAM
-[ RECORD 2 ]--+---------------------------
transaction_id | 45035996274054029
batch_create   | 2015-09-17 12:30:15.629
batch_start    | 2015-09-17 12:30:15.639644
batch_end      | 2015-09-17 12:30:17.995045
timeslice      | 00:00:09.952
target_schema  | public
target_table   | kafka_flex2
node_name      |
ktopic         | test4
kpartition     | 1
start_offset   |
end_offset     | 20970
num_messages   | 20971
last_duration  | 00:00:02.289001
total_bytes    | 104855000
reason         | END_OF_STREAM
```

kafka_events

Logs micro-batches and other important events from the scheduler in an internal log table.

Column	Data Type	Description
event_ time	TIMESTAMPTZ	The time the event was logged.
log_level	VARCHAR (32)	The type of event that was logged. **Valid Values:** • TRACE • DEBUG • FATAL • ERROR

Column	Data Type	Description
		• WARN • INFO
location	VARCHAR (1024)	The class responsible for logging the message.
batch_ create	TIMESTAMP	Displays the time the micro-batch was created, if the event is related to a specific batch.
target_ schema	VARCHAR (256)	Displays the target schema for the micro-batch, if the event is related to a specific batch.
target_ table	VARCHAR (256)	Displays the target table for the micro-batch, if the event is related to a specific batch.
message	VARCHAR (65000)	A description of the event.
exception	VARCHAR (4096)	If this log is in the form of a stack trace, this column lists the exception.

Examples

```
=> SELECT * FROM kafka_config.kafka_events;

-[ RECORD 1 ]-+-------------
event_time    | 2015-09-17 13:28:35.548-04
log_level     | INFO
location      | com.vertica.solutions.kafka.scheduler.StreamCoordinator
batch_create  |
target_schema |
target_table  |
message       | Received configuration details; frame duration: 10000, refresh interval 60000, eof
timeout interval: 0, brokers (eng-g9-004:9092,eng-g9-005:9092), resource pool: kafka_default_pool
exception     |

-[ RECORD 2 ]-+-------------
event_time    | 2015-09-17 13:28:45.643-04
log_level     | INFO
location      | com.vertica.solutions.kafka.scheduler.MicroBatch
batch_create  | 2015-09-17 12:28:45.633
target_schema | public
target_table  | kafka_flex1
message       | Generated tuples: test3|2|-2,test3|1|-2,test3|0|-2
exception     |

-[ RECORD 3 ]-+----------------
event_time    | 2015-09-17 13:28:50.701-04
log_level     | INFO
location      | com.vertica.solutions.kafka.scheduler.MicroBatch
```

```
batch_create  | 2015-09-17 12:28:45.633
target_schema | public
target_table  | kafka_flex2
message       | Total rows inserted: 0
exception     |
```

kafka_scheduler

Holds the metadata related to a singular scheduler.

Column	Data Type	Description
scheduler_version	VARCHAR	Version of the scheduler.
frame_duration	INTERVAL	Indicates the length of time of the frame.
brokers	VARCHAR	Comma-separated list of Kafka brokers.
config_refresh_interval	INTERVAL	The interval of time that the scheduler runs before applying any changes to its metadata (such as, changes made by using the `--edit` option). See the `--frame-refresh` scheduler utility option in Kafka Utility Options section of this guide.
resource_pool	VARCHAR	The resource pool associated with this scheduler.
new_topic_policy	VARCHAR	Displays when during the frame the topic runs. This is the value set with the `--new-topic-policy` in the topic utility. • FAIR: Takes the average length of time from the previous batches and schedules itself appropriately. • START: Runs all new topics at the beginning of the frame. In this case, Vertica gives the minimal amount of time to run.

Column	Data Type	Description
		• END: Runs all new topics starting at the end of the frame. In this case, Vertica gives the maximum amount of time to run. **Default Value:** FAIR
eof_timeout_interval	INTERVAL	End of File timeout interval Maximum amout of time the scheduler waits for Kafka before ending the batch. Kafka pauses if the end of a stream is met or a bad offset is given. **Default Value:** max_duration/10

Examples:

```
=> SELECT * FROM kafka_config.kafka_scheduler;

-[ RECORD 1 ]----------+-------------------------------
scheduler_version      | 0.9
frame_duration         | 00:00:10
brokers                | broker1:9092,broker2:9092
config_refresh_interval| 00:01
resource_pool          | kafka_default_pool
new_topic_policy       | FAIR
eof_timeout_interval   |
```

kafka_scheduler_history

Shows the history of launched scheduler instances.

Column	Data Type	Description
elected_leader_time	TIMESTAMP	Time when this instance took over.
host	VARCHAR (256)	Host name of the machine running the scheduler instance.
launcher_name	VARCHAR	Name of the currently active scheduler instance.

Column	Data Type	Description
	(128)	**Default Value:** NULL
scheduler_ version	VARCHAR (64)	Scheduler version.

Examples

```
=> SELECT * FROM kafka_config.kafka_scheduler_history;

-[ RECORD 1 ]-------+------------------------
elected_leader_time | 2015-09-17 12:28:35.509
host                | 10.20.41.201
launcher_name       |
scheduler_version   | 0.9
```

kafka_targets

Contains the metadata for all Vertica target tables, along with their respective rejection tables.

Kafka_targets also holds the COPY information necessary for the corresponding micro-batch. Because the target, not the Kafka topic determines the batches, each row in this table corresponds to a separate micro-batch.

Column	Data Type	Description
target_schema (primary key/identifier)	VARCHAR (128)	Name of the schema for the target table.
target_table (primary key/identifier)	VARCHAR (1024)	Name of the target table for this batch.
enabled	BOOLEAN	If FALSE, the batch will not run.
parser	VARCHAR (1024)	Identifies the parser used for this target table.
rejection_table	VARCHAR (1024)	Name of the rejection table for this target table.
parser_ parameters	VARCHAR (65000)	List of the parameters already set for the active parser.

Column	Data Type	Description
load_method	VARCHAR	Specifies the method of loading data into the Vertica target table. **Valid Values:** • AUTO • TRICKLE • DIRECT **Default Value:** TRICKLE
target_columns	VARCHAR (65000)	Either a list of columns used to load data into for this target table or a column expression.

Examples

```
=> SELECT * FROM kafka_config.kafka_targets;

-[ RECORD 1 ]-----+---------------------
target_schema     | public
target_table      | kafka_flex1
enabled           | t
parser            | KafkaJSONParser
rejection_table   | public.kafka_rej
parser_parameters | omit_empty_keys=true
load_method       | TRICKLE
target_columns    |

-[ RECORD 2 ]-----+---------------------
target_schema     | public
target_table      | kafka_flex2
enabled           | t
parser            | KafkaJSONParser
rejection_table   | public.kafka_rej
parser_parameters | omit_empty_keys=true
load_method       | TRICKLE
target_columns    |
```

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