

Apache Flink Overview

Date published: 2019-12-17

Date modified: 2019-12-17

The Cloudera logo is displayed in a bold, orange, sans-serif font. The word "CLOUDERA" is written in all caps, with a stylized 'E' that has three horizontal bars.

Legal Notice

© Cloudera Inc. 2024. All rights reserved.

The documentation is and contains Cloudera proprietary information protected by copyright and other intellectual property rights. No license under copyright or any other intellectual property right is granted herein.

Unless otherwise noted, scripts and sample code are licensed under the Apache License, Version 2.0.

Copyright information for Cloudera software may be found within the documentation accompanying each component in a particular release.

Cloudera software includes software from various open source or other third party projects, and may be released under the Apache Software License 2.0 (“ASLv2”), the Affero General Public License version 3 (AGPLv3), or other license terms. Other software included may be released under the terms of alternative open source licenses. Please review the license and notice files accompanying the software for additional licensing information.

Please visit the Cloudera software product page for more information on Cloudera software. For more information on Cloudera support services, please visit either the Support or Sales page. Feel free to contact us directly to discuss your specific needs.

Cloudera reserves the right to change any products at any time, and without notice. Cloudera assumes no responsibility nor liability arising from the use of products, except as expressly agreed to in writing by Cloudera.

Cloudera, Cloudera Altus, HUE, Impala, Cloudera Impala, and other Cloudera marks are registered or unregistered trademarks in the United States and other countries. All other trademarks are the property of their respective owners.

Disclaimer: EXCEPT AS EXPRESSLY PROVIDED IN A WRITTEN AGREEMENT WITH CLOUDERA, CLOUDERA DOES NOT MAKE NOR GIVE ANY REPRESENTATION, WARRANTY, NOR COVENANT OF ANY KIND, WHETHER EXPRESS OR IMPLIED, IN CONNECTION WITH CLOUDERA TECHNOLOGY OR RELATED SUPPORT PROVIDED IN CONNECTION THEREWITH. CLOUDERA DOES NOT WARRANT THAT CLOUDERA PRODUCTS NOR SOFTWARE WILL OPERATE UNINTERRUPTED NOR THAT IT WILL BE FREE FROM DEFECTS NOR ERRORS, THAT IT WILL PROTECT YOUR DATA FROM LOSS, CORRUPTION NOR UNAVAILABILITY, NOR THAT IT WILL MEET ALL OF CUSTOMER’S BUSINESS REQUIREMENTS. WITHOUT LIMITING THE FOREGOING, AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, CLOUDERA EXPRESSLY DISCLAIMS ANY AND ALL IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY, QUALITY, NON-INFRINGEMENT, TITLE, AND FITNESS FOR A PARTICULAR PURPOSE AND ANY REPRESENTATION, WARRANTY, OR COVENANT BASED ON COURSE OF DEALING OR USAGE IN TRADE.

Contents

What is Apache Flink?	4
Streaming use cases with Flink	4
Flink Streaming Applications	5
Handling state in Flink	5
Event-driven applications with Flink	7
Sophisticated windowing in Flink	8
Using watermark in Flink	8
Creating checkpoints and savepoints in Flink	9

What is Apache Flink?

Flink is a distributed processing engine and a scalable data analytics framework. You can use Flink to process data streams at a large scale and to deliver real-time analytical insights about your processed data with your streaming application.

Flink is designed to run in all common cluster environments, perform computations at in-memory speed and at any scale. Furthermore, Flink provides communication, fault tolerance, and data distribution for distributed computations over data streams.

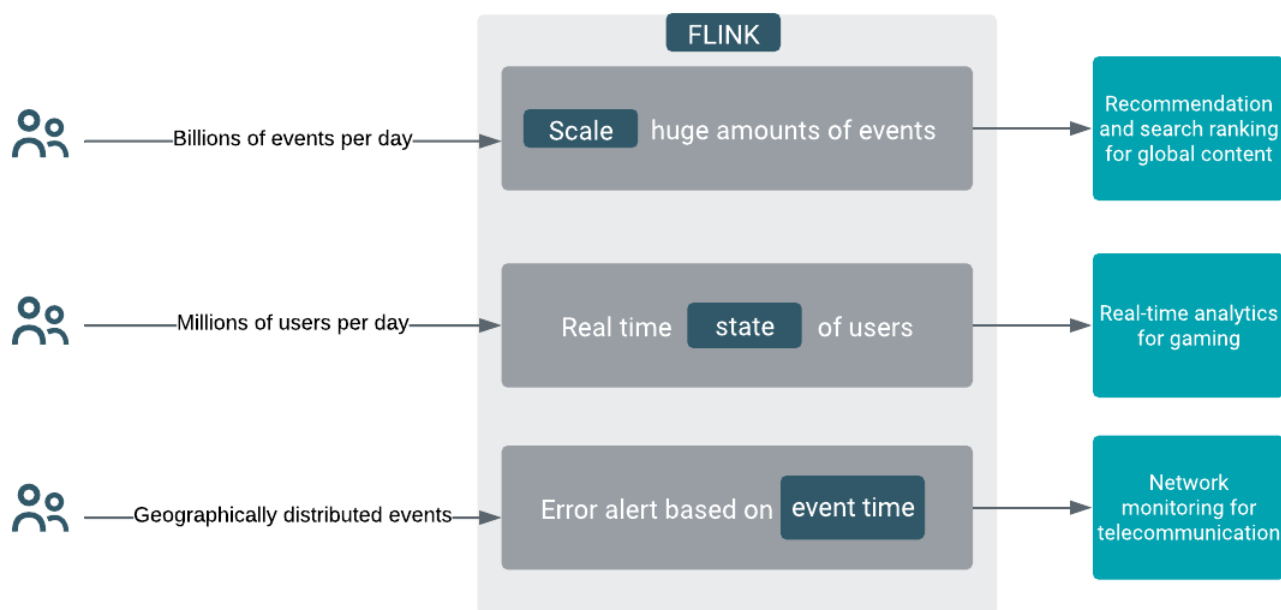
Flink applications process stream of events as unbounded or bounded data sets. Unbounded streams have no defined end and are continuously processed. Bounded streams have an exact start and end, and can be processed as a batch. In terms of time, Flink can process real-time data as it is generated and stored data in storage filesystems. In CSA, Flink is used for unbounded, real-time stream processing.

For more information about Flink, see the [Apache Flink documentation](#).

Streaming use cases with Flink

You can create your Flink streaming applications based on the role of your processed data. Flink use cases include fraud detection, network monitoring, alert triggering, and other solutions to enhance user experience.

A large variety of enterprises choose Flink as a stream processing platform due to its ability to handle scale, stateful stream processing, and event time. See the following illustration for example use



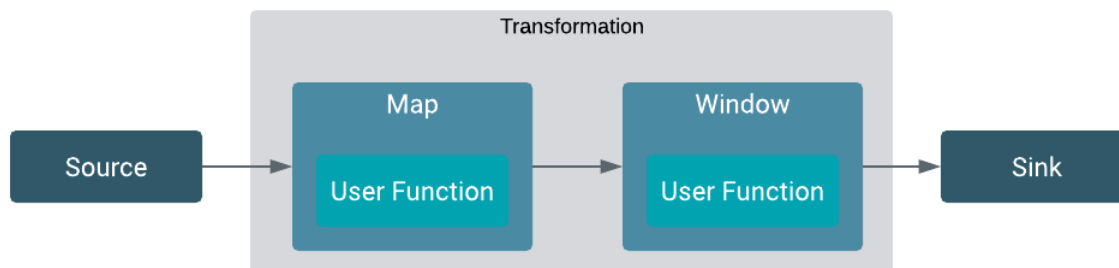
cases.

For specific examples of Apache Flink users, see the [Apache Flink Powered by](#) page.

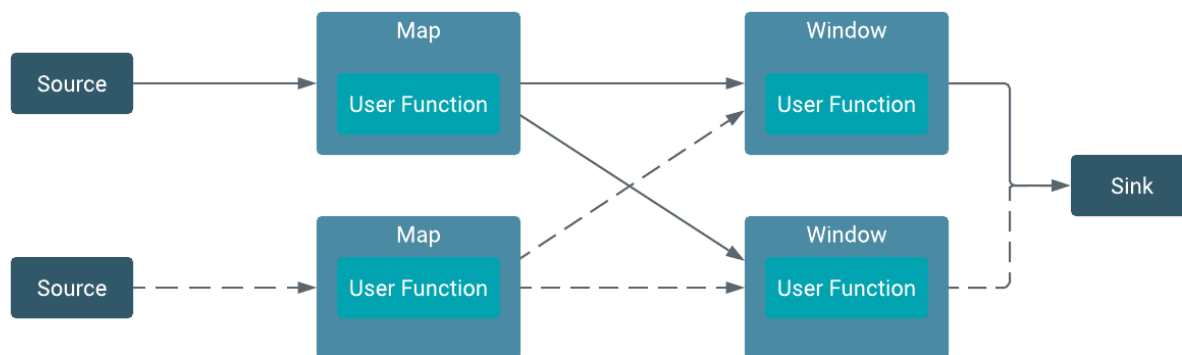
Flink Streaming Applications

You can use APIs to develop Flink streaming applications where the data pipeline consists of one or more data source, data transformation, and data sink. You can build the architecture of your application with parallelism and windowing functions to benefit from the scalability and state handling features of Flink.

The `DataStream` API is used as the core API to develop Flink streaming applications using Java or Scala programming languages. The core building blocks of a streaming application are `datastream` and `transformation`. In a Flink program, the incoming data streams from a source are transformed by a defined operation which results in one or more output streams to the sink as shown in the following illustration.



The structure of this dataflow is implemented in a pipeline that gives a Flink application its core logic. On a dataflow one or more operations can be defined which can be processed in parallel and independently to each other. With windowing functions, different computations can be applied to different streams in the defined time window to further maintain the processing of events. The following image illustrates the parallel structure of dataflows.



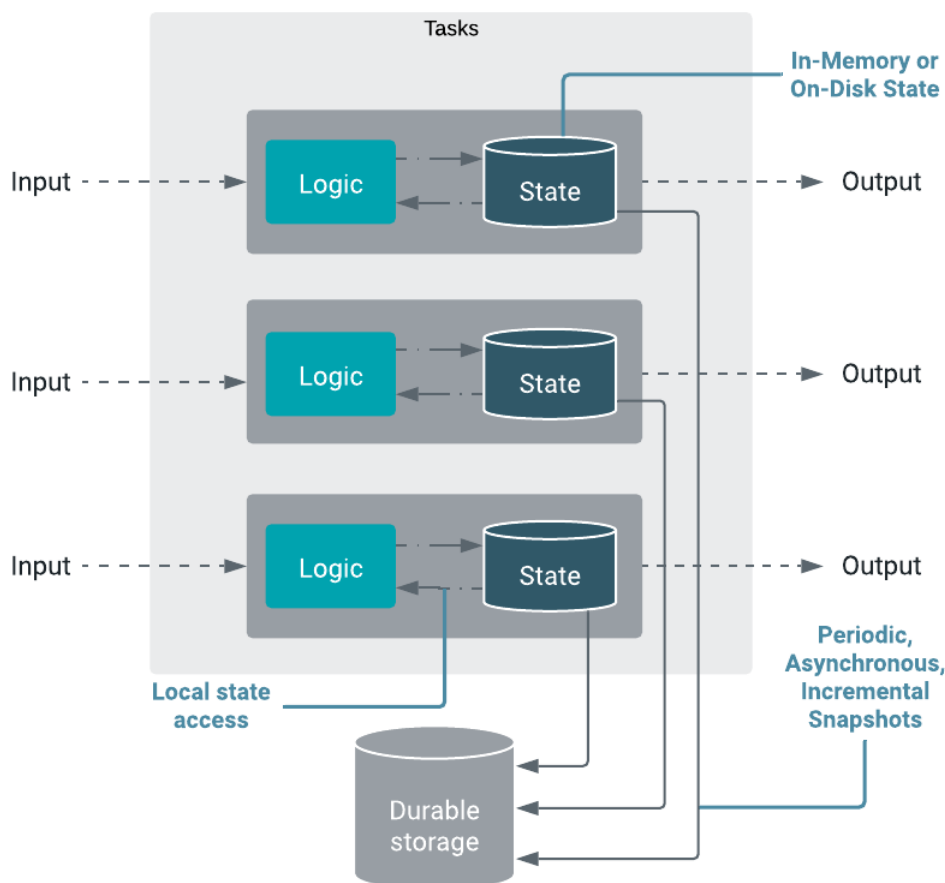
Handling state in Flink

You can use Flink to store the state of your application locally in state backends that guarantee lower latency when accessing your processed data. You can also create checkpoints and savepoints to have a fault-tolerant backup of your streaming application on a durable storage.

Stateful applications process dataflows with operations that store and access information across multiple events. There are two basic types of states in Flink: keyed state and operator state. The difference between them is that a keyed state is always bound to keys and can only be used on keyed streams. In operator state, the state is bound to an operator on one parallel substream. Keyed streams are created by defining keys for the elements of a stream. The keyed stream is read by the stateful operator and per key state is stored locally and can be accessed by the operator throughout the data streaming process. A basic stateful application structure is shown in the following illustration.



6



CSA supports Java heap and RocksDB state backends. The practical difference between them is that the Heap option is recommended for small states, while the RocksDB option is the production grade solution for large states. RocksDB also supports incremental checkpointing.

Related Information

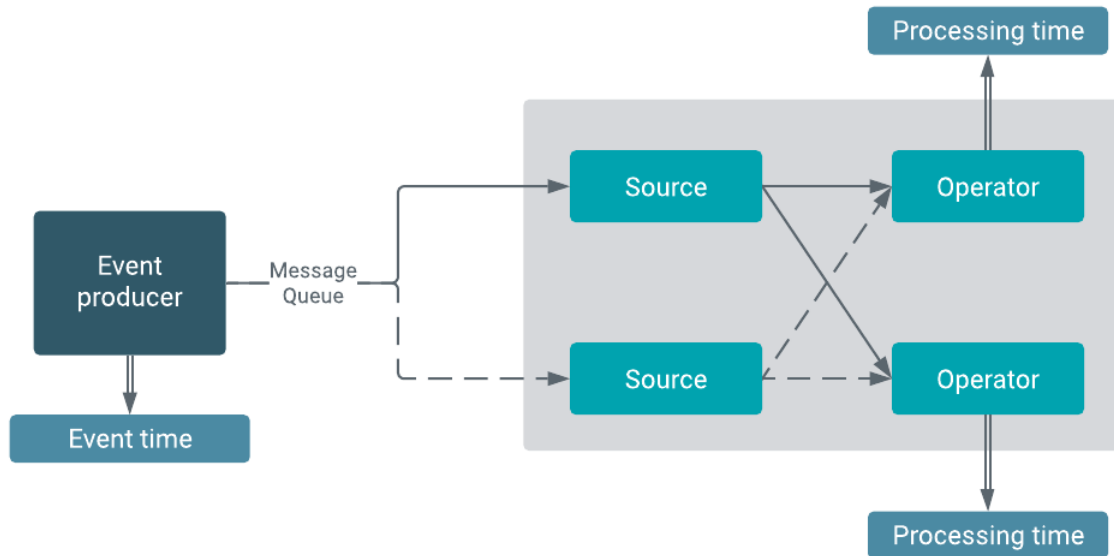
[Creating checkpoints and savepoints in Flink](#)

[RocksDB state backend configuration](#)

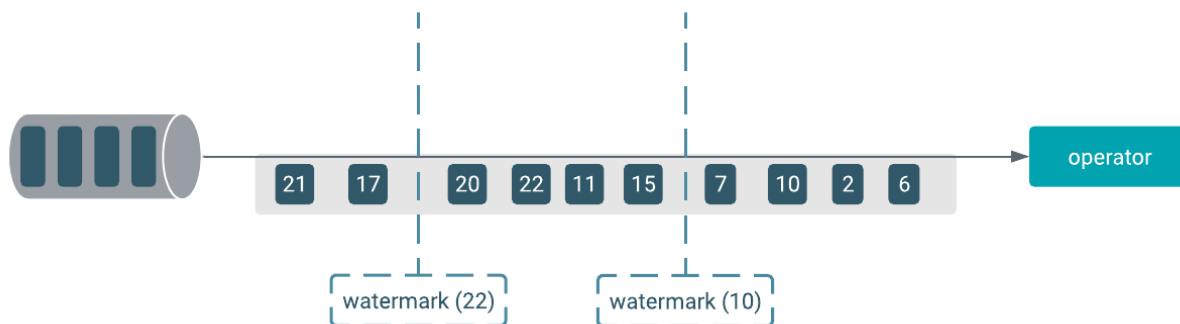
Event-driven applications with Flink

In time-sensitive cases where the application uses alerting or triggering functions, it is important to distinguish between event time and processing time. To make the designing of applications easier, you can create your Flink application either based on the time when the event is created or when it is processed by the operator.

Event-driven applications can be used in cases where the incoming events need to trigger other internal or external action. Consider an event-driven application ingesting events from multiple sources. If timeliness between input sources is valuable information the most straightforward approach to coordinate that is to write the original timestamp of recording the event to the event itself. For Flink, time is distinguished between event time and processing time as shown in the illustration below. Event time is defined by the time the event is created. Event time is already embedded in the record, before entering Flink. Processing time is the time at which the operator processes data. If an application is process time-based, the system clock on the machine is used for the operations.



Let's think of a streaming application with a session window that aggregates data between 10:00 and 11:00. The given watermark will be the time until the data is processed. In this case, the watermark is 11:00. This means the window will process the events that were created until 11:00.



Creating checkpoints and savepoints in Flink

You can use checkpoints and savepoints to make Flink applications fault tolerant throughout the whole pipeline. With checkpoints and savepoints, you can create a backup mechanism from which you can restore your whole application, with or without state, in case of failure or upgrade.

Flink contains a fault tolerance mechanism that creates snapshots of the data stream continuously. The snapshot includes not only the dataflow, but the state attached to it. In case of failure, the latest snapshot is chosen and the system recovers from that checkpoint. This guarantees that the result of the computation can always be consistently restored.

While checkpoints are created and managed by Flink, savepoints are controlled by the user. A savepoint can be described as a backup from the executed process.

Related Information

[Checkpoint](#)

[Savepoint](#)