==> DStream in Apache Spark?

Discretized Stream (DStream) is the basic abstraction provided by Spark Streaming. It is a continuous stream of data. It is received from a data source or from a processed data stream generated by transforming the input stream. Internally, a DStream is represented by a continuous series of RDDs and each RDD contains data from a certain interval. Any operation applied on a DStream translates to operations on the underlying RDDs.

DStreams can be created from various sources like Apache Kafka, HDFS, and Apache Flume. DStreams have two operations:

1. Transformations that produce a new DStream.
2. Output operations that write data to an external system.

There are many DStream transformations possible in Spark Streaming. Let us look at **filter(*func*)**. filter(*func*) returns a new DStream by selecting only the records of the source DStream on which func returns true.

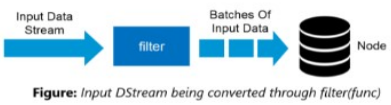


Figure: *Input DStream being converted through filter(func)*

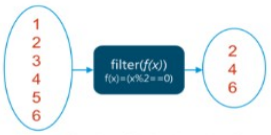


Figure: *Filter Function For Even Numbers*

==> Caching in Spark Streaming

DStreams allow developers to cache/ persist the stream's data in memory. This is useful if the data in the DStream will be computed multiple times. This can be done using the persist() method on a DStream. For input streams that receive data over the network (such as Kafka, Flume, Sockets, etc.), the default persistence level is set to replicate the data to two nodes for fault-tolerance.

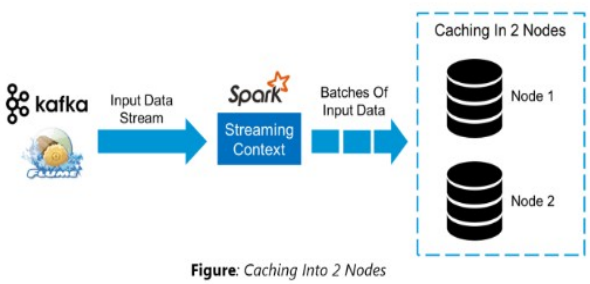


Figure: *Caching Into 2 Nodes*

==> Significance of Sliding Window operation?

Sliding Window controls transmission of data packets between various computer networks. Spark Streaming library provides windowed computations where the transformations on RDDs are applied over a sliding window of data. Whenever the window slides, the RDDs that fall within the particular window are combined and operated upon to produce new RDDs of the windowed DStream.

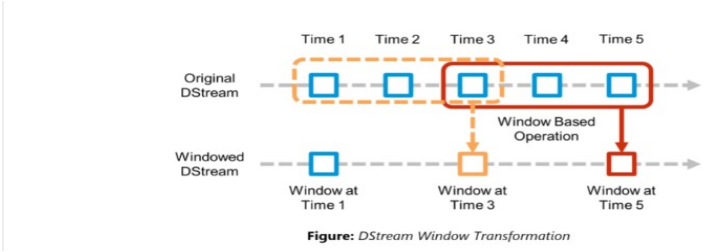


Figure: *DStream Window Transformation*

==> Broadcast variables?

Broadcast variables allow the programmer to keep a read-only variable cached on each machine rather than shipping a copy of it with tasks. They can be used to give every node a copy of a large input dataset in an efficient manner. Spark also attempts to distribute broadcast variables using efficient broadcast algorithms to reduce communication cost.

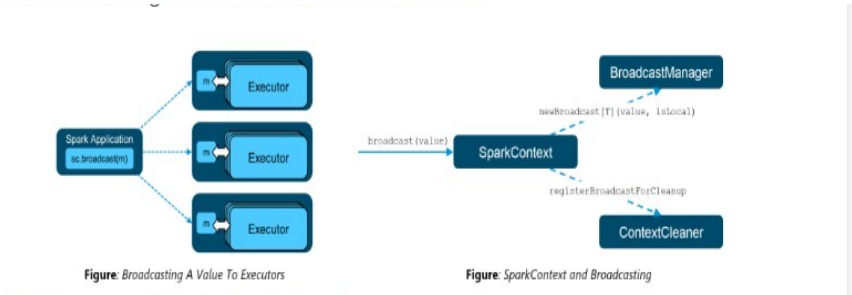


Figure: *Broadcasting A Value To Executors*

Figure: *SparkContext and Broadcasting*

==> Sparse Vector?

A sparse vector has two parallel arrays; one for indices and the other for values. These vectors are used for storing non-zero entries to save space.

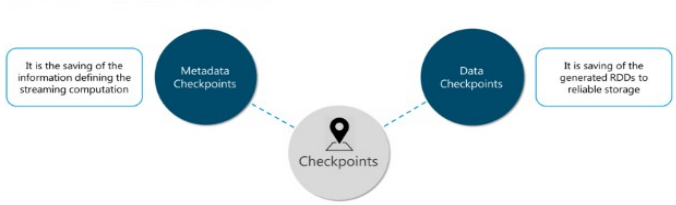
```
1Vectors.sparse(7,Array(0,1,2,3,4,5,6),Array(1650d,50000d,800d,3.0,3.0,2009,95054))
```

The above sparse vector can be used instead of dense vectors.

```
val myHouse =
Vectors.dense(4450d,2600000d,4000d,4.0,4.0,1978.0,95070d,1.0,1.0,1.0,0.0)
```

==> Does Apache Spark provide checkpoints?

Checkpoints are similar to checkpoints in gaming. They make it run 24/7 and make it resilient to failures unrelated to the application logic.



Lineage graphs are always useful to recover RDDs from a failure but this is generally time-consuming if the RDDs have long lineage chains. Spark has an API for checkpointing i.e. a REPLICATE flag to persist. However, the decision on which data to checkpoint – is decided by the user. Checkpoints are useful when the lineage graphs are long and have wide dependencies.

==> What do you understand by Lazy Evaluation?

Spark is intellectual in the manner in which it operates on data. When you tell Spark to operate on a given dataset, it heeds the instructions and makes a note of it, so that it does not forget – but it does nothing, unless asked for the final result. When a transformation like map() is called on an RDD, the operation is not performed immediately. Transformations in Spark are not evaluated till you perform an action. This helps optimize the overall data processing workflow.

==> How is Spark SQL different from HQL and SQL?

Spark SQL is a special component on the Spark Core engine that supports SQL and Hive Query Language without changing any syntax. It is possible to join SQL table and HQL table to Spark SQL.

==> Explain a scenario where you will be using Spark Streaming.

When it comes to Spark Streaming, the data is streamed in real-time onto our Spark program.

Twitter Sentiment Analysis is a real-life use case of Spark Streaming. Trending Topics can be used to create campaigns and attract a larger audience. It helps in crisis management, service adjusting and target marketing.

Sentiment refers to the emotion behind a social media mention online. Sentiment Analysis is categorizing the tweets related to a particular topic and performing data mining using Sentiment Automation Analytics Tools.

Spark Streaming can be used to gather live tweets from around the world into the Spark program. This stream can be filtered using Spark SQL and then we can filter tweets based on the sentiment. The filtering logic will be implemented using MLlib where we can learn from the emotions of the public and change our filtering scale accordingly.

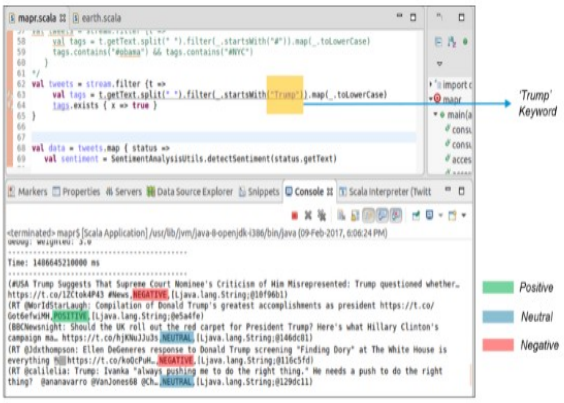


Figure: *Performing Sentiment Analysis on Tweets with 'Trump' Keyword*

The above figure displays the sentiments for the tweets containing the word *'Trump'*.