Twitter Sentiment Analysis using Lambda Architecture

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Outline

Sentiment Analysis

What

Sentiment analysis it's the interpretation and classification of emotions within voice and text data using text analysis techniques

Why

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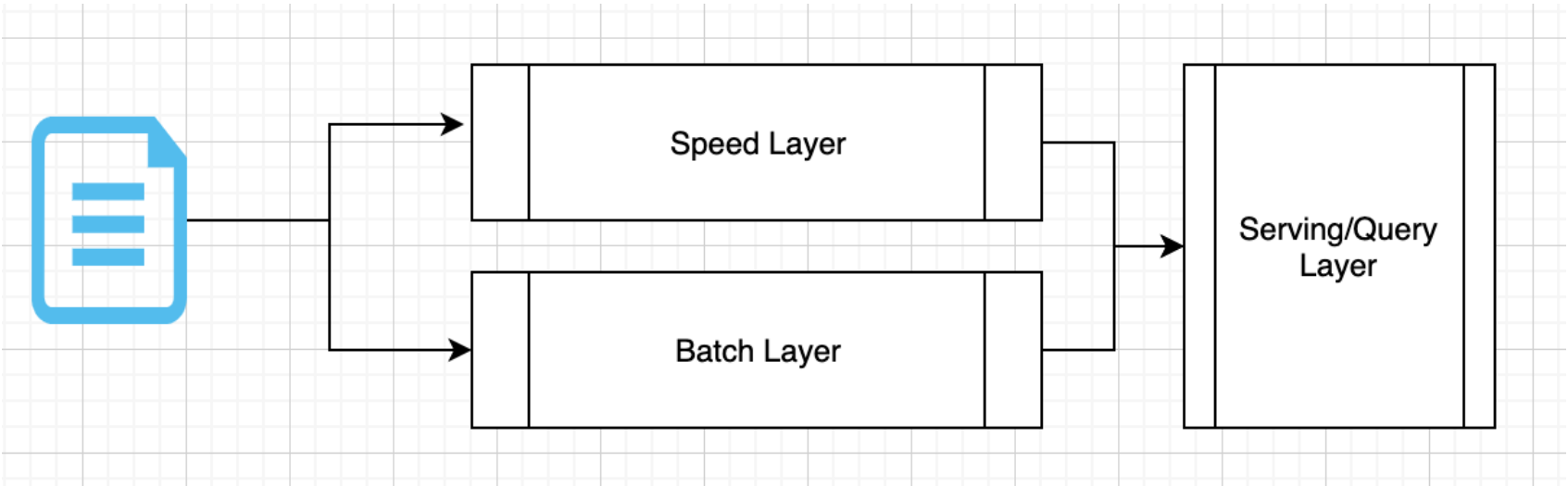
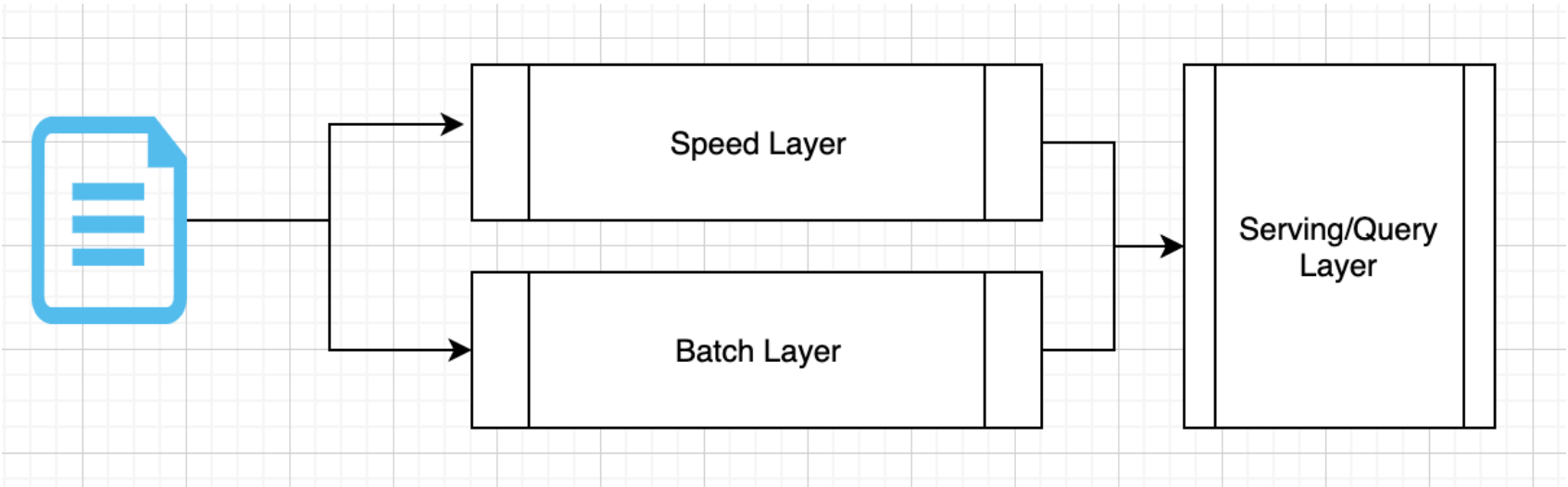
To do *SA* you need to analyze a large amount of data

Lambda Architecture



Lambda Architecture



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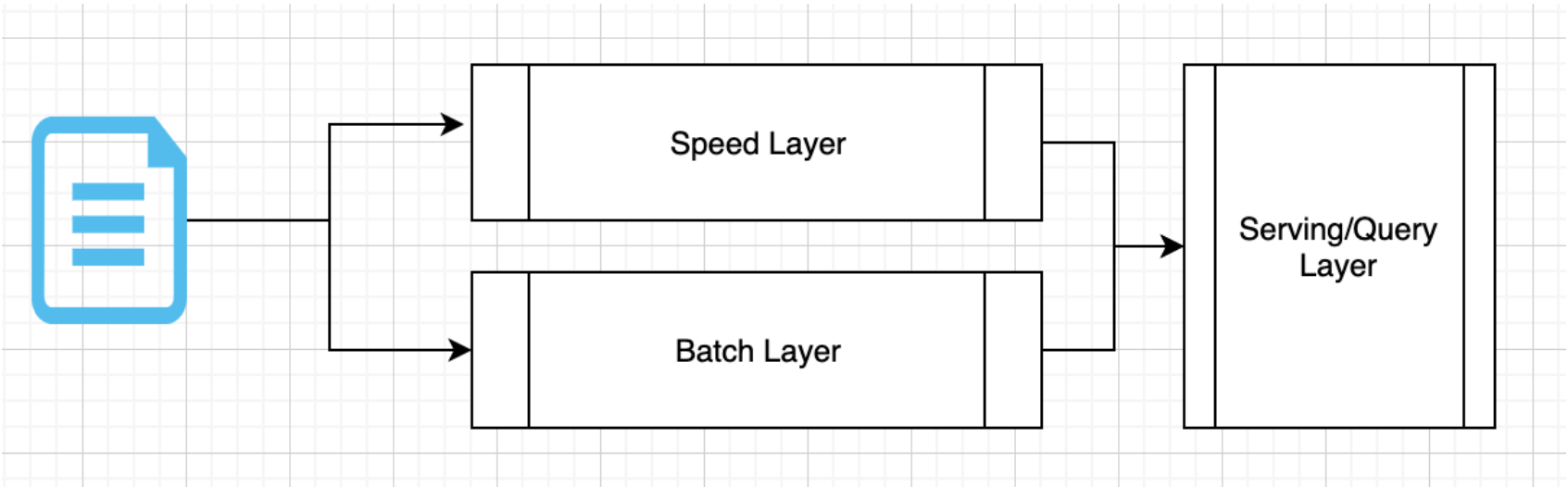

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- **Speed Layer**: compute similar functions to the batch layer ones but on *recent data*

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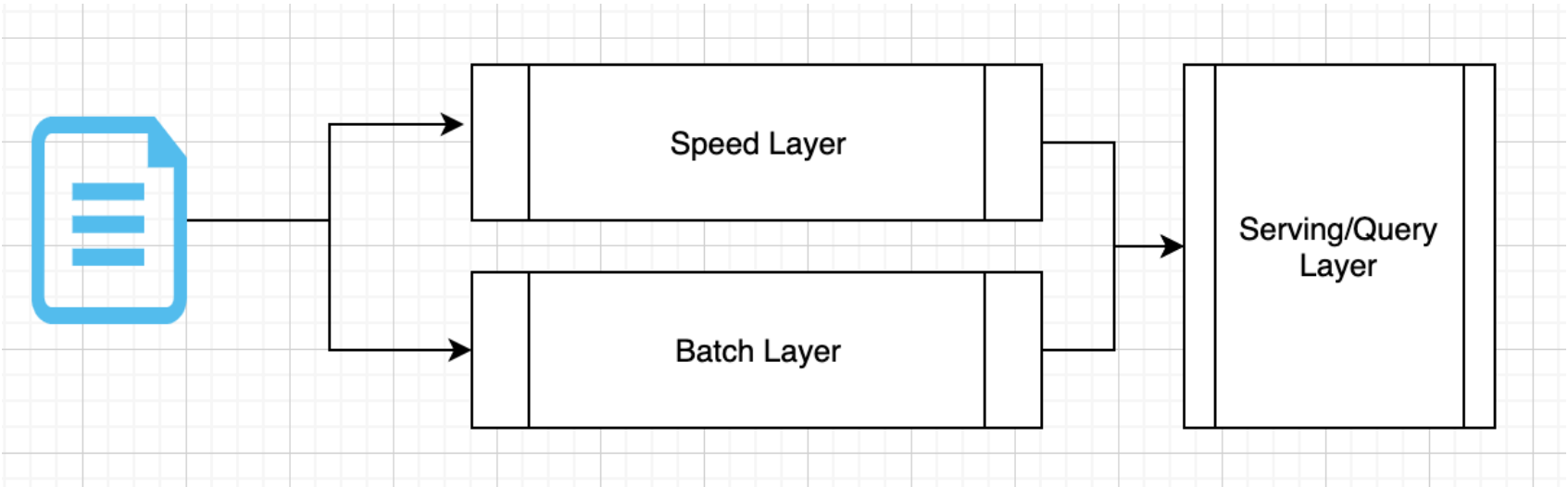

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- **Speed Layer**: compute similar functions to the batch layer ones but on *recent data*
- **Serving Layer**: answers to *real-time queries* reading batch and speed views

Lambda Architecture

The Lambda Architecture is summarized by these three functions:

- $batchView = function(allData)$
- $realtimeView = function(realtimeView, newData)$
- $query = function(batchView, realtimeView)$

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Communication

Communication between layers could happen via the HDFS, or via a distributed database

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- Analyze sentiments for specific keywords
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Solution

Each pair <`period, keyword`> must have its own counters

Tweets Classification with LingPipe

sentiment140 dataset

This dataset contains **1.6 Million tweets**. Each tweet is annotated with the the **sentiment** (0 = negative, 4 = positive).

Classification

- We trained a **LingPipe classifier** on *sentiment140* dataset
- We saved the model so that it can be loaded to classify tweets
- The classifier has a training accuracy of $\sim 80\%$, but this wasn't the focus of this work

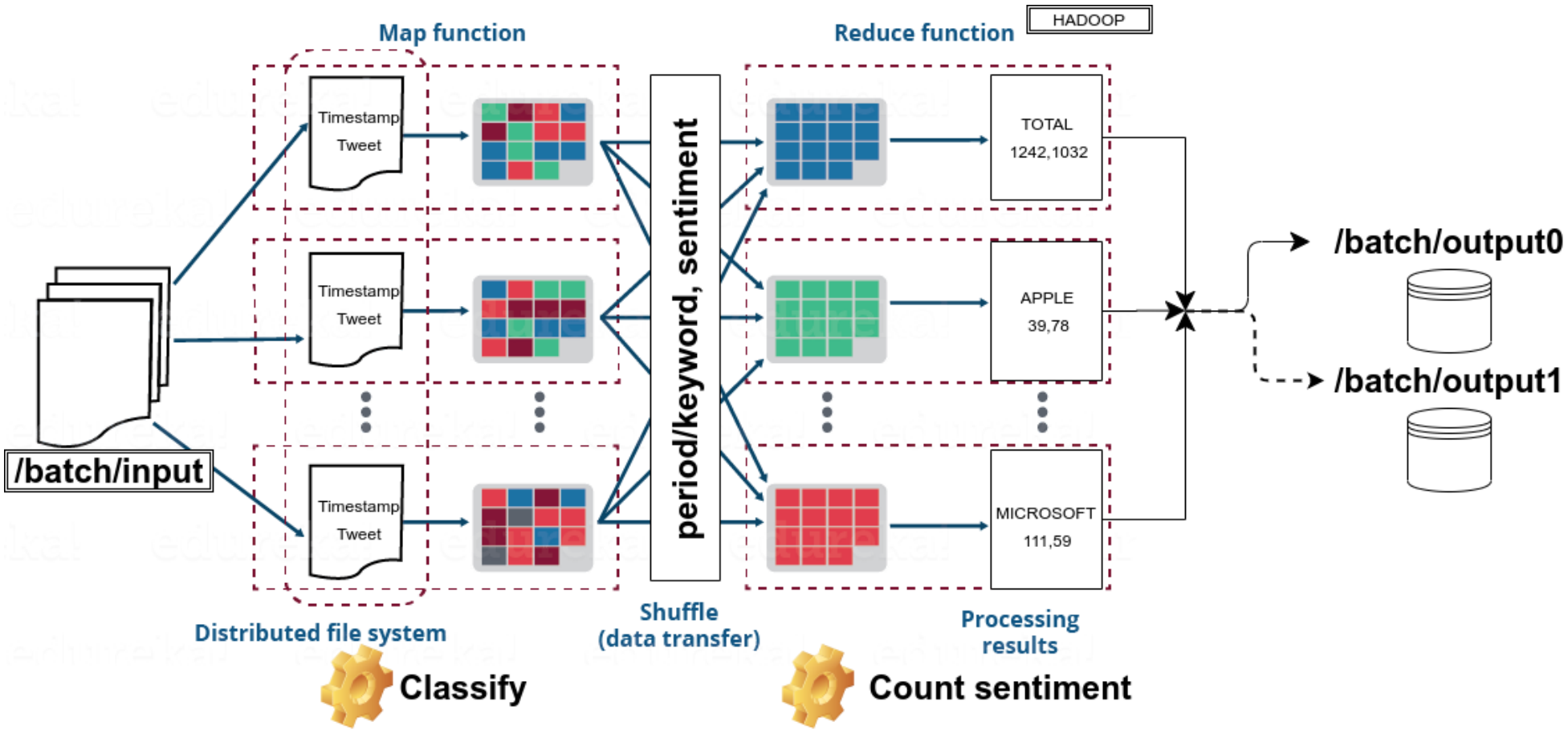
Tweets Generation

The Generator is a continuously-running process that simulates the emission of tweets by users.

- Tweets are sampled from sentiment140
- The generator associates each generated tweet with the current timestamp
- Tweet's timestamp and text are concatenated
- Concatenation is written into `/batch/input` and `/speed/input` HDFS folders

The parameters *maxFileDim* and *maxDeltaTime* control the buffer dimension and the max waiting time before write, respectively.

Batch Layer Schema



Mapper pseudo-code

Algorithm 1: Mapper

Input : tweet
Output: <period/keyword, sentiment>*

```
1 tweetTimestamp, tweetText = tweet.split(",")
2 classifier = loadClassifier()
3 sentiment = classifier.evaluate(tweetText)
4 for word in tweetText.split(" ") do
5     outputKey = tweetTimestamp + "/" + word
6     context.write(outputKey, sentiment)
7 end
8 period = getPeriod(tweetTimestamp)
9 context.write(period + "/total", sentiment)
```

Reducer pseudo-code

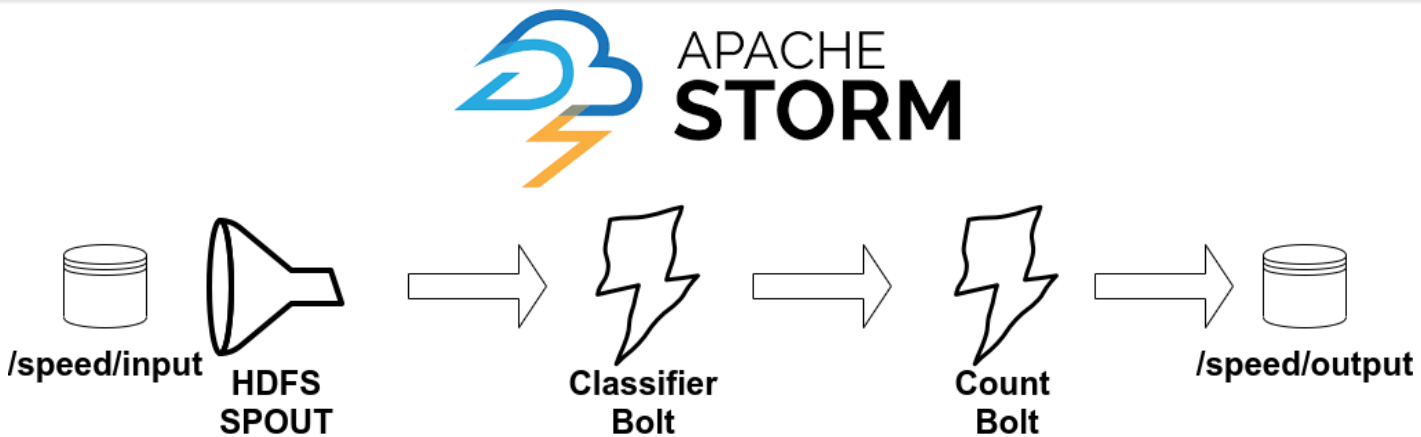
Algorithm 2: Reducer

Input : <key, sentiments>
Output: <key, stats>

```
1  numGood = 0
2  numBad = 0
3  for sentiment in sentiments do
4      if sentiment == 0 then
5          numBad++
6      else
7          numGood++
8  end
9  stats = str(numGood) + "," + str(numBad)
10 context.write(key, stats)
```

Speed Layer

- Speed layer uses a HdfsSpout for read the data
- It works at the same way of batch layer but with recent data
- Classifier Bolt is analogous to Mapper, Count Bolt is analogous to Reducer



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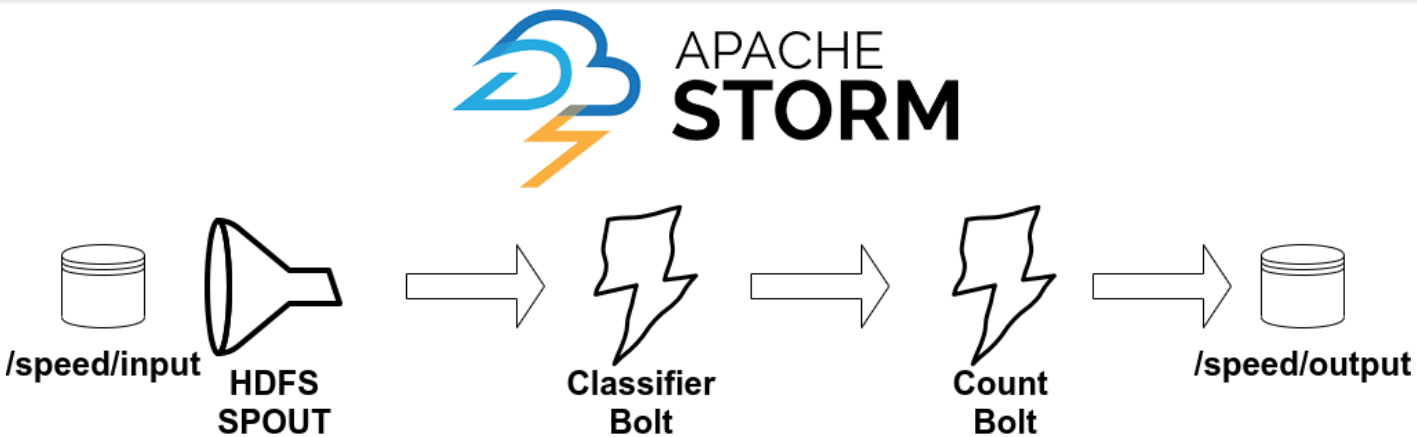


Counters have to be reset when Batch Layer finishes computation: therefore, a synchronization is required

Ping Pong schema

Generated tweets can be:

1. **Not yet seen** by the batch layer
2. **In processing** by the batch layer for the first time
3. **Already processed** by the batch layer

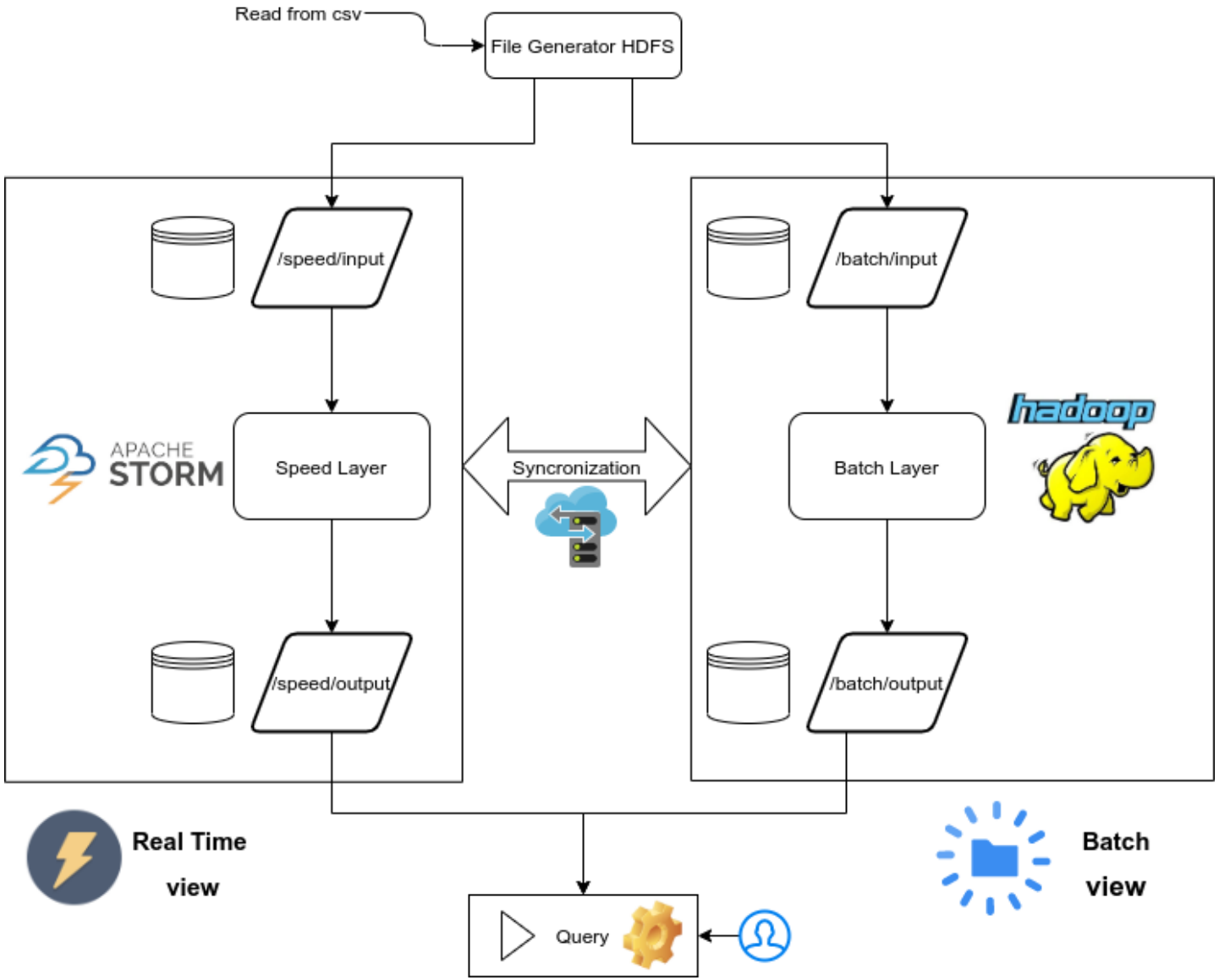
Batch layer

- writes last output folder in `/sync`
- writes processed and inProgress timestamps in `/sync`

Speed layer

- reads inProgress timestamp from `/sync`
- counts tweet after inProgress timestamp only

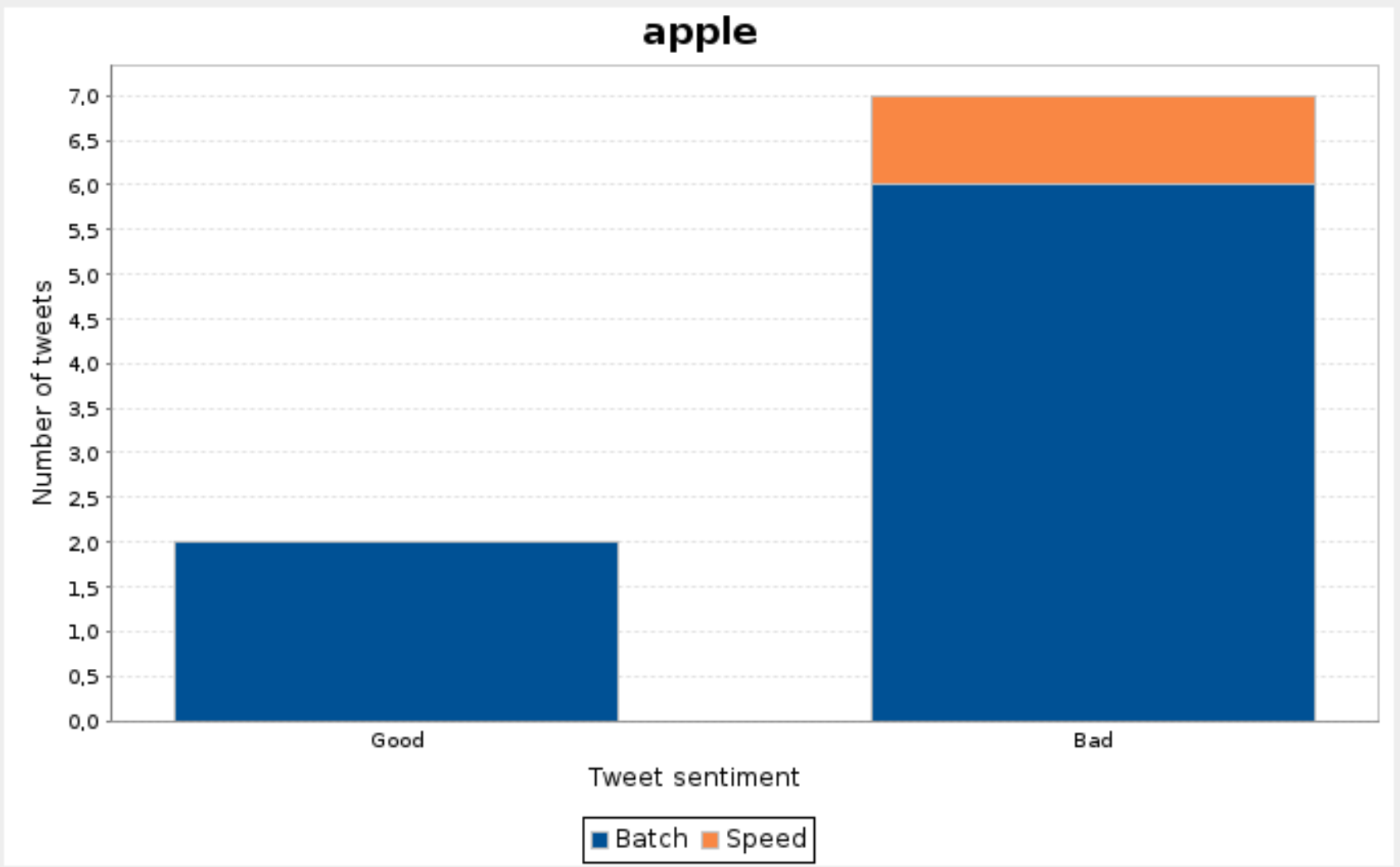
Complete architecture



The Serving Layer reads Batch and Speed views.
Results are provided via a GUI.

- The GUI allows you to specify a **time interval** by entering the start and end date
- The sentiment analysis considers the tweets sent in the chosen interval
- A **real-time summary** is provided for all tweets and for specified keywords

Stacked bar plot



Graphic User Interface

End

Thanks for the attention