Data Intensive Computing
CSE 587

Volatility Analysis Report

Using Mapreduce with hbase to compute the volatility of stocks in NASDAQ

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Programming Assignment 1

Problem Statement

1. Use Mapreduce to compute the volatility of stocks in NASDAQ
2. Evaluate the scalability of your implementation on different data sizes and number of nodes.

Description

In this assignment, you will use Mapreduce on a Hadoop environment at CCR to compute the monthly volatility of stocks. You are given daily data of 2970 stocks on NASDAQ market for 3 years from 01/01/2012 to 12/31/2014 (except holidays, otherwise called trading days). Imagine that you are a data analyst working for an investment company, your daily job is to analyse stock price data, and find out which stocks in a certain period have higher earnings potential, etc. One characteristic that is widely used by traders is the volatility index. You can get more details at http://stockcharts.com/school/doku.php?id=chart_school:technical_indicators:standard_deviation _volatility
Your data is 2970 CSV format files (Comma Separated). Each file contains the data for one stock using its symbol as the file name. A stock list file is also provided.

Data Format

For example, in the file **AAPL.csv**(Apple inc. stock), there are 7 columns, each row represents one day. The 5th column Close can be neglected(no use).

Date represents the date of the stock AAPL;

Open represents the open price in that day of stock AAPL;

High represents the highest price in that day of stock AAPL;

Low represents the lowest price in that day of stock AAPL;

Adj Close represents the close price in that day of stock AAPL;

Volume represents the volume in that day of stock AAPL;

Calculation

The calculation steps of Volatility is as follows:

- Calculate the average (mean) price for the number of periods or observations.
- Determine each period's deviation (close less average price).
- Square each period's deviation.
- Sum the squared deviations.
- Divide this sum by the number of observations.
- The standard deviation is then equal to the square root of that number.

Objective

- Find the top 10 stocks with Lowest (min) volatility
- Find the top 10 stocks with the Highest (max) volatility

Algorithm

I used HBase tables to store the values after each map reduce jobs.

Number of Mapper Implementation : 4
Number of Reducer Implementation : 3

Roles of each Mapper and Reducer:

Mapper1

- splits the input data and options the stock name, date and close adjacent value.
- Store the values in the table ‘raw

Mapper2

- Get the name, month, year from the ‘raw’ table and send it to the reducer.
- key - stock_name + month + year
- value - date + adjacent close value

Reducer2

- Since after the map step the values which have same key are grouped together and passed to the reducer as iterable, values that correspond to specific month and year of the particular stock are grouped together.
- Beginning adjacent close value and end adjacent close value are obtained by integrating through the iterable and the value of xi for the corresponding month is computed.
- Write the company name and the computed Xi values in the table **'xi_table'**

Mapper2

- Now we have to consolidate all the values obtained from the reducer with respect to company name.
- Key - Company Name
- Value - Xi

Reducer2

- All the xi corresponding to the the respective companies are grouped together.
- Volatility for the particular company is obtained from these values.
- Write the company name and the computed volatility in the table **'vol_table'**

Mapper3:

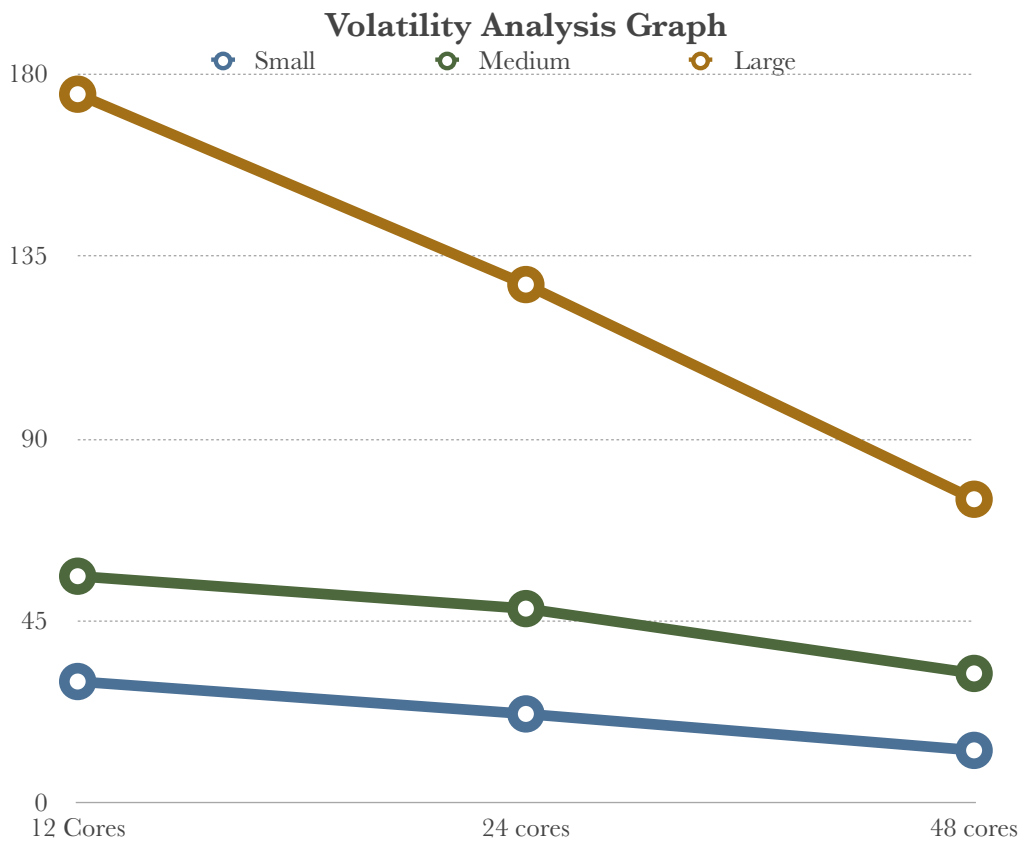
- All the companies are grouped together with a common key.
- Key - Common
- Value = Company Name + Volatility

Reducer3:

- Obtained iterable contains all the company name with values and they are sorted by a custom comparator.
- top 10 and bottom 10 values are obtained from the List and written to **'result_table'.**

Results and Graph

Problem size	Time in 3 Nodes	Time in 4 Nodes	Time in 6 Nodes
Small	30:10	22:39	13:35
Medium	56:23	48:58	32:10
Large	175:27	128:40	75:51



Performance and Scalability

From the above table and graph we can see that the ***time required for Computation decreases as the number of cores increases.***

For small data, the time taken by 4 nodes decreases about one-fourth of the time taken by one node. Similarly for medium data too time decreases by one fourth of the time taken by the 1 node. For large data, one node took around 13 hours whereas 4 node took around 2 hours. This is one sixth of the time taken in 4 nodes.

Conclusion

We can see from the above graph, that map reduce programs perform better if we increase the cores of the computation. So, **scale out** is better than scale up. Computation time of pig and hive seems to be much smaller. However the time taken to load the data initially seems to be of more time than others. So base is faster than others.