

COMP 464 - High Performance Computing

High Frequency Trading & 2010 Market Flash Crash

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1 Overview

With the advent of low cost advance computational capabilities and rapid grow of market transactions. The ability to process a high volume of transactions and calculation in an ever decreasing window of time have become a corner stone of modern financial markets (cite). The months leading to May of 2010 in the U.S were filled with political unrest overseas and news about the European debt crisis, then in May 6, 2016 protections for the default of the Greek government sovereign debt increased and the Euro declined sharply against the U.S Dollar and Japanese Yen.

The turmoil of the afternoon of May 6, 2010 in futures and securities markets were down 4% from previous day, then prices of futures contracts in particular stock index instruments declined suddenly another 5%-6% in very short period of time before rebounding within a very short period of time. The complexities and some of the details of what happened that day are covered on a report to the U.S Senate Committee on Banking and are beyond the scope of this project. (cite)

As computational capabilities continue to grow exponentially and financial markets around the world are increasingly dependable on automated systems it is worth to spend some time analysis the market depth data of the weeks leading to and the day of May 6, 2010 to have a better understanding of market behavior during this high volatility period and to compare some of this project findings with official report to congress from the CFTC and SEC. The data used in this project is from CME Group and corresponds to market depth transactions in milliseconds of the E-Mini S&P 500 futures and options contracts.

2 Methodology

The market depth data that the CME Group provides contains all market data messages required to recreate the order book (list of orders that a trading firm uses to record the interest of buyers and sellers in a particular financial instrument.) each message contains between five to ten orders deep in futures markets and three orders deep in options markets this data is time stamped to the millisecond allowing for an in depth analysis of the price movement. (cite)

In order to process the large volume of transactions (millions of transactions per week) and the goal is to compute daily, hourly, minute, seconds, millisecond volume and other data metrics it is necessary to implement statistical operations such as distributions, average in parallel as well as filtering map-reduce type jobs are ideal for type of task as the nature of the data (independent transactions) allows for parallel processing in most cases.

3 Performance

When processing the market depth data there different factors to consider such as the distribution of the files amount different nodes (Hadoop) and how to distributed evenly the work that each node would perform. To measure performance scalability metrics can be use in each of the statistical and filtering operations.

4 Reference

Rustler User Guide – Hadoop Cluster

<https://portal.tacc.utexas.edu/user-guides/rustler>

Introduction to High Performance Scientific Computing – Victor Eijkhout

<http://pages.tacc.utexas.edu/~eijkhout/istc/istc.html>

Kirilenko, Andrei; Kyle, Albert S.; Samadi, Mehrdad; Tuzun, Tugkan (May 5, 2014), The Flash Crash: The Impact of High Frequency Trading on an Electronic Market (PDF), retrieved 8 November 2017

http://www.cftc.gov/idc/groups/public/@economicsanalysis/documents/file/oce_flashcrash0314.pdf

U.S. Securities and Exchange Commission and the Commodity Futures Trading Commission (September 30, 2010). "Findings Regarding the Market Events of May 6, 2010"

<https://www.sec.gov/news/studies/2010/marketevents-report.pdf>