Business Motivations and Goals for Open Source Software

Radically open-source algorithmic trading engine
Business Motivations and Goals for Open Source Software

Counter Intuitive Motivations For Open Source

**Increasing Productivity**
By coding less....

**Instil Trust in Product**
By exposing all your flaws...

**Increase Adoption**
By giving clients the freedom to leave....
Agenda

Introduction to QuantConnect and the LEAN project.

Effectively Competing Against Larger Players.

Challenges of Building Hard Technology.

Keeping Up With Pace of Innovation Required.
Circa: 2012. Algorithms, Secrets and Software

Algorithmic trading industry is incredibly secretive, attributing trading advantages to sophisticated highly engineered software.

**High Value, High Expense**
Complex software requiring large investments of engineering and infrastructure expense.

**Signal Value**
Algorithmic trading signals directly convert into potential investment returns.
**Tight Contracts**
Funds employ restrictive non-competes and lock ups on employees to keep details about their algorithmic trading a secret.

**Legal Risk**
FBI arrests Sergey Aleynikov for alleged theft of Goldman code, for using a git repository.

**Expensive Financial Data**
Exchange monopolies keep tight grip on the available financial data, driving up prices making it difficult for individuals to procure data required for analysis.
What is QuantConnect?

We are a global community of engineer, scientist and quants passionate about algorithms and finance.

www.quantconnect.com/about

WE BELIEVE IN COLLABORATION, RADICAL OPENNESS AND COMMUNITY.

WE BELIEVE GENIUS IS DISTRIBUTED.

WE BELIEVE THE FUTURE OF INVESTMENT WILL BE AUTOMATED.
LEAN is a radically open-source cutting-edge algorithmic trading technology.

Since launching in 2012, LEAN has:

- grown to over **65K** quants globally
- created **1.2M** algorithms
- deployed **36K** live strategies
- traded **1.25B** volume
Global Open Source Community

Global community of engineers, scientists and quants, all united by a passion for the financial markets. Funds leverage LEAN to fast-track their strategy development.

GLOBAL BREAKDOWN

19% Asia
26% Europe
55% United States

80+ Engineers
Contributing to source code

1200 Forks
Users cloning of LEAN codebase

Dozens of Funds
Using LEAN for research

100+ Demonstrations
Python and C# Demonstrations

www.github.com/quantconnect/lean
Core Team

Jared Broad
CEO, Biomedical Engineer

Alexandre Catarino
Quantitative Development
CQF, PhD Philosophy

Gustavo Aviles
COO, Industrial Engineer

Juan Jose
Data Engineering
PhD Economics

Stefano Raggi
Cloud Engineer
Computer Engineer

Jing Wu
Financial Engineering
Alpha Engineering

Martin Molinero
Open Source Engineering
Software Engineer

Briana Bigio
Biomedical Engineering
Operations
QC HQ: Seattle, WA
Problem 1:

#1. Competing against larger, well funded competitors.
Others You May Know

Quantopian

Quantiacs

ALGO Trader

RiceQuant

NUMERAI

≈ +$100M VC Funding

QUANTCONNECT

Grown through organic community word of mouth, users investment and bootstrapping.

As of 2017, less than $1M Funding

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Closed Source Humble Beginning
2014, Closed Source

2012 – Launch, $40k Angel (Start Up Chile)

2014 – Broke.

2,000 Accounts
but
4 Clients - $76/mo
(2 of them family)

What are we doing this for?

PS: Quantopian had $7M in Funding
The Cupboard

Some Perks
- Good Coffee, Empanadas
- Open 24/7
- Concrete Block - Cool, Quiet
- Steal Wifi From Neighbors
- $100 Per Month Rent
Why Open Source?

Solid esoteric reasons to open source...
But little evidence to risk it all on a gamble.
Why Open Source?

Our Bet...
The majority of people will pay for convenience and ease of use.

Our value isn’t from code, its in usage of the code.
Crowd Funding

June 2014
What do we have to lose?

Let’s find “The 100”: at least 100 people passionate about the project enough to sign up at $10/mo.

If we do, we’ll open source the project.

(Or if we can’t, we’ll quit and go get day jobs).
WEBSITE

Welcome to the QuantConnect Algorithm Development Terminal

Wish to see QuantConnect Open Sourced?

We want to open source QuantConnect to give you backtesting in Visual Studio but we need your help! If we reach 100 passionate fans we'll open it to the world!

Reach 12 of 100 Supporter Target!

Upgrade today to Open Source QuantConnect

Starter Algorithms

Basic Template

Exponential Moving Average Cross

50d-10d Exponential Moving Average Cross

50d-10d Exponential Moving Average Cross strategy using the 50 day moving average of close prices, with a debouncing 0.1% tolerance.

SPY Dollar Averaging

Investing at small regular intervals through 2012-2014 averaging the S&P500 index. This is a traditional entry technique for a long term investor.

My Algos

Project Name | Last Modified
---|---

Introduction to QuantConnect

Introduction to the QuantConnect Algorithm Development Terminal

Jared Broad

We believe in a transparent and level playing field in the financial markets; that the crowd is better than an individual bank or hedge fund, and that genius does not live in a cubicle in NYC. We believe that you, our supporters, are the future of finance.

Latest News

Latest news and updates from the team at QuantConnect.

New Feature] Custom Order Tagging

You can now tag orders with a short string of custom information. This lets you record critical information relating to the order which will display next to the order in the trades tab.

Debugging Enhancements, Memory Leak Fixes

We're releasing a new build of the server today which has some good improvements for your debugging and backtesting. Code errors in the Initialize() function will now be properly reported to console - Check errors in custom data creation will also be reported to console - Check memory leaks

YES!!!
Open Source Caused Feature Explosion

2012 - Launch
2014
2014, 2015
2015
2016 – Really Hard
2017 - 100% Open Source Contribution

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Problem 2:

#2. Algorithmic trading is a difficult and error prone technology.
Difficult Technology, High Impact

**Flash Crash**

A flash crash is an event in electronic securities markets wherein the withdrawal of stock orders rapidly amplifies price declines. The result appears to be a rapid sell-off of securities that can happen over a few minutes, resulting in dramatic declines. A flash crash, like the one that occurred on May 6, 2010, is exacerbated as computerized trading programs react to aberrations in the market, such as heavy selling in one or many securities, and automatically begin selling large volumes at an incredibly rapid pace to avoid losses. Flash crashes can trigger circuit breakers at major stock exchanges like the NYSE, which halt trading until buy and sell orders can be matched up evenly and trading can resume in an orderly fashion.

**BREAKING DOWN 'Flash Crash'**

Shortly after 2:30 p.m. EST on May 6, 2010, a flash crash began as the Dow Jones Industrial Average fell more than 1,000 points in 9 minutes, the biggest such drop in history, at that point. Over one trillion dollars in equity was evaporated, although the market regained 70 percent by the end of the day. Initial reports that the crash was caused by a miswired order proved to be erroneous, and the causes of the flash were attributed to a Navinder Sarao, a futures trader in the London suburbs, who pled guilty for attempting to "spoof the market," by quickly buying and selling hundreds of E-Mini S&P Futures contracts through the Chicago Mercantile Exchange.

There have been other flash crash type events in recent history wherein the volume of computer generated orders outpaced the ability for the exchanges to maintain proper order flow:

- August 22, 2013: Trading was halted at the Nasdaq for more than 3 hours when computers at the NYSE could not process pricing information from the Nasdaq.
- May 18, 2012: Facebook's IPO. While not a flash crash per se, Facebook shares were held up for more than 30 minutes at the opening bell as a glitch prevented the Nasdaq from accurately pricing the shares causing a reported $460 million in losses.
Community Review

The global open source community provide incredible validation and review.

Peer Review
Create customized impact models to handle order impact on fills.

Rapid Feedback
Quickly obtain feedback from engaged pool of users. Collaborate in chat rooms directly with consumers.

Improving Regression and Unit Testing
The community helps us implement new regression and unit tests, finding the thousands of edge cases.
Instilling Trust of Clients

Winning trust of community is critical with such mission critical software. Why should clients trust a start up with limited track record?

- **Transparency**: Public visibility into code issues and flaws, along with list of work in progress.
- **Voice**: Ability to communicate concerns and contribute, be heard publicly.
- **Regression**: Public unit and regression testing displaying success and failures.

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Recruiting and Building an Audience

Building an audience of fans is critical to any sustainable business.

Industry Attention
Attracted the attention of industry, investors and clients.

Powerful Recruiting
Our entire team was sourced from the open source project. Love hard problems.

Strong Retention
People are voluntarily working on LEAN, gives us strong retention.

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#3. Complex needs made it difficult to keep pace with innovation.
Nearly Infinite Complexity

1000 Models * 1000 Different Implementations

Slippage Models  Realtime Events Management
Transaction Fee Models  Data Feed Implementations
Market Impact Models  Algorithm Setup Implementations
Custom Data Implementations  Logging and Debug Management
Order Filling Models  Algorithm Settings Models
Brokerage Models  API Implementations
Margin Model  Brokerage Setup Factories
Margin Call Model  Caching System Implementations
Brokerage Implementations  Streaming Data Provider
Data Downloader Implementations  Corporation Action Implementations
Indicator Implementations  Universe Selection Implementations
History Providers  Alpha Generation Implementations
Settlement Models  Portfolio Construction Implementations
Asset Class Models  Point Price Providers
Result Handling Implementations  Trade Builder for Statistics Creation
Messaging Implementations  Regression Algorithm Implementations
Transaction Processing Model  Risk and Execution Model Implementations
Codesign Focus

Define Interfaces
Define how the software communicates.

Provide Examples, Review
Provide template example implementations and detailed thoughtful review feedback to community.

Write Documentation
Invest heavily in beautiful HTML documentation to help the community learn quickly.
Codesign Focus

**Bitfinex**
Crypto exchange implementation shared back to the community from a hedge fund using LEAN.

**Binance**
Crypto exchange implementation shared back to the community from a hedge fund using LEAN.

**Alpaca**
Commission free brokerage, algorithmic trading competitor to Robinhood, submitted a brokerage implementation to LEAN.
Core Fears of Lock In

Understanding the true fears of clients of vendor lock-in and how to eliminate them with open source.

**Fear of bugs which are not patched.**
Unpatched issues in the code base making business inefficient.

**Fear required features not prioritized.**
Critical features and improvement required but no pathway to implement them.

**Fear price hikes make business unsustainable.**
Pricing changes in the software will force the company to move to another platform.

Phasing Out Brokerage Integrations

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Open Up Technology

Opening up the platform allowed clients freedom to evolve at their own pace, along with eliminating lock in fears, increasing adoption.

**Freedom**
Open source gives clients freedom to modify, fix, extend the software.

**Lock In Dissolves**
Fears of vendor lock in dissolve and adoption improves.

**Self Direction**
Soliciting community involvement gives self direction and control.

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Choosing an Appropriate License

What is your value proposition to clients?
Unpatched issues in the code base making business inefficient.

Who are your target users?
Unpatched issues in the code base making business inefficient.
LEAN Engine Design

Each component of the LEAN Engine is customizable and pluggable. With slight configuration changes, you can route to new brokerages and select new datafeeds.
The Framework

- **UNIVERSE SELECTION**
  - Select asset for trading

- **ALPHA CREATION**
  - Generate signals prediction

- **PORTFOLIO CONSTRUCTION**
  - Create target portfolio

- **EXECUTION MODULE**
  - Execute target portfolio

- **RISK MANAGEMENT**
  - Manage risk on open positions

**BROKER**

**Coarse Universe**

**Fine Universe**

**ASSETS**

**INSIGHTS**

**SHARE COUNT**

**MANAGE RISK**

**QUANTCONNECT ALGORITHM**

BASE ALGORITHM API. ALL COMMON METHODS
Data Integrations

US Equities and Fundamental Data
QuantQuote provides US equities data to tick resolution; survivorship bias free. Trade and NBBO quote support for backtesting. Paired with MorningStar fundamental data for professional grade equities backtesting.

Multi-Market Forex and Contracts for a Difference (OANDA/FXCM)
Currency trading across multiple exchanges and marketplaces; with spread modelling for accurate order fills. Supporting markets FXCM, OANDA and Interactive Brokers.

Futures and Options (AlgoSeek)
AlgoSeek provides tick by tick future trades and quotes, and minute resolution options support. LEAN can backtest and trade option and future chains.

Cryptocurrency Support (Kaiko/GDAX)
Kaiko and GDAX supply cryptocurrency trade and quote data at tick resolution, enabling trading across major currencies in US. Binance and Bitfinex are also planned additions.