

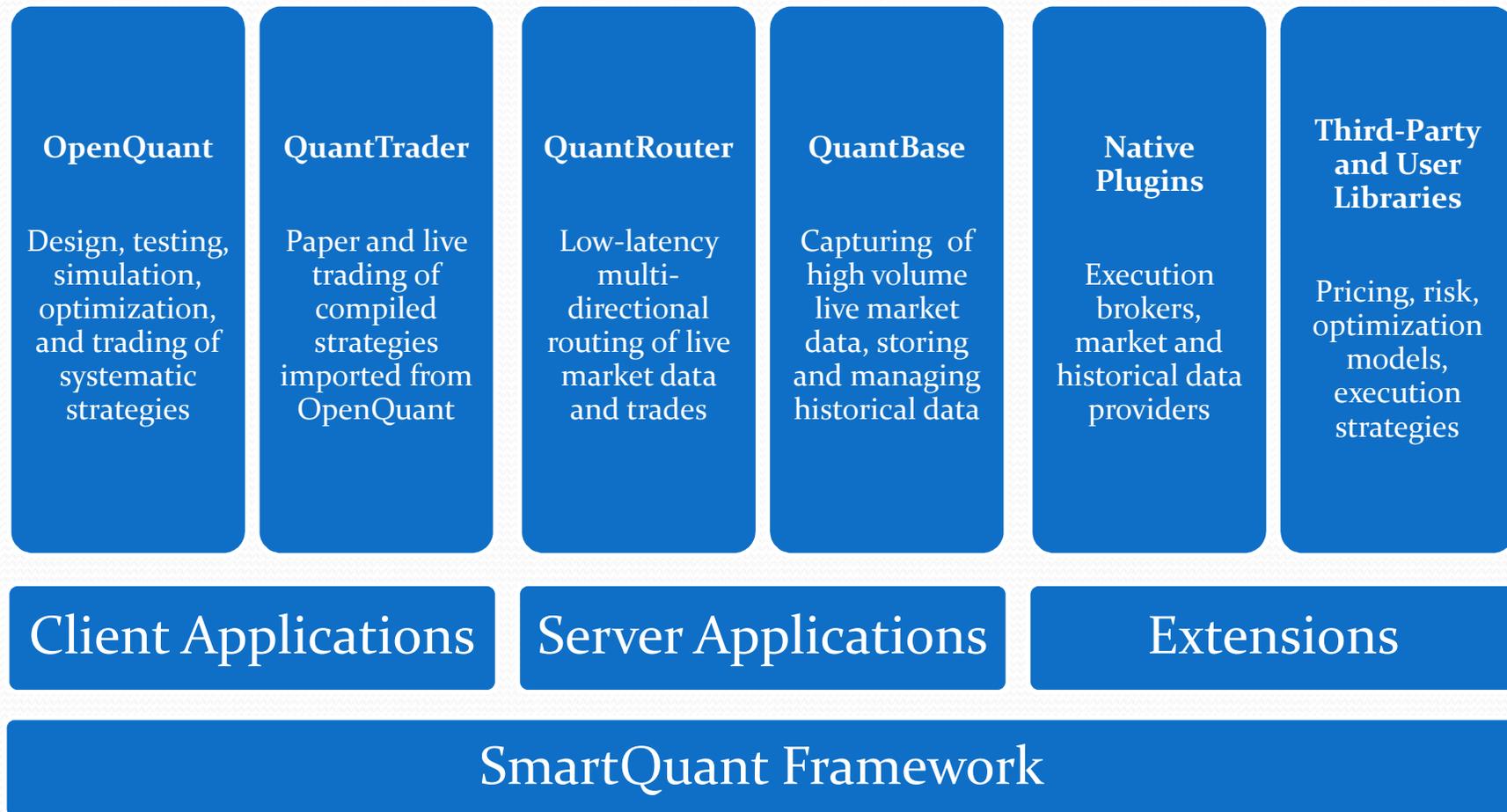
SmartQuant End-to-End Algo Trading Infrastructure

SmartQuant USA

Overview

- SmartQuant Algo Trading Infrastructure is designed for quantitative investors and traders, as well as institutional users such as hedge funds, proprietary trading groups, brokers, consultants and service providers.
- All products share the same underlying complex-event processing framework, which allows to seamlessly integrate them for tasks of any complexity.
- Developers can use a rich API to write their own strategies, while taking advantage of built-in capabilities such as consistent trading simulations, data management, and optimization.
- The same strategy code can be switched to paper or live trading, eliminating any mismatches between development and production.
- The system is open, in a sense that it can be extended by additional customized plug-ins to handle market data, execution, and simulation.

A Complete Front-Office Solution



A Comprehensive and Coherent Framework

Complex Event Processing (CEP) approach allows comprehensive treatment of all market events as they occur, without unnecessary assumptions and middle layers

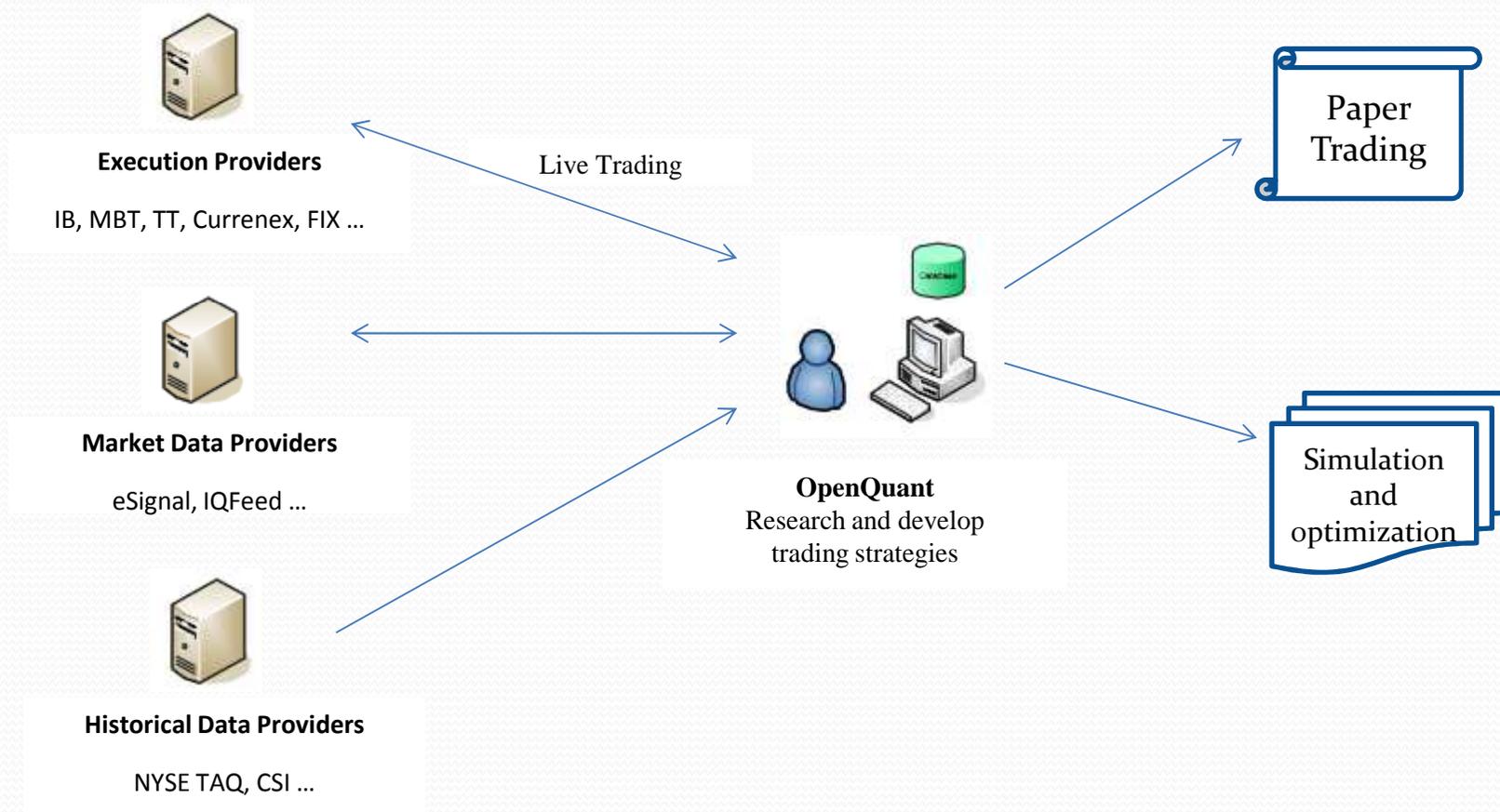
CEP approach extends to strategy as well, allowing to execute actions on events such as OnTick(), OnQuote(), OnBar(), OnOrderFilled(), etc for each instrument and for the portfolio as a whole

Robust
Systematic Strategy
Development

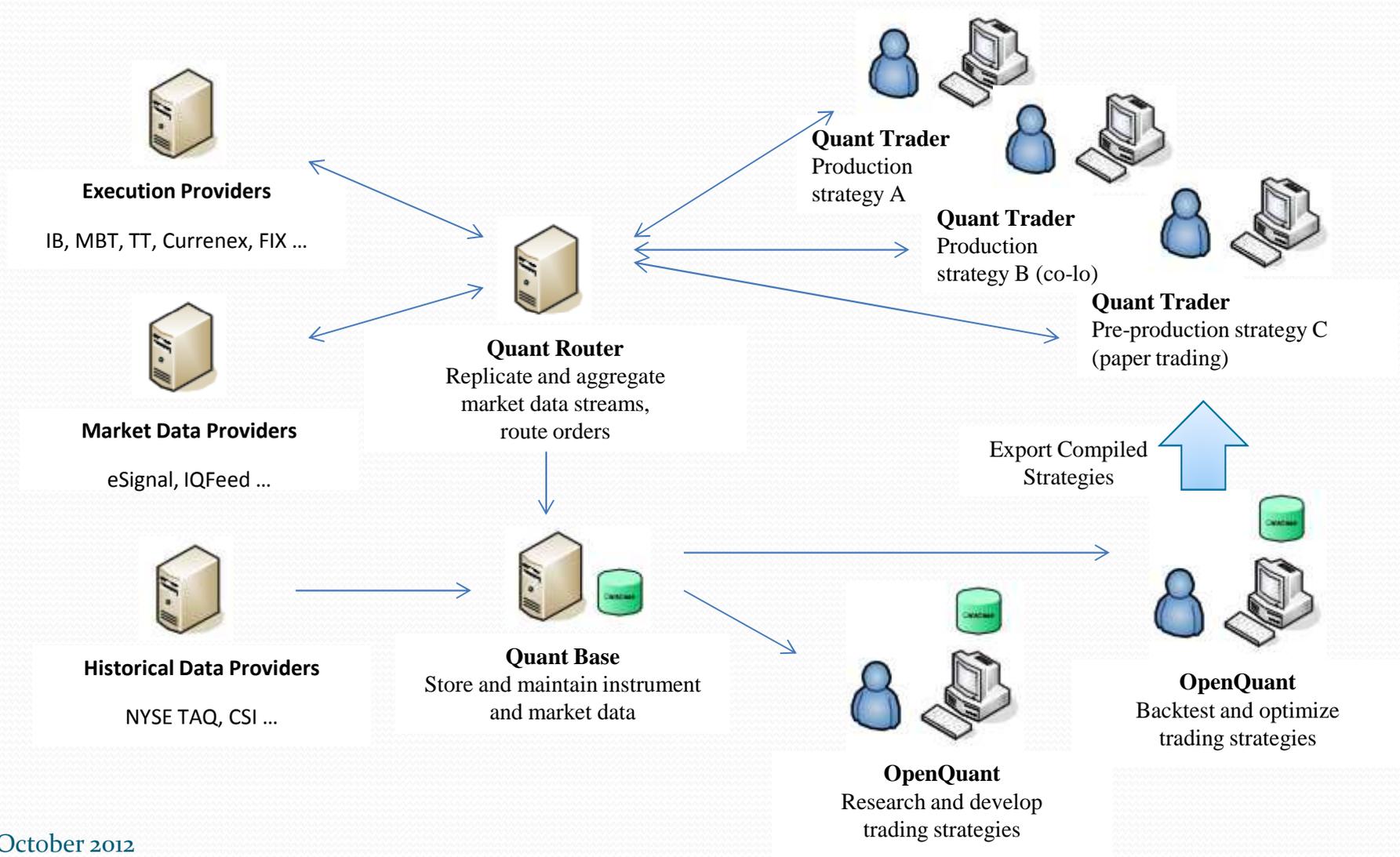
Data management aligned with strategy: ticks, quotes, bars and synchronization automatically precludes the accidental use of ahead of time data in historical simulations

Integrated simulation engine capable of replicating the full complexity of real trading, including trading costs and slippage, allows realistic backtests and optimization of strategies

Quant Strategist Setup



Small Quant Fund/Desk Setup



OpenQuant

SmartQuant CEP Framework

- The framework is based on *throwing* and *catching* actionable events
- Anywhere in the framework, the corresponding code can be entered to perform a customized action when a given event is triggered
- Every event becomes actionable within the framework:
 - Market events: `OnQuote()`, `OnTick()`
 - Data processing events: `OnBarOpen()`, `OnBar()`, `OnBarSlice()`
 - Portfolio events: `OnStrategyStart()`, `OnPositionChanged()`, `OnPositionClosed()`, etc.
 - Trading events: `OnOrderFilled()`, `OnOrderPartiallyFilled()`, `OnOrderCancelRejected()`, etc.
- Each of these and many other events represent a virtual method that can be overloaded by the user to define a specific action, if needed.
- Instead of following each thread of if/then actions along a complex branching tree, the developer defines responses to a relatively limited set of relevant events.
- The strategy code becomes very nimble, while the framework handles the complex internal connections and makes sure that the consistency is maintained.

Systematic Development Process

Research

- Search for alpha signals and predictable patterns for tactical trading
- Design relative value metrics and scan for arbitrage opportunities

Testing

- Run historical backtests, both on the original set of instruments and wider universe
- Run real time paper trading, with either internal execution simulation or broker

Optimization

- With strategy structure identified, define optimization parameters and objectives
- Optimize using global (in-sample) or walk forward (rolling out-of-sample) approach

Production

- Run the same code in production trading as the one used for testing and optimization
- Maintain limited number of manual controls and flexibility to adjust parameters

Flexible Strategy Development

- The Portfolio Manager Edition allows a highly modular strategy development.
- Strategy design is based on Alpha Signal, Portfolio Construction, Risk Management, and Execution objects, each of which can be extended by the user to customize his/her strategies.
- Strategies allow flexible interaction with external data via simple driver text files.
- Multiple strategies can be run simultaneously within a single meta-strategy.
- Risk management is defined on three levels:
 - Position risk management controls maximum position and other such constraints
 - Portfolio risk management controls total risk of portfolio and executes umbrella hedges.
 - Liquidity risk management controls the broker margin cushion and allows automatic down- or up-leveraging of the portfolio based on user criteria
- The provided sample risk management object uses multiple hedging instruments using user-supplied estimates instrument betas for umbrella hedging. Users can override this with their own single- or multi-factor or non-linear risk models.
- Other useful features include:
 - Multi-currency accounting and simulations allow trading international portfolios.
 - Instrument level definitions, such as tick size or trade lots, for realistic trading.
 - Flexible trading activity and position scaling depending on time of day and other criteria, including ramp ups and ramp downs at the start and end of trading sessions.

Flexible Simulation Scenarios

- The SmartQuant framework includes the Scenario class, which defines how various backtests, walk forward tests, Monte Carlo simulations and other such simulations are run.
- The Scenario class has a Run() method which is overloadable by the user, who can define with great flexibility various assumptions and dependencies in the simulation.
- By default, it would simply run the strategy on the actual historical data between a given start and end time.
- But it is also easy to define many other modes of simulation:
 - Batch backtests – running the same backtest with changing parameters or instruments
 - Walk forward tests – running the simulation in a loop with re-defining the “in-sample” period, re-optimizing the parameters, and running over the next “out-of-sample” period
 - Monte Carlo and Bootstrap Monte Carlo – generating the Monte Carlo paths of data using either a model or a bootstrap technique and running the simulation on each path
 - Continuous backtests – obtain the parameters for each next day from the result of the backtest over previous growing interval
 - Backtest-to-Live scenarios – pre-run certain backtests and compute some parameters before turning on the Live mode, automatically
- The Scenario object also allows a user-defined objective function for optimization and solving for the parameters, and user-defined report format for the results.

Integrated Development Environment

- OpenQuant Portfolio Manager Edition contains all of the necessary components for the systematic development process and can server as a complete development solution for quantitative strategies.
- The integrated development environment allows infinitely flexible strategy research and experimentation. Strategies can be as simple as a few lines of code, taking advantage of built-in indicators and simple order type, or as complex as large libraries of code including user defined objects, behaviors and extensions.
- Strategy debugging mode can run strategies with user-defined time step interval to trace internal event, signal and execution flow with high resolution.
- Integrated data management allows to import or capture market data and use it for historical backtests, as well as real time paper and live trading.
- Powerful backtesting and simulation includes realistic trading and costs assumptions which can be modified by the user.
- Detailed monitoring of portfolio positions and transaction details allows the user to quickly identify any bottlenecks or challenges in real life implementation of the strategy.
- Flexible Strategy Monitor with user defined watch variables allows constant and consistent view of the performance aligned with the strategy design.

Integrated Development

The screenshot displays the OpenQuant IDE interface. The main window shows a C# code editor for a strategy named "code.cs (Simple Moving Average Crossover)". The code implements a crossover strategy with the following logic:

```
public override void OnBar(Bar bar)
{
    // does the fast average cross over the slow average?
    // if so, time to buy long
    Cross cross = sma1.Crosses(sma2, bar);
    // we only allow one active position at a time
    if (entryEnabled)
    {
        // if price trend is moving upward, open a long
        // position using a market order, and send it in
        if (cross == Cross.Above)
        {
            marketOrder = MarketOrder(OrderSide.Buy, Qty, "Entry");
            marketOrder.Send();
            // if one cancels all exit method is desired, we
            // also issue a limit (profit target) order, and
            // a stop loss order in case the breakout fails.
            // The OCA exit method uses a real stop loss order.
            // The Stop exit method uses a stop indicator.
            // Use either the OCA or Stop method, not both at once.
            if (OCAExitEnabled)
            {
                // create and send a profit limit order
                double profitTarget = LimitOCALevel * bar.Close;
                limitOrder = SellLimitOrder(Qty, profitTarget, "Limit OCA " + OCACount);
                limitOrder.OCAGroup = "OCA " + Instrument.Symbol + " "
                    + OCACount;
                limitOrder.Send();
            }
            // create and send a stop loss order
            double lossTarget = StopOCALevel * bar.Close;

```

The interface includes several panels:

- Instruments:** A tree view showing various financial instruments like ETFs (QQQQ), FX (EUR A0-FX, EUR USD, GBP A0-FX), Index (SPY), and Stocks (AAPL, AMZN, BRCD, CHKP, CIEN, CSCC, DELL, MSFT, QLGC, RFMD, YHOO).
- Providers:** A list of data providers including Genesis, Hotspot, IB, Integral, IQFeed, Ivory Scorpion, MBTrading, Nordnet, Open E Cry, OSL FIX, PATS API, Plaza II, QuantRouter, QUIK FIX, Simulator(execution), SmartCOM, TT API, TT FIX, and Historical Data.
- Solution Explorer:** A tree view of the project structure, showing folders for Market Data, Scenario, Simple Moving Average Crossover, Instruments, Code, and various event handlers like OnStrategyStart, OnStrategyStop, OnActiveChanged, OnBarOpen, OnBar, OnBarSlice, OnTrade, OnQuote, OnOrderBookChanged, OnPositionOpened, OnPositionChanged, OnPositionClosed, and OnPositionValueChanged.
- Properties:** A panel showing configuration settings for the strategy, including Account (Currency: USD), Exit (CrossoverExitEnabled: True, OCAExitEnabled: True, StopExitEnabled: True), OCA (LimitOCALevel: 1.05, StopOCALevel: 0.98), Parameters (Qty: 100), Reporting (ReportEnabled: False, TestingPeriod: day1), and SMA (Color1: 255, 255, 0; Color2: 173, 216, 23).
- Output:** A panel at the bottom for displaying execution logs.

Integrated Data Management



Integrated Backtesting



Integrated Trade Processing

The screenshot displays the OpenQuant Order Manager interface. The main window shows a table of trade execution data for various instruments. The table includes columns for Date/Time, Symbol, Side, Type, Qty, Avg. Price, Price, Stop Price, Status, and Text. The data shows a series of trades for APL, MSFT, CSCD, and YHOO, with some orders being cancelled.

Date/Time	Symbol	Side	Type	Qty	Avg. Price	Price	Stop Price	Status	Text
3/26/2004 11:59:59...	APL	Sell	Stop	100	0.00	0.00	26.50	New	Stop OCA 182
3/26/2004 11:59:59...	APL	Sell	Limit	100	0.00	28.39	0.00	New	Limit OCA 182
3/26/2004 11:59:59...	APL	Buy	Market	100	27.04	0.00	0.00	Filled	Entry
3/26/2004 11:59:59...	MSFT	Sell	Stop	100	0.00	0.00	24.53	New	Stop OCA 182
3/26/2004 11:59:59...	MSFT	Sell	Limit	100	0.00	25.28	0.00	New	Limit OCA 182
3/26/2004 11:59:59...	MSFT	Buy	Market	100	25.03	0.00	0.00	Filled	Entry
3/26/2004 11:59:59...	CSCD	Sell	Stop	100	0.00	0.00	22.93	New	Stop OCA 175
3/26/2004 11:59:59...	CSCD	Sell	Limit	100	0.00	24.57	0.00	New	Limit OCA 175
3/26/2004 11:59:59...	CSCD	Buy	Market	100	23.40	0.00	0.00	Filled	Entry
3/25/2004 11:59:59...	YHOO	Sell	Stop	100	0.00	0.00	46.00	Cancelled	Stop OCA 155
3/25/2004 11:59:59...	YHOO	Sell	Limit	100	49.29	49.29	0.00	Filled	Limit OCA 155
3/25/2004 11:59:59...	YHOO	Buy	Market	100	46.94	0.00	0.00	Filled	Entry
3/25/2004 11:59:59...	DELL	Sell	Stop	100	0.00	0.00	33.08	New	Stop OCA 184
3/25/2004 11:59:59...	DELL	Sell	Limit	100	0.00	35.45	0.00	New	Limit OCA 184
3/25/2004 11:59:59...	DELL	Buy	Market	100	33.76	0.00	0.00	Filled	Entry
3/23/2004 11:59:59...	DELL	Sell	Market	100	33.17	0.00	0.00	Filled	Crossover Exit
3/17/2004 11:59:59...	YHOO	Sell	Stop	100	43.95	0.00	43.95	Filled	Stop OCA 154
3/17/2004 11:59:59...	YHOO	Sell	Limit	100	0.00	47.09	0.00	Cancelled	Limit OCA 154

Below the main table, there is a 'Reports' section for report ID 040325235959_9049, showing transaction details:

TransactTime	OrdStatus	OrderQty	CumQty	LeavesQty	LastQty	LastPx	AvgPx	Text
3/31/2004 11:5...	Cancelled	100	0	100	0	0.00	0.00	Stop OCA 155
3/25/2004 11:5...	New	100	0	100	0	0.00	0.00	Stop OCA 155

The interface also includes a 'Solution Explorer' on the right showing a project structure for 'Simple Moving Average Crossover', and a 'Properties' window at the bottom right showing details for a selected order, such as Account, ClientID, Date/Time, Instrument, and Order details.

Integrated Portfolio Monitoring

The screenshot shows the OpenQuant - Portfolio application interface. The main window displays a 'Portfolio' view with a table of positions and a table of transactions. The positions table includes columns for Symbol, Side, Price, Qty, Bought, Sold, Short, Margin, Debt, Value, and PnL. The transactions table includes columns for DateTime, Symbol, Side, Price, Qty, Value, Cost, PnL, Currency, and Comment. The interface also features a Solution Explorer on the right, a Properties panel, and an Output window at the bottom.

Symbol	Side	Price	Qty	Bought	Sold	Short	Margin	Debt	Value	PnL
AAPL	Long	27.04	100	100	0	0	0.00	0.00	2704.00	0.00
CSCO	Long	23.57	100	100	0	0	0.00	0.00	2357.00	17.00
DELL	Long	33.62	100	100	0	0	0.00	0.00	3362.00	-14.00
MSFT	Long	24.93	100	100	0	0	0.00	0.00	2493.00	-10.00

DateTime	Symbol	Side	Price	Qty	Value	Cost	PnL	Currency	Comment
3/31/2004 11:59:59 PM	YHOO	Sell	49.29	100	4928.70	0.00	234.70	USD	Limit OCA 155
3/26/2004 11:59:59 PM	AAPL	Buy	27.04	100	2704.00	0.00	0.00	USD	Entry
3/26/2004 11:59:59 PM	MSFT	Buy	25.03	100	2503.00	0.00	0.00	USD	Entry
3/26/2004 11:59:59 PM	CSCO	Buy	23.40	100	2340.00	0.00	0.00	USD	Entry
3/25/2004 11:59:59 PM	YHOO	Buy	46.94	100	4694.00	0.00	0.00	USD	Entry
3/25/2004 11:59:59 PM	DELL	Buy	33.76	100	3376.00	0.00	0.00	USD	Entry
3/23/2004 11:59:59 PM	DELL	Sell	33.17	100	3317.00	0.00	12.00	USD	Crossover Exit
3/22/2004 11:59:59 PM	YHOO	Sell	43.95	100	4395.30	0.00	-89.70	USD	Stop OCA 154
3/22/2004 12:00:00 AM	CSCO	Sell	22.23	100	2223.00	0.00	-55.00	USD	Stop OCA 174
3/17/2004 11:59:59 PM	YHOO	Buy	44.85	100	4485.00	0.00	0.00	USD	Entry
3/15/2004 11:59:59 PM	CSCO	Buy	22.78	100	2278.00	0.00	0.00	USD	Entry

Currency	Account	Position	Value	Margin	Debt	Equity	Leverage
USD	97625.24	10916.00	108541.24	0.00	0.00	108541.24	0.00

Integrated Strategy Monitoring

The screenshot shows the 'General Quantitative Asset Management - Strategy Monitor' application. The main window displays a table of strategies and instruments. The 'Strategy' table shows the following data:

Strategy	TimeStamp	TimeFactor	LeverageFa...	CapitalAlloc...	MarketRisk	NetMarketV...	GrossMarke...	RealizedPrnL	UnrealizedP...	TotalPrnL	Transaction...	NumL
GQTempl...	14:56:00	1.00	1.00	1000000.00	74930.96	242448.56	663603.76	0.00	0.00	0.00	0.00	
MOMST...												
REVSTR...	14:56:00	1.00	1.00	500000.00	0.00	372585.06	372585.06	0.00	0.00	0.00	0.00	
RTSTRAT												

The 'Instrument' table shows the following data for 'REVSTRAT - DUK':

Instrument	TimeStamp	TimeFactor	LeverageFa...	MaxPos	CurPos	CurPrice	MarketValue	Signal	TrgPos	RealizedPrnL	UnrealizedP...	T
AMAT	14:56:00	1.00	1.00	3500	1120	10.97	12286.40	0.35	1212.75	0.00	0.00	
BMV	14:56:00	1.00	1.00	1200	1200	32.98	39576.00	0.98	1171.46	0.00	0.00	
DELL	14:56:00	1.00	1.00	4000	3746	9.36	35062.56	0.95	3799.01	0.00	0.00	
DUK	14:56:00	1.00	1.00	600	500	64.45	32225.00	0.97	580.45	0.00	0.00	
EMC	14:56:00	1.00	1.00	1500	1300	25.69	33397.00	0.98	1465.97	0.00	0.00	
GE	14:56:00	1.00	1.00	1700	251	22.55	5660.05	0.25	431.59	0.00	0.00	
GNW	14:56:00	1.00	1.00	6900	5500	5.47	30085.00	0.78	5389.37	0.00	0.00	
INTC	14:56:00	1.00	1.00	1800	1500	21.70	32550.00	0.85	1522.93	0.00	0.00	
MO	14:56:00	1.00	1.00	1100	1100	32.77	36047.00	1.00	1099.69	0.00	0.00	

The 'REVSTRAT - DUK' detailed view shows the following data:

DateTime	TimeStamp	TimeFactor	LeverageFa...	MaxPos	CurPos	CurPrice	MarketValue	Signal	TrgPos	RealizedPrnL	UnrealizedP...
10/11/2012 9:31:00...	09:31:00	0.00	1.00	600	0	65.00	0.00	0.07	0	0.00	0.00
10/11/2012 9:32:00...	09:32:00	0.00	1.00	600	0	64.91	0.00	0.38	0	0.00	0.00
10/11/2012 9:33:00...	09:33:00	0.00	1.00	600	0	64.86	0.00	0.52	0	0.00	0.00
10/11/2012 9:34:00...	09:34:00	0.00	1.00	600	0	64.78	0.00	0.70	0	0.00	0.00
10/11/2012 9:35:00...	09:35:00	0.00	1.00	600	0	64.76	0.00	0.73	0	0.00	0.00
10/11/2012 9:36:00...	09:36:00	0.00	1.00	600	0	64.66	0.00	0.86	0	0.00	0.00
10/11/2012 9:37:00...	09:37:00	0.00	1.00	600	0	64.64	0.00	0.88	0	0.00	0.00
10/11/2012 9:38:00...	09:38:00	0.00	1.00	600	0	64.63	0.00	0.89	0	0.00	0.00
10/11/2012 9:39:00...	09:39:00	0.00	1.00	600	0	64.69	0.00	0.83	0	0.00	0.00
10/11/2012 9:40:00...	09:40:00	0.00	1.00	600	0	64.71	0.00	0.81	0	0.00	0.00
10/11/2012 9:41:00...	09:41:00	0.10	1.00	600	0	64.70	0.00	0.82	49.09	0.00	0.00
10/11/2012 9:42:00...	09:42:00	0.20	1.00	600	0	64.70	0.00	0.82	98.17	0.00	0.00

The 'Output' window shows the following log entry:

```
10/11/2012 9:29:40 AM QQQ StrategyStart
09:29:40.6318156: Solution GQTemplate STARTED (stopped=False started=True)
```

QuantTrader

Production Code Deployment

- While the OpenQuant system is well suited for research, testing and optimization, many of its built-in functions are not necessary for production.
- QuantTrader is a lightweight version of the OpenQuant Portfolio Management Edition designed specifically as a production deployment engine.
- It has the same paper and live trading capabilities, including portfolio and strategy monitoring, but does not offer the simulation mode or ability to change the code (strategy parameters can still be changed).
- Being lightweight, it is also more robust and suitable for automated trading.
- Once the strategy is defined and optimized, it can be compiled and exported into a package together with its relevant settings in the OpenQuant.
- This package can then be imported into QuantTrader and run in various production environments: from trading server, in co-location, etc.
- The strategy source code is invisible, allowing for more secure deployment in shared environments such as co-location, or other situations where confidentiality is required.
- Importantly, QuantTrader is also less expensive, which is important when deploying potentially many different strategies produced by the same researchers.

Export Strategy from OpenQuant

The screenshot displays the OpenQuant software interface. A central dialog box titled "Export To QuantAgent" is open, asking the user to "Please, select items you want to export to QuantAgent". The dialog contains a list of items with checkboxes: "Simple Moving Average Crossover" (checked), "References", "Market Data", "Properties", "Simple Moving Average Crossover" (checked), "Instruments", and "Properties".

The background interface shows the "OpenQuant - Portfolio" window. The "Positions" table is visible:

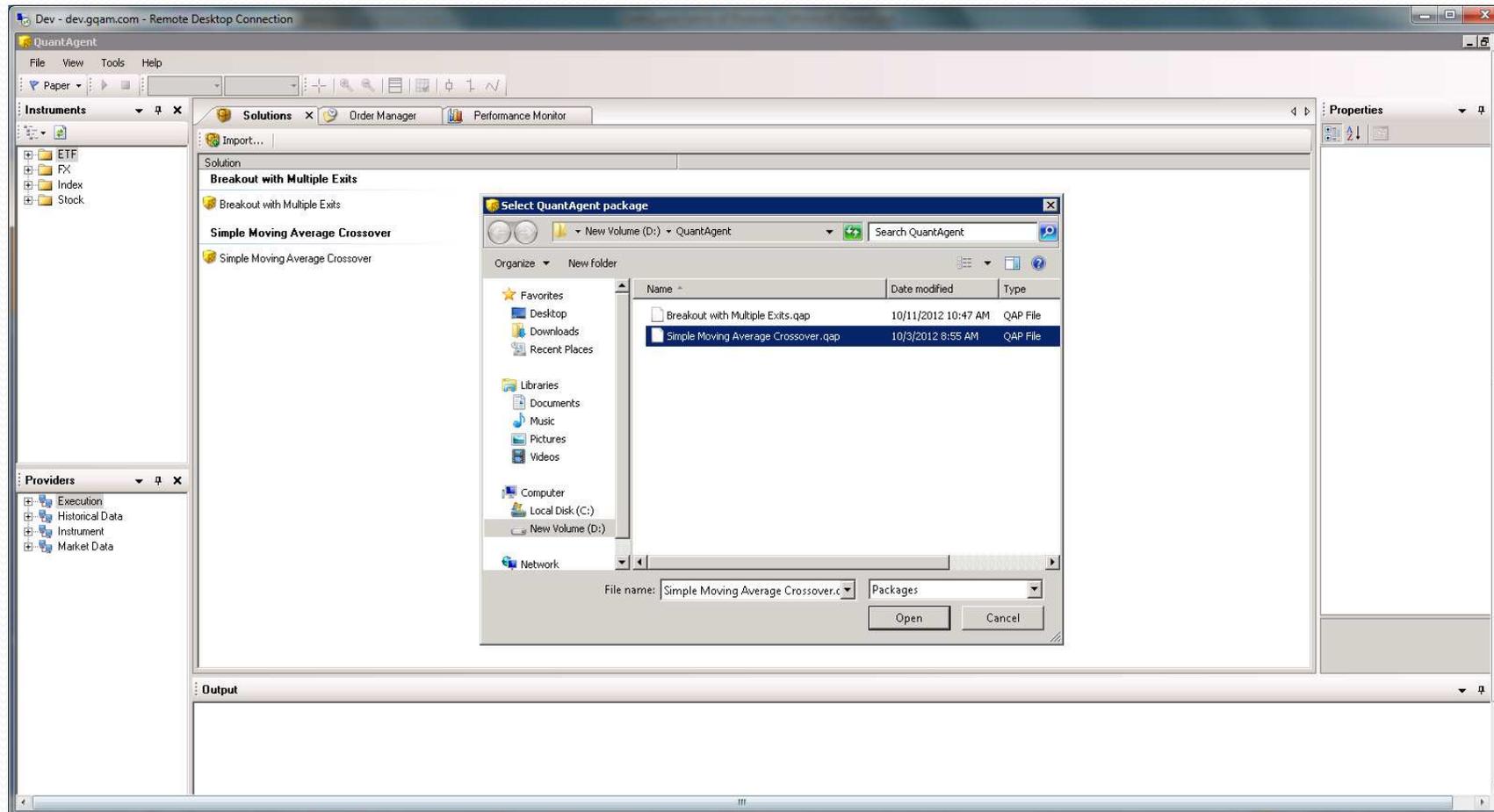
Symbol	Side	Price	Qty	Bought	Sold	Short	Margin	Debt	Value	PnL
AAPL	Long	27.04	100	100	0	0	0.00	0.00	2704.00	0.00
CSCO	Long	23.57	100	100	0	0	0.00	0.00	2357.00	17.00
DELL	Long	33.62	100	100	0	0	0.00	0.00	3362.00	0.00
MSFT	Long	24.93	100	100	0	0	0.00	0.00	2493.00	0.00

The "Transactions" table is also visible:

DateTime	Symbol	Side	Price	Qty
3/31/2004 11:59:59 PM	YHOO	Sell	49.29	1
3/26/2004 11:59:59 PM	AAPL	Buy	27.04	1
3/26/2004 11:59:59 PM	MSFT	Buy	25.03	1
3/26/2004 11:59:59 PM	CSCO	Buy	23.40	1
3/25/2004 11:59:59 PM	YHOO	Buy	46.94	1
3/25/2004 11:59:59 PM	DELL	Buy	33.76	1
3/23/2004 11:59:59 PM	DELL	Sell	33.17	1
3/22/2004 12:00:00 AM	YHOO	Sell	43.95	1
3/22/2004 12:00:00 AM	CSCO	Sell	22.23	1
3/17/2004 11:59:59 PM	YHOO	Buy	44.85	1
3/15/2004 11:59:59 PM	CSCO	Buy	22.78	1

The "Solution Explorer" on the right shows a tree view of the strategy "Simple Moving Average Crossover" with various components like "Market Data", "Scenario", "Code", "OnStrategyStart", etc. The "Properties" window at the bottom right shows details for the selected instrument, including "Account", "Date Time", "Instrument", "Price", "Qty", "Side", "Stop Price", "Time In Force", "Trailing Amt", "Type", "Avg Price", "Cum Qty", and "Last Price".

Import Strategy into QuantTrader



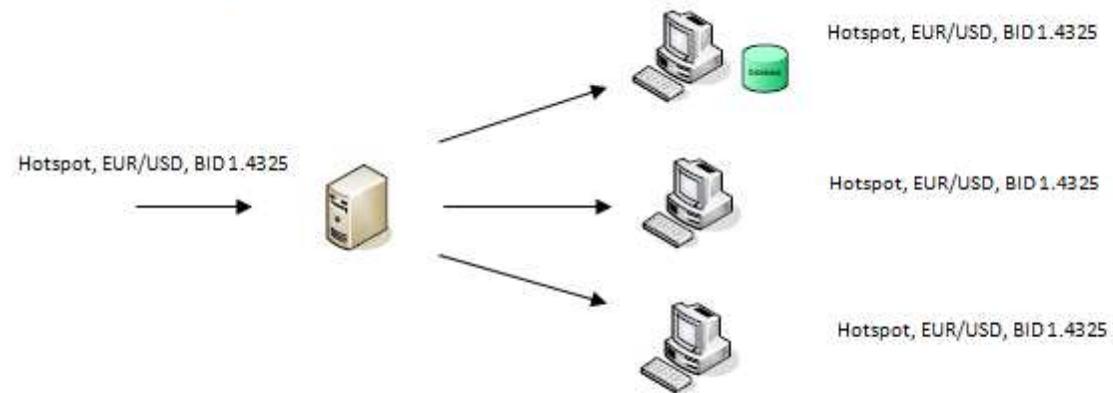
QuantRouter

Multi-Use, Multi-Directional

- QuantRouter is a stand alone server side .NET application that can be deployed on a local computer or remote server.
- It is designed to serve clients demanding feed replication, feed consolidation, feed aggregation, feed transformation and smart order routing.
- QuantRouter offers a possibility to work with multiple data feeds and brokers within a single OpenQuant application.
- QuantRouter also offers a possibility to connect several OpenQuant applications to the same data feed or execution account.
- The Feed Server comes with a growing number of built-in market data provider adapters, such as IB (Interactive Brokers), Hotspot FX, Currenex FX, Integral FX, TT FIX (Trading Technologies), MBT, etc.
- Users can develop their own adapters to market data feed providers, which are not supported out of the box in the Feed Server.
- The order routing capability of QuantRouter allow the users to write their own smart routers, or simply rout trades to different brokers depending on predefined criteria such as the type of the instrument.

Data Routing

Feed Replication



Feed Consolidation



Data Routing (Contd.)

Feed Aggregation

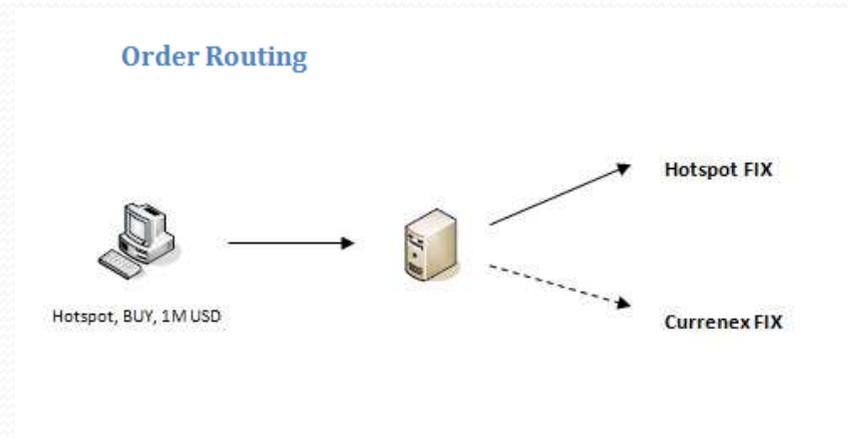


Feed Transformation



Order Routing

- User can define the order routing in the strategy
- OpenQuant is connected to QuantRouter as its execution provider
- QuantRouter receives the orders and routes them to appropriate broker/execution provider
- The list of execution providers for QuantRouter can include both built-in providers and custom ones written by the user



QuantBase

Powerful Data Center

- QuantBase is a stand alone server side .NET application that can be deployed on a local computer or remote server.
- It has an integrated relational database component for managing instrument definitions and other descriptive data.
- Its main engine is a proprietary (non-relational) database optimized for fast capture and access to linear time series data.
- QuantBase is similar to the integrated data management component contained in the OpenQuant, but is much more powerful and highly scalable.
- The limitations on the single QuantBase installation are mostly those imposed by the operating system, such as the maximum size of the files (16TB under NTFS).
- If necessary, several QuantBase installations can be connected together into a cluster to handle exceptionally large amounts of data.

Data Management Capabilities

- QuantBase can capture real time data feeds from different data providers into a high performance data engine.
- In a typical scenario the QuantBase can be launched on a dedicated server, capturing quotes for a large number of instruments and markets 7 days a week, 24 hours a day.
- Analysts, strategy developers and traders can connect to QuantBase and load historical data for a specific subset of instruments into the DataManager of their local OpenQuant development environment for further strategy backtesting, pattern recognition and analysis.
- QuantBase connection can be also managed automatically from within the strategy code, for as-needed access to necessary historical data.
- QuantBase is capable of handling vast amounts of market data, including full high frequency tick-by-tick data.
- Historical data can be imported from a variety of recognized data formats, including plain text files and standard TAQ tape files.

Extensions

Extensible Framework

- SmartQuant Framework is highly modular and extensible.
- Users can select from a broad and constantly growing list of built-in extensions for execution, market data and historical data providers.
- Users can also write their own custom provider plug-ins, if necessary, using the SmartQuant Connectivity Pack.
- We also offer custom development of plug-ins for end users and providers.
- The following list shows some of the built-in provider extensions:

Constantly Growing List of Extensions

Provider Name	Provider Type	Connection Type	Provider Website
Interactive Brokers	Execution, Market Data, Historical Data	API	http://www.interactivebrokers.com
Open E Cry	Execution, Market Data, Historical Data	API	http://www.openecry.com
SmartCOM	Execution, Market Data, Historical Data	API	http://www.itinvest.ru
Ivory Scorpion	Execution, Market Data, Historical Data	FIX	http://www.ivory-sw.com
Finam Transaq	Execution, Market Data, Historical Data	API	http://www.finam.ru
Trading Technologies	Execution, Market Data	FIX and API	http://www.tradingtechnologies.com
Currenex	Execution, Market Data	FIX	http://www.currenex.com
HotSpot	Execution, Market Data	FIX	http://www.hotspotfx.com
Integral	Execution, Market Data	FIX	http://www.integral.com
MBTrading	Execution, Market Data	API	http://www.mbtrading.com
Nordnet	Execution, Market Data	API	http://www.nordnet.se
OSL FIX	Execution, Market Data	FIX	http://www.otkritie.com
PATS API	Execution, Market Data	API	http://www.patsystems.com
QUIK FIX	Execution, Market Data	FIX	http://www.quik.ru
Plaza II	Execution, Market Data	API	http://www.rts.ru
Alfa Direct	Execution , Market Data	API	http://www.alfadirect.ru
IQFeed	Market Data, Historical Data	API	http://www.iqfeed.net
QuoteTracker	Market Data, Historical Data	API	http://www.quotetracker.com
eSignal	Market Data	API	http://www.esignal.com
CSI Data	Historical Data	API	http://www.csidata.com
Google	Historical Data	API	http://www.google.com
Yahoo!	Historical Data	API	http://www.yahoo.com

Future Products

MS Visual Studio Integration

- No need to switch back and forth between library code and OpenQuant interface when developing complex strategies.
- Ability to easily integrate and reference third-party libraries in user strategies
- Ability to integrate the strategies with components written in other languages and packages, such as C++, Java, Matlab, R, or Python via custom wrappers and APIs
- Benefit from familiar and powerful Visual Studio development environment:
 - Tooltips, autocomplete, highlights, context help, etc.
 - Debugging
 - Testing
 - Profiling
 - Source control
 - Windows and settings management

MS Visual Studio Integration

Project1 - Microsoft Visual Studio

FILE EDIT VIEW PROJECT BUILD SMARTQUANT DEBUG TEAM SQL TOOLS TEST ANALYZE WINDOW HELP

Quick Launch (Ctrl+Q)

Backtest Explorer

20121030 214407930

Order Manager

Program.cs

SMAPerInstrument.cs

DateTime	Symbol	Side	Type	Qty	Avg. Price	
01.07.2010 10:53:00	AAPL	Buy	Market	1	245,6300	0
01.07.2010 11:48:00	AAPL	Sell	Market	1	248,1200	0
01.07.2010 12:07:00	AAPL	Buy	Market	1	247,5600	0
01.07.2010 12:10:00	AAPL	Sell	Market	1	247,4400	0
01.07.2010 12:21:00	AAPL	Buy	Market	1	247,4800	0
01.07.2010 12:27:00	AAPL	Sell	Market	1	247,1600	0
01.07.2010 12:34:00	AAPL	Buy	Market	1	248,3000	0
01.07.2010 12:57:00	AAPL	Sell	Market	1	248,8600	0
01.07.2010 13:24:00	AAPL	Buy	Market	1	249,3300	0
01.07.2010 13:33:00	AAPL	Sell	Market	1	248,1200	0
01.07.2010 13:40:00	AAPL	Buy	Market	1	249,4500	0
01.07.2010 13:50:00	AAPL	Sell	Market	1	248,1000	0

Reports

TransactTime	Command	ExecType	Status	Side	Type
--------------	---------	----------	--------	------	------

Output

Show output from: Build

Output Find Results 1

Bar Chart

249,6
249,4
249,2
249,0
248,8
248,6
248,4
248,2

11.0
11.2
11.4
11.6
11.8

июл 2010 июл 2010

Solution Explorer

Solution 'Project1' (1 pro...)

- Project1
 - Properties
 - References
 - Scenarios
 - SimpleScenario
 - Strategies
 - SMAPerInstru...
 - App.config
 - Program.cs

Properties

Ready

Ultra-Low Latency Framework

- Crossplatform (Windows, Linux, Mac OS) algo trading framework.
- Can be compiled under RTOS (Real Time OS) to guarantee low interrupt latency.
- Fast backtesting speed / Ultra-Low live trading latency:
 - 5 million events per second processing speed on i7 CPU imply 0.2 microsecond (200 nanosecond) latency.
- Parallel multicore optimization. Cloud/cluster optimization.
 - 35 million events per second optimization speed on i7 CPU with 4 physical (8 logical) cores.
- Native C++
 - Inlines, compiler/linker optimization, etc.
 - Object pools, ring buffers, non-locking event queues, atomic operations for multithreading, custom memory management and garbage collector.
- Inherits the best of SmartQuant C# framework and benefits from ten years of development and usage experience
 - Uses powerful scenario mechanism.
 - C# API allows familiar user experience and compatibility with OpenQuant strategies

Ultra-Low Latency Framework

The screenshot displays a backtesting application window titled "Backtest". The interface includes a menu bar (File, Data, Scenario, Help), a toolbar with a "Mode" dropdown set to "Backtest", and several panels:

- Instruments:** Lists "AAPL".
- Order Manager:** A table showing order execution details for AAPL.
- Providers:** Lists "IB", "ExecutionSimulator", and "DataSimulator".
- Properties:** Shows strategy parameters for "TStrategy" and "TMyStrategy".
- Output:** A log window showing debug messages.

The Order Manager table contains the following data:

ID	DateTime	Symbol	Side	Type	Qty	CumQty	Price	StopPx	A...
5634	20/06/2012 15:56:10	AAPL	Sell	Stop	100	0	0	583.51	0
5633	20/06/2012 15:56:10	AAPL	Sell	Limit	100	0	586.51	0	0
5632	20/06/2012 15:56:10	AAPL	Buy	Market	100	100	0	0	58
5631	20/06/2012 15:53:10	AAPL	Sell	Market	100	100	0	0	58
5630	20/06/2012 15:50:30	AAPL	Sell	Stop	100	0	0	583.89	0
5629	20/06/2012 15:50:30	AAPL	Sell	Limit	100	0	586.89	0	0
5628	20/06/2012 15:50:30	AAPL	Buy	Market	100	100	0	0	58
5627	20/06/2012 15:47:10	AAPL	Sell	Market	100	100	0	0	58
5626	20/06/2012 15:42:30	AAPL	Sell	Stop	100	0	0	583.49	0
5625	20/06/2012 15:42:30	AAPL	Sell	Limit	100	0	586.49	0	0

The Properties panel shows the following values:

Name	Value
TStrategy	
Name	MyStrategy
Descript...	My first strategy
TMyStrategy	
Length1	12
Length2	32
Profit	2
Loss	1

The Output panel shows the following debug messages:

```
Debug: Full count = 0 Empty count = 2237
Debug: Data run done, count = 10037383 ms = 4909 event/sec = 2.04469e+06
Debug: TDataSimulator: Unsubscribe
Debug: TStrategy::OnStrategyStop
Debug: Full count = 0 Empty count = 2279
Debug: Scenario charting...
Debug: Scenario stop...
Debug: Scenario thread done
```

At the bottom right, the status bar indicates "Backtest Stopped Realtime 04/09/2012 10:09:33".

Visual Quant

- The major goal of VisualQuant is to provide a new development model that enables users to assemble their own underlying framework using predefined (or user provided) building blocks.
- Users have full access to all functional blocks within the underlying trading engine, and can extend the constructed engine with their own building blocks.
- Users can create their own custom trading application with embedded GUI elements and virtually any type of advanced filters, strategies, and reports
- Key advantages:
 - Functional Flexibility
 - Functional Extensibility
 - Data and Event Flow Transparency
 - More Specific Trading Architectures
 - Increased Efficiency and Performance
 - Simpler User Interface

Visual Quant

- Another objective of VisualQuant is to allow quant strategists to create and experiment with strategies without having to understand C# programming.
- Complete and functional strategies can be created simply by dragging and interconnecting a suitable set of building blocks on to the development canvas.



Firm Overview

SmartQuant Timeline

- Anton Fokin initially developed the predecessor of the SmartQuant framework in 1998 as an open-source project based on the adaptation of complex data-processing frameworks originally developed by the author for nuclear physics research projects.
- He then licensed it to Fortis Bank in 2000, and led its adaptation as an internal project for portfolio optimization and statistical arbitrage
- Anton left Fortis and founded SmartQuant in 2003 as an independent firm that developed a fully-fledged trading platform solution built on the latest MS C# and .NET technology.
- In 2007, SmartQuant technology has been licensed for exclusive distribution on the institutional client market by QuantHouse S.A., a leading French financial software firm. Among the clients that licensed the QuantFACTORY product and its components: Societe Generale Asset Management, QIM, Fysics Capital, Global Capital, and others
- SmartQuant Ltd. continued to develop its framework and new products and focused on sales to retail investors, growing to several thousand installations worldwide, and creating a devoted following and user ecosystem among quant developers/traders using its products.
- The QuantHouse exclusive license ended in early 2012, when QuantHouse was acquired by Standard & Poors CapitalIQ subsidiary. SmartQuant retained its IP and full rights.
- SmartQuant has subsequently formed a partnership with Arthur M. Berd (BERD LLC) to co-develop portfolio management libraries and strategies and to re-enter the institutional investor market with a suite of new professional products.

Anton Fokin

Founder, CEO, Chief Architect

- Dr. Fokin founded SmartQuant Ltd. in 2002 and remains its CEO and Chief Architect.
- He manages the team of software engineers and quant developers who produce new products and support existing products of SmartQuant.
- Prior to founding SmartQuant in 2003, Dr. Fokin was a trade and risk analyst in the Quantitative Strategies Group of the Global Securities Lending and Arbitrage division of Fortis Bank, which licensed his original trading technology software and adopted it as the core of the portfolio management and statistical arbitrage projects developed by the bank.
- During 1998-2000, he developed R-Quant, an open source projects for automated trading strategy development and testing, which was among the first to employ CEP concepts.
- In his academic career prior to joining the Fortis Bank in 2000, Dr. Fokin held research positions at Uppsala University (Sweden) and collaborated with CERN nuclear particle accelerator group working on data processing algorithms, where he contributed to the development of the ROOT software package for data analysis which later became the main tool for experimental nuclear physicists both in CERN and elsewhere.
- Anton Fokin has earned his Ph.D. in Physics from the Lund University in Sweden, and M.S. from St-Petersburg State Polytechnic University, Russia.

Arthur M. Berd

Strategic Partner

- Arthur M. Berd is a Managing Principal at BERD LLC and a Strategic Partner at SmartQuant Ltd.
- Until January 2011, he was the head of macro volatility strategies at Capital Fund Management, a hedge fund specializing in systematic investment strategies headquartered in Paris. Before joining CFM in early 2008, he was a co-founder and head of research at Quantitative Alternatives LLC, a startup hedge fund in Rye Brook, NY, and before that the head of quantitative market strategies at BlueMountain Capital Management, a leading credit hedge fund in New York.
- Prior to 2005, Arthur was a Senior Vice President at Lehman Brothers where he was responsible for a variety of quantitative credit models and strategies across corporate bonds and credit derivatives, and was instrumental in advising the Firm's largest institutional clients on credit portfolio strategies. Before joining Lehman Brothers in 2001, he was a Vice President at Goldman Sachs Asset Management, focusing on fixed income and equity portfolio construction and risk management.
- Dr. Berd is the Editor-in-Chief of the Journal of Investment Strategies, a former member of the editorial boards of the Journal of Financial Forecasting and the Journal of Credit Risk, and is the founder and coordinator of the quantitative finance section of www.arXiv.org, a global electronic research repository. He is an author of more than 30 publications and a frequently invited speaker at major industry conferences. Dr. Berd edited the recently published book "Lessons from the Financial Crisis" (RiskBooks, 2010), and contributed chapters to several other books on finance.
- Arthur M. Berd is a charter member of the CFA Institute. He holds a Ph.D. in physics with Ph.D. Minor in finance from Stanford University, and a M.S. in physics with highest honors from Moscow Institute of Physics and Technology.

Growing Development Team

- Core team of highly experienced developers, working together for more than 9 years. Key team member profiles:
 - **Team Leader, Systems and Architecture:** 12 years of software industry experience. Joined the current team in 2003 and has been responsible for the implementation of the overall systems architecture and most of the communications and data infrastructure of the whole system. Is the main expert on processing complex events (trading orders, transactions, quotes, etc.)
 - **Team Leader, Trading Analytics:** 9 years of industry experience, entirely within the same team. Responsibilities include the design of the trading environment, backtesting analytics, portfolio optimization and analysis of event-based quantitative strategies.
- Strong new additions to the main team coming from the top universities in Russia, with excellent credentials and programming skills
- Growing set of affiliations with experienced developer teams worldwide, with long-time expertise in programming in the OpenQuant environment.
- Ability to provide individualized support for institutional clients, including long-term consulting assignments and custom development.



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