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- Search for hidden liquidity and icebergs
- Detect opportunities in dark pools
- Apply execution logic to maximize results and minimize market impact

## StreamBase for Smart Order Routing



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## BUSINESS ISSUE

Achieving best execution and minimizing market impact are becoming increasingly complex because of growing market fragmentation.

## CAPABILITIES NEEDED

Both buy-side and sell-side trading organizations need tools to:

- Rapidly connect to additional venues
- Search for hidden liquidity and icebergs
- Detect opportunities in dark pools
- Apply execution logic to maximize results and minimize market impact

## SOLUTION

StreamBase enables rapid development of order routing systems that correlate market events, detect hidden liquidity, apply execution algorithms, and instantly route orders to capture execution opportunities. StreamBase expresses your firm's unique order routing logic and keeps you ahead of the competition.

## SMART ORDER ROUTING

Traders are under constant pressure to provide the most effective trading and execution capabilities. So how can smart execution help you compete?

Smart Order Routing products cannot provide outstanding execution results simply by routing orders to the displayed best bids and offers. Today's smart execution tools must be able to seek out both displayed and undisplayed liquidity, monitor the executions coming from each venue, observe recent execution history to sense hidden liquidity, apply execution algorithms based on the most current snapshot of market activity, slice an order based on best execution opportunities present at that moment, and route to the destinations most likely to fill the order at the best available price.

### StreamBase for Smart Order Routing

The StreamBase Smart Order Router provides a nimble, flexible, high-speed processing system that enables best execution by processing displayed market data, gathering data from dark pools, and intelligently routing orders to ensure best execution, maximized fills, and minimized market impact.

### The StreamBase System:

- Enables extremely low-latency, high-frequency trading in equities
- Aggregates an order book from multiple execution venues in real-time without waiting to populate a database
- Monitors best bids and offers and updates instantly as the market moves
- Tracks and manages depth of book
- Probes and monitors available execution venues to discover hidden reserves
- Prioritizes routing using algorithms based on current order book, assessment of available liquidity, and execution responsiveness
- Manages order state, linking parent orders, child orders, and executions
- Tracks the full order lifecycle and provides audit trails
- Supports compliance reporting
- Tracks market state associated with each trade to support RegNMS and MiFID compliance

## The StreamBase Smart Order Router

The StreamBase Smart Order Router includes six core components:

### 1) Market Data Module

- Interfaces with any market data feed
- Processes data from multiple venues
- Filters data to focus on venues, symbols, and events of interest
- Constructs a moving snapshot of the market
- Calculates market data metrics

### 2) Liquidity Detector

- Tracks displayed liquidity
- Monitors executions exceeding displayed volume
- Measures speed of responses on dark books
- Observes changes in top of book following executions
- Routes indications where possible
- Aggregates all data points into a moving snapshot
- Sets unique validity criteria for each event type

### 3) Execution Algorithms

- Incorporates client designed algorithms and provides each algorithm with access to the liquidity snapshots
- Automatically selects algorithms with rules-based order classification, or enables clients to select execution algorithms
- Execution algorithms may divide order into child orders to be routed across multiple venues

### 4) Smart Order Router

- Slices order in accordance with selected algorithm
- Selects destinations based on algorithms and market snapshots
- Maintains compliance with order protection and best execution obligations
- Enables venue prioritization based on transaction costs or other factors
- Compiles orders in compliance with destination requirements
- Routes via your existing market gateways

### 5) Order State Management

- Maintains order state
- Matches orders and executions
- Logs order flow

- Tracks order lifecycle
- Correlates venue orders with client orders coming in from FIX

### 6) Order Classification Rules Manager

- Contains user-defined custom routing rules

### Handling Market Data

StreamBase receives market data in the form of streams. As the data flows through the system, StreamBase is able to identify changes and update the in-memory order book, aggregating all the data to produce a complete, continually updating snapshot of the entire market, including depth. It holds this aggregate view in memory, offering instant reference to enable execution strategies and order routing.

Some of our feed handlers are listed below, but if your specific need is not listed, please contact your sales representative for a more complete list:

- ACTIV Financial
- Bloomberg
- Interactive Data
- Thomson Reuters
- TIBCO
- Wombat

### Detecting Hidden Liquidity

The StreamBase system constantly tracks quotes, trade reports, and response rates from the market data feed and executions from orders it has routed. It tracks a variety of events including:

- Market quotes
- Fill rates from different venues
- Executions compared to displayed volume
- Speed of executions
- Response rates
- Cancellations
- Trade reports from dark pools

### Routing for Best Execution

Based on the information it gleans, the StreamBase Smart Order Router combines all of these observations to determine the best market opportunities. When it receives an order, it instantly decides where to route, how much of

the order to route to each destination, and what kind of orders to create for each venue. It monitors the fills and manages the orders while they are open. It then routes executions back to the source system and captures the data necessary for logging, audit trails, and compliance reporting.

### Integration with Existing Systems

The StreamBase platform integrates smoothly with your existing trading infrastructure, minimizing disruption to your existing architecture.

### Other StreamBase Capabilities:

- Includes adapters to common messaging systems
- Integrates with any OMS, EMS, or algorithmic trading system through documented C++, .NET, and Java APIs
- Incorporates algorithms as Java or C++ plug-ins
- Integrates with all market data feeds and supports multiple data formats and protocols
- Supports destination-based trading rules to ensure that orders comply with the requirements of each venue
- Connects with multiple FIX engines to smoothly integrate with your existing market connectivity systems
- Includes a graphical studio enabling a palette of operators to support rapid development and testing of new functionality

### STREAMBASE SPECIFICATIONS

#### Connectivity Examples (e.g. Market Data, General Adapters, APIs, Databases, Visualization)

- ACTIV Financial
- Bloomberg
- FIX
- HotSpot
- Thomson Reuters
- JDBC
- JMS Publish/Subscribe
- CSV
- HP Vertica Analytical Database
- MySQL
- Thomson Reuters Velocity Analytics
- C++
- Java
- .NET
- Adobe Flex
- Eclipse RCP
- Microsoft Excel
- Panopticon

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#### Enterprise Functionality

- Clustering
- High availability
- Manageability
- Optimized for multi-core

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#### Server Platforms

- Red Hat Enterprise Linux AS 4.0, 5.0, 6.0
- Novell SUSE Linux Enterprise Server 10
- Sun Solaris 10
- Windows Vista, Windows Server

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#### Development Platform

- Mac OS X
- Red Hat AS/AP 4.0, 5.0, 6.0
- Windows XP, Windows Vista Business, Windows Server 2003, 2008, Windows 7

### STREAMBASE AWARDS



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