



# Skyler C3 Order Routing Solution

## ***Grab liquidity faster with minimal market impact with Skyler's C3 Order Routing Solution***

### **Key Features**

- Slice and route orders to multiple liquidity pools
- Embed custom routing logic
- Integrate FIX with trading systems and exchanges
- Leverage ultra low latency market data

Skyler introduces the C3 Order Routing Solution - the solution to access more liquidity at better prices without moving the market.

The benefits for the customer include:

- Better prices through the ability to take liquidity more rapidly
- Lower market impact through smaller and highly distributed orders
- Deploy smarter routing algorithms that consider execution quality, costs, and custom liquidity indicators
- Save money by avoiding broker offered routing
- Offer better trading quality and speed to buy side customers by accessing the liquidity pools directly

### **The Need**

Traders often split orders and route them to different market centers in order to reduce market impact and achieve best prices for their trades. A key tool in this practice is the smart order router. In addition to finding the National Best Bid or Offer (NBBO) across markets, smart order routing systems decide how an order is split and routed and how many shares are purchased at particular venues while ensuring RegNMS compliance. It continuously scans different liquidity pools in order to get the best price. In addition a host of other parameters such as aggression levels, execution quality, speed and costs can also be considered in the routing logic.

An increasing number of brokers as well as buy side companies have realized that an internal smart order routing system allows them to access liquidity faster, reduce market impact, significantly reduce trading costs and offer the ability to deploy smarter trading strategies. Skyler's C3 Order Routing Solution addresses this need for fast and flexible internal smart order routing applications that provide the customer with improved trading efficiency and lower costs.

### **The Skyler C3 Order Routing Solution**

The Skyler C3 Order Routing Solution is designed to optimize each trade. It is a unique application that can maximize trading efficiency. It allows the user to:

- Slice and route orders with ultra low latency
- Embed custom routing logic that takes multiple factors into account
- Support multiple order types
- Maintain and persist all order states
- Use multiple in and output FIX connections
- Leverage low latency market data including custom indicators
- Ensure RegNMS and OATS compliance
- Run in parallel to your OMS system

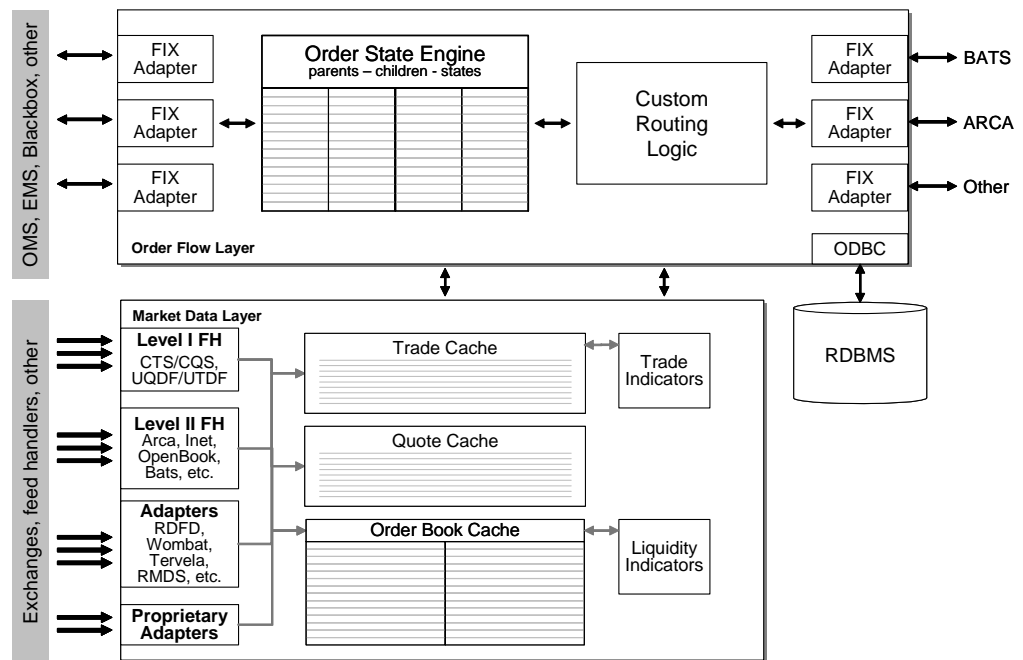


Figure: System diagram of sample smart order routing solution

### Skyler C3 Order Routing Solution Overview

The Skyler C3 Order Routing Solution consists of two main layers – the first layer deals with the order flow and the second layer deals with the market data. These two layers are tightly integrated and seamlessly interact to achieve lowest possible latency while executing the routing logic at record speeds.

#### Managing the Order Flow

The order flow layer of Skyler’s order routing solution deals with the incoming and outgoing FIX orders. It receives orders via ultra low latency embedded FIX engines from multiple sources such as OMS systems, black box trading applications, or other trading engines. These FIX engines also manage fill reports to the original FIX sources.

The Skyler C3 order routing solution maintains an order state machine that queues all the orders and manages the parent – child order relationship. In addition, it maintains the order state in terms of partial or complete fills.

The Skyler C3 order routing solution embeds a simple routing logic that deals with market and limit orders with or without discretion. It combines the information from the order state machine with the Level II order book that reflects the liquidity at different venues. Based on that information the routing logic sweeps the book and splits parent orders into child orders and sends them via FIX engines to different liquidity pools therefore achieving best possible prices. In addition, the routing logic is constrained to always ensure RegNMS compliance by comparing the target price with the NBBO.

In addition to the built-in order routing logic, Skyler expands this capability for the customer to customize proprietary order routing logic. These custom routing libraries can access the order state machine as well as the market data information and execute proprietary routing logic. This could include aggression levels, execution costs, quality of services provided by the different exchanges, or other factors. In that sense the user can become infinitely creative in generating extremely smart order routing logic.

The outbound embedded FIX engines directly connect to the main liquidity pools in the market. New FIX engines to dark pools or hubs can be quickly configured and added. The FIX engines manage the communication with the exchanges and inform the order state machine of incoming fills or other exchange specific messages.

The order flow layer of the Skyler C3 order routing solution ensures RegNMS as well as OATS compliance. It persists state to disk and logs all communication with the FIX sources and destinations. This ensures that order state can always be retrieved if necessary or in case of a system failure.

In addition, the Skyler C3 order routing solution allows the user to monitor order states at any time.

#### **Managing the Market Data**

The market data layer of the Skyler C3 order routing solution captures, aggregates, and analyzes the incoming market data and provides the aggregated and derived information to the order routing logic in the order flow layer.

The market data layer receives the Level II order as well as Level I quote and trade data via Skyler C3 feed handlers directly from the exchanges, consolidated feeds or from existing feed handling infrastructure. It aggregates the order book for all price levels across all markets so the order routing logic can request a single view that informs and updates on the fragmented liquidity information. In addition to the order book aggregation, the market data layer captures the NBBO and can derive custom indicators based on the order or trade information. These indicators, that show momentum or compare executed liquidity versus displayed liquidity over a time window on a per venue basis, can be easily included in the custom routing decision.

For more information on the Skyler C3 order book aggregation mechanism and C3 feed handlers, please see Skyler C3 Liquidity Discovery Use Case.

For more information on embedding custom indicator calculations or conducting time series analytics, please see Skyler C3 Algorithmic Container Use Case.

#### **Integration into Trading Infrastructure**

The Skyler C3 Order Routing Solution seamlessly integrates with existing trading infrastructure. It can run in parallel to existing OMS or EMS applications and communicate via the FIX standard or the API. The system is released on 64bit Linux and as a multi-threaded application exploits available CPU's, both the number of CPU's and speed of the CPUs provided.

**Examples of Skyler C3 Order Routing Solution**

**Example 1: Market Sweep with venues at different prices**

<b>Level I</b>	NBBO	21.94 (500) X 21.95 (500)						
<b>Level II</b>	BIDS	OFFERS						
	Time	Venue	Price	Size	Time	Venue	Price	Size
	9:06:05	ARCA	21.94	500	9:06:05	INET	21.95	500
	9:07:06	INET	21.93	500	9:07:04	BATS	21.96	500
	9:08:01	BATS	21.92	500	9:08:01	ARCA	21.97	500

**Scenario A: MKT SWEEP**

Trader 1 Buy 1500 @ MKT, IOC

Expected Results:

Trader 1 - SOR Routes and Fills 500 shares @ 21.95 with INET

Trader 1 - SOR Routes and Fills 500 shares @ 21.96 with BATS

Trader 1 - SOR Routes and Fills 500 shares @ 21.97 with ARCA

**Scenario B: MKT SWEEP**

Trader 2 Sell 1500 @ MKT, IOC

Expected Results:

Trader 2 - SOR Routes and Fills 500 shares @ 21.94 with ARCA

Trader 2 - SOR Routes and Fills 500 shares @ 21.93 with INET

Trader 2 - SOR Routes and Fills 500 shares @ 21.92 with BATS

**Example 2: Market Sweep with custom routing logic: rank by price, size, and then cost  
Optimize for commission cost**

Rank by Price: If price is the same use size

Rank by Size: If size is the same use cost

Rank by Costs: If price and size are the same, use cheapest cost

Rank by Fill Rates: If price, size, & costs are the same, then rank by fill rates

Sample INET commission: 0.30

Sample BATS commission: 0.28

<b>Level I</b>	NBBO	21.94 (1,500) X 21.95 (1,500)						
<b>Level II</b>	BIDS	OFFERS						
	Time	Venue	Price	Size	Time	Venue	Price	Size
	9:06:05	ARCA	21.94	500	9:06:05	INET	21.95	500
	9:07:04	INET	21.94	500	9:07:04	BATS	21.95	500
	9:08:01	BATS	21.94	500	9:08:01	ARCA	21.95	500

**Scenario A: MKT SWEEP with Custom Routing Logic**

Trader 3 Buy 500 @ MKT, IOC

Expected Results:

Trader 3 - SOR Routes and Fills 500 shares @ 21.95 with BATS

Since the cost to trade with BATS is .28 cents and cheaper than trading with INET (.30)

**About Skyler**

Skyler is an enterprise software company delivering ultra low latency trading solutions to the financial services industry. The Skyler C3 Solutions source liquidity, analyze tick data, trigger

smarter trading decisions, and achieve higher fill rates at better prices. Skyler's customers benefit from faster insights into activities in the market, the ability to deploy innovative new trading strategies, and faster access to the market and therefore higher trading efficiency. The Skyler C3 Liquidity Discovery, Tick Analytics, Algorithmic Container, Order Routing, and Compliance Solutions are focused on specific customer needs and emphasize flexibility, ease of use, and simplicity of integration. They combine powerful, low-latency in-memory data processing technologies with market specific business logic modules.

To test drive the Skyler C3 solutions, contact 925.689.9814 or [contact@skylertech.com](mailto:contact@skylertech.com). Please visit us at our website [www.skylertech.com](http://www.skylertech.com).