



# Best Execution Pricing

## Methodology



# Introduction

Best Execution Pricing provides high quality and real-time streaming Level 1 time-stamped data including a reference Best Bid and Best Ask for instruments based on real time top of book prices from a selected set of exchanges.

This allows investors to support their different use cases.

Kaiko as an **independent** valuation service provider is committed to publish **transparent** best execution prices based on the following methodology.

# Methodology

## Description

The aggregated Best Bid, Best Ask (Best Execution Price) is based on the calculation of the Best Bid VWAP and the Best Ask VWAP. These aggregated prices are built on the basis of top of book data, made available by Kaiko at an exchange and pair level.

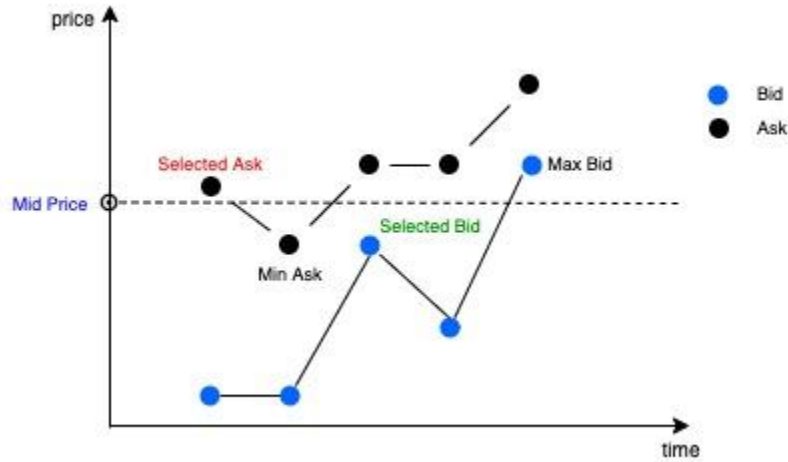
Over a 10 seconds rolling period, top of book data for each of the selected exchanges is captured and for each venue an average mid price is calculated:

$$Mid_{exch} = \text{Average value of (all Best Bids}_{exch} + \text{Best Asks}_{exch})$$

The mid price is then used to determine the Best Bid (*BB*) and the Best Ask (*BA*) over the observed period per exchange. The nearest bid/ask prices to the mid price over each 10 seconds period, are those qualified as the best bid/ask prices.

$$BB_{exch} = \text{nearest Bid price to and below the mid price}$$

$$BA_{exch} = \text{nearest Ask price to and below the mid price}$$

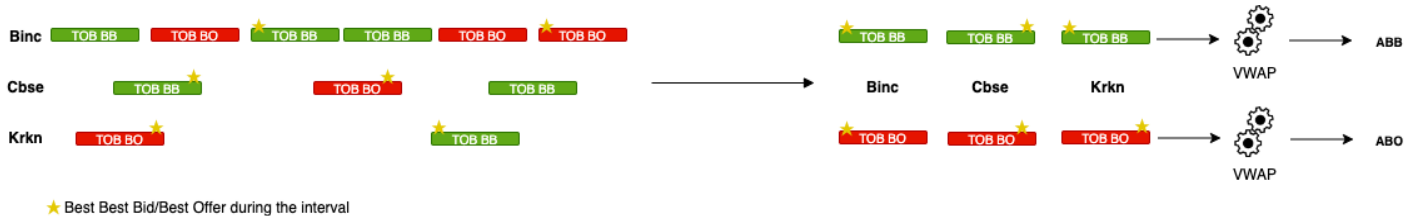


The Aggregated Best Bid (ABB) and Aggregated Best Ask (ABA) is finally obtained using a volume weighted average price (VWAP) methodology over the best bids and asks found across all selected exchanges:

$$ABB = VWAP(BB_{exch1}; BB_{exch2}; \dots; BB_{exchn})$$

$$ABA = VWAP(BA_{exch1}; BA_{exch2}; \dots; BA_{exchn})$$

In addition to the aggregated prices, the price is also made of the equivalent in volumes. Aggregated volumes of Best Bids and Best Asks, respectively Aggregated Best Bid Volume(ABBV) and Aggregated Best As



k Volume(ABAV) are calculated as follow:

$$ABBV = \sum_i BB Volume_{exch i}$$

$$ABAV = \sum_i BA Volume_{exch i}$$

## Locks and Crosses

Locks and crosses - ie when spreads are zero or negative - could occur when calculating the price. Kaiko has introduced, as described above, the mid-price mechanism to reduce the probability of such an event but, in the end, it is still possible to get such a situation. Locks and crosses are more likely due to certain market conditions like narrow spreads, high volatility and low order book depth.

## Exchange Selection

The exchange list used for Best Execution Pricing calculation is based on the Kaiko Exchange Ranking Framework list published under <https://www.kaiko.com/pages/exchange-ranking>. Whenever it is possible, the top of book data will be sourced from the top 10 exchanges of this list which guarantees a reliable representation of an instrument price. In case of instruments with low liquidity, the top of book data could not be available on all exchanges and therefore only those providing best bid and best ask prices within the top 10 exchanges initially selected by Kaiko, will participate in the Best Execution Pricing calculation. Kaiko undertakes a periodic review of this list as described on framework methodology. You can find more details [here](#).

## Data Monitoring

Kaiko has a robust monitoring and resilient architecture that minimizes any disruption to service. External factors are events beyond Kaiko control, for example an unscheduled and extraordinary condition in which the market used to source input data is interrupted. Should an external event occur, Kaiko will assess the impact on the Best Execution Pricing's accuracy.

Where the disruption extends in time, Kaiko will use reasonable efforts to identify solutions to provide clients with reliable prices.

## Outlier Management

To achieve an accurate quote calculation, we have implemented a robust outlier management layer, which serves the vital role of excluding any invalid data points from our calculation. This critical step is essential in ensuring the accuracy and integrity of the price, as it identifies and eliminates data outliers that could potentially distort our calculations.

# Implementation

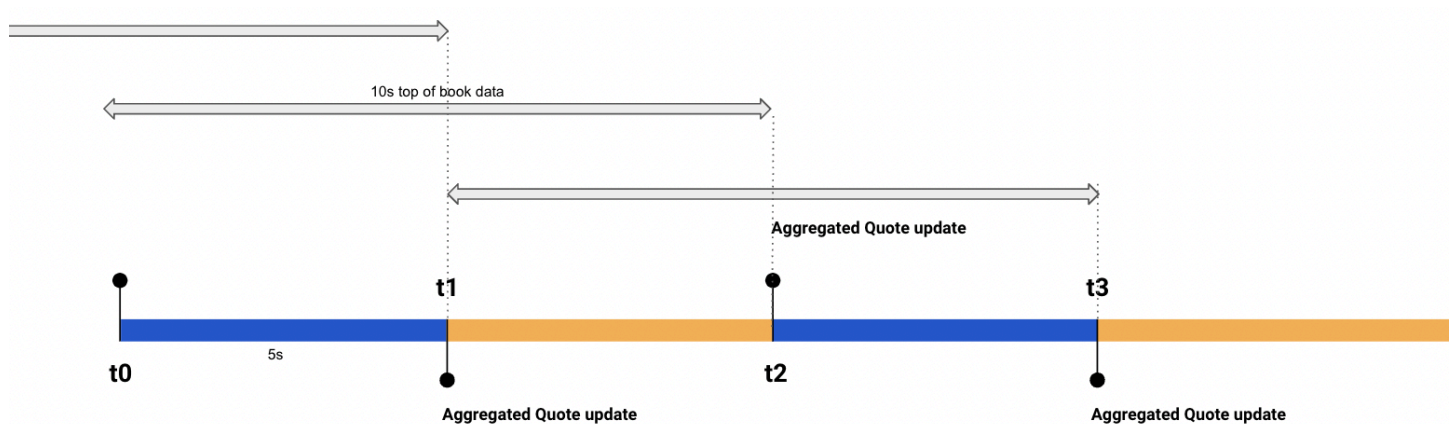
## Inputs / Parameters

Parameter	Description
InstrumentClass	Instrument Class. Could be spot, future, perpetual future or option
Code	Instrument code as expected by Kaiko API.

## Computation Intervals

Computation of the price is based on 2 time intervals:

- **Aggregation window interval:** define the time interval during which data is collected before the aggregation. The value of this parameter is **10 seconds**.
- **Update Frequency interval:** define the frequency of updates sent by the endpoint. The actual frequency is **1 second**.



## Output

Parameter	Description
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Timestamp	Event generation timestamp.
Price	Best execution price
Volume	Quote volume used in price calculation.
Event	Define the side of the price. Bid or Ask.

## Delivery

Best Execution Pricing is available through Kaiko Stream Service. Updates are sent every one second and include 2 messages describing each one, the update on the bid and ask sides.

## Use Cases

Cryptocurrencies is a fragmented market that means that there are different prices of one currency across different platforms and exchanges. Best Execution Pricing addresses the fragmentation of crypto markets by providing a fair quote to investors through a rigorous approach to crypto-instruments price valuation. There is large number of use cases:

- Liquidity Risk Management
- Pricing
- Compliant reporting and monitoring
- Research

# Appendix

Example of Price for ETH-USD



Price sheet

Parameter	Value
<b>Update Frequency</b>	1 second
<b>Aggregation Window</b>	10 seconds
<b>Delivery</b>	Kaiko Stream/SDK
<b>Coverage</b>	Exchanges: At most top 10 exchanges as per Kaiko Exchange Ranking framework Instruments: All instruments.

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We can provide a full trial of our enterprise-grade market data services, with access to trades, order books, candlesticks, and more for all leading spot and derivatives exchanges

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