Assignment for University of Jyvaskyla

Application overview

Web application for stock brokerage who wants to do off market trades (Orders are matched outside of a stock exchange) for single stock - APPLE (AAPL).

The web application interacts with end users through a REST API.

Web application should fetch latest market data of the stock from a feed in order to validate the price of the input orders.

System Requirement

1. Web application should provide a REST end point for the end users to submit orders, An order consists of
    a. Whether its a Bid or an Offer
        i. Bid - User want's to buy
        ii. Offer - User want's to sell
    b. Price - Up to two decimal places
        i. In case of a Bid - Max price the user is willing to pay per unit quantity
        ii. In case of an Offer - Min price the user is willing to get for the sale of unit quantity
    c. Quantity - Integer
        i. Amount of stock the user is willing to Buy or Sell
2. Any input order's price should be validated against market data of AAPL's last traded price
    a. To verify the brokerage execution prices are inline with actual trade prices
    b. Fetch last traded price from the third party API - Introduction | Market Data Docs
        i. Fetch last trade price ('last') of AAPL from endpoint - GET /v1/stocks/quotes/AAPL
    c. Respect the rate limitations mentioned here - Rate Limiting | Market Data Docs
        i. Configure the application to fetch the data hourly
    d. System should validate that at the input, Price of an order is within +- 10% of the last traded price
3. Input orders should be matched with existing orders on the other side
    a. If they match, system should record a trade, Trade should contain
        i. Traded time
        ii. Traded price (Highest value of the Bid and Offer prices)
        iii. Traded quantity (Min of Bid and Offer Quantity)
    b. If the input order does not match or only matches partially, then the remaining quantity should be stored in the system, Any upcoming order will match with these.
    c. If there are multiple orders in the system eligible for matching, then
        i. System should start according to order priority
            1. Bid order priority - Highest Price to Lowest price
            2. Offer order priority - Lowest price to Highest price
        ii. If there are multiple orders with the same priority / price, then System should start matching from the oldest order
    d. Refer example below
4. System should provide a REST end point to get the trade information, ordered in the trade time ascending order.

Expected Outcome

1. Develop the above system with CI setup
2. CI should be configured to provide:
    a. Unit test report including code coverage

b. E2E testing for given scenarios - Refer scenarios below

c. Automated Releases generation with:

i. Change log

ii. version number

Additional items

1. Setup code quality testing in the CI and generate code quality report
2. Setup code security analysis (Eg. Static Application Security Testing in GitLab - SAST)

Example

1. Initial order submission - Market last traded price - 190.00
   a. Input Bid of Qty: 1000, Price: 200.00 is stored in the system - Ord 1

Bid	Offer
Ord1 - 1000 @ 200.00	

2. Second order - Market last traded price - 200.00
   a. Input Bid of Qty: 500, Price: 210.00 - Ord 2

Bid	Offer
Ord2 - 500 @ 210.00	
Ord1 - 1000 @ 200.00	

3. Third order - Market last traded price - 200.00
   a. Input Offer of Qty 750, Price: 225.00
   b. Order is rejected - Price 225 is outside market's last traded price range (+- 10%)

Bid	Offer
Ord2 - 500 @ 210.00	
Ord1 - 1000 @ 200.00	

4. Fourth order - Market last traded price - 200.00
   a. Input Offer of Qty 500, Price: 205 - Ord 4
   b. Trade happens between Ord 2 and Ord 4 at time T1
      i. Price 210 (Max of Ord 2, Ord 4)
      ii. Qty 500 (Min of Ord2, Ord4)

Bid	Offer
Ord1 - 1000 @ 200.00	

Trades

Time	Price	Quantity
T1	210	500

5. Fifth Order - Market last traded price - 200.00
    a. Input Offer - Qty 1500, Price: 200 - Ord5
    b. Trade happens between Ord 1 and Ord 5 at time T2
        i. Price 200 (Max of Ord 1 and Ord 5)
        ii. Qty 1000 (Min of Ord 1 and Ord 5)

Bid	Offer
	Ord 5 - 500 @ 200.00

Trades		
Time	**Price**	**Quantity**
T1	210	500
T2	200	1000

6. Sixth order - Market last traded price - 200.00
    a. Input Offer - Qty 750, Price 200 - Ord 6

Bid	Offer
	Ord 5 - 500 @ 200.00
	Ord 6 - 750 @ 200.00

6. Seventh order - Market last traded price - 200.00
    a. Input Bid - Qty 1000, Price 200 - Ord 7
    b. Trade is possible with Ord 7 - Ord 5 and Ord 7 - Ord 6
    c. System should start matching with the oldest order (Ord 7 - Ord 5, Ord 7 - Ord 6)
        i. Trade 1 happens between Ord 7 - Ord 5,
            1. Price: 200
            2. Qty: 500
        ii. Trade 2, Ord 7 - Ord 6
            1. Price: 200
            2. Qty: 500

Bid	Offer
	Ord 6 - 250 @ 200.00

Trades

Time	Price	Quantity
T1	210	500
T2	200	1000
T3	200	500
T3	200	500

E2E scenarios

1. Verify input prices are validated based on latest market data
    a. Fetch current market last trade price of AAPL - example M1
    b. Verify Bid order at Price M1 x 1.08 is accepted
    c. Verify Offer order at Price M1 x 0.90 is accepted
    d. Verify Bid order at Price M1 x 1.11 is rejected
    e. Verify Offer order at Price M1 x -1.01 is rejected
    f. Verify no trades have happened
2. Verify input quantity is valid
    a. Fetch current market last trade price of AAPL - M2
    b. Bid order at Price M2, Qty 0 is rejected
    c. Bid order at Price M2, Qty 10.1 is rejected
    d. Offer order at Price M2, Qty -100 is rejected
    e. Verify no trades have happened
3. Verify Trades happen according to the given logic
    a. Fetch current market last trade price of AAPL - M3
    b. Ord 1 - Bid Price: M3, Qty: 100
    c. Ord 2 - Offer, Price: M3 x 0.8, Qty: 200
    d. Ord 3 - Bid Price: M3 x 1.01, Qty: 200
    e. Ord 4 - Bid Price: M3 x 0.95, Qty: 50
    f. Ord 5 - Bid Price: M3, Qty: 30
    g. Ord 6 - Offer, Price: M3, Qty 250 - T1
    h. Fetch trades
        i. Expected:

Trades		
Time	**Price**	**Quantity**
T1	M3 x 1.01	200
T1	M3	50