Case Study:
Improving Quality of Brokerage Trade Execution

In recent years, the competition in the brokerage market has increased significantly. To keep up, a brokerage firm has to provide access to multiple markets and products. That's where a Smart Order Router (SOR) comes into play. This is the component that sends client orders for execution to multiple venues (stock exchanges or larger banks) to find the best match. An Algo Trading component can be added on top to implement specific strategies.

If you have ever tried to test your Smart Order Router or Algo Trading system, most likely you have run into a limitation in the venue test environment - downstream consuming and matching your orders.

Challenge: limited test environment

Here is the problem we've seen in every trading application we've tested – from the world's top banks to medium and small size brokers.

A trade execution partner, such as a stock exchange or large bank, provides limited test environment. You can perform only connectivity and smoke testing using this environment, while any complex functional, regulatory or performance testing for your SOR cannot be done.

We've solved this problem for 15+ clients and 50+ various trading apps. In this case study, we share insights from our relevant experience.

Solution: SOR venue simulator

You need to create a venue simulator or test stub and use it during functional and performance testing of your Smart Order Router or Algo Trading app.

Test Setup – SOR Venue Simulator
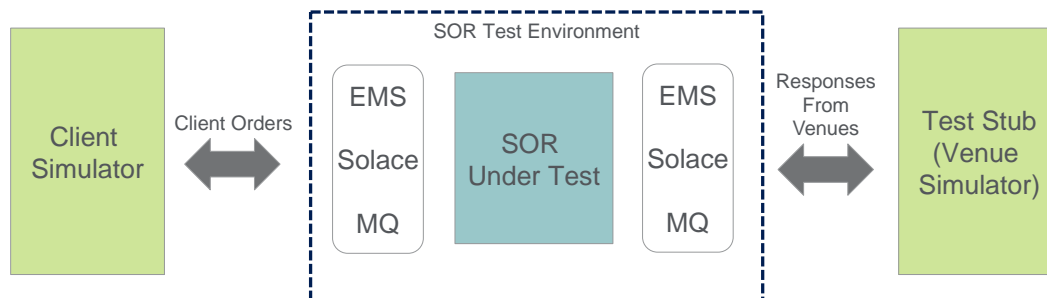
Legend: ■ Test Harness ■ Queues ■ System Under Test

Every trading application is different, so there is no standard tool you can employ as a simulator out of the box. You would need to create it - collect requirements, develop, deploy and test.

Meet the **Allied Testing Venue Simulator**!

Allied Testing Venue Simulator features

While helping many clients with this problem, we've developed multiple modules for the **Allied Testing Venue Simulator** tool. We can help customize it for your apps and reduce your tooling development effort.

Allied Venue Simulator Built-in Capabilities		
Connectivity	**Message Types**	**Test Types**
• Direct TCP • IBM MQ • Tibco EMS Solace • Web Socket	• FIX • SWIFT • Native binary • XML • JSON	• Algo strategy validation • Integration Testing with complex order types • Fault Tolerance • Regulatory • Market data simulation • Huge market burst (e.g. COVID-19) • Race Condition

The tool has two important additional features:
- Grafana integration for instant visualization of test results (see examples in the next section);
- Ability to support rates up to 40000 messages/sec from a single server for high-volume tests.

Examples and results

With the help of the venue simulator tool, you will not depend on your trade execution partner at all during the testing process. You will be able to execute any test type you want or are obliged to by a regulator.

Here are the examples of how we used the **Allied Testing Venue Simulator** to discover critical operational limitations for our clients' Smart Order Routers and Algo Trading systems (actual values are masked due to Non-Disclosure Agreements).

Algo Trading System maximum throughput

Our client, one of the world's largest banks, was planning to add more client traffic to an Algo Trading System. They asked us to find the system maximum throughput. The test would show whether there was enough bandwidth, i.e. whether the system would cope with the increased workload.

Our simulator was a perfect fit for the test, since it was able to simulate high volume of responses from a stock exchange as we add more traffic. Finally, we were able to reach the breakpoint.

On the graph below, the X-axis is time, the Y-axis is the number of processed orders per sec.


Thanks to the test, our client was able to add more traffic to its Algo Trading System, since the identified breakpoint was far enough to affect the planned traffic growth.

Smart Order Router bottleneck

Similarly to the previous example, we were asked to find a breakpoint for a Smart Order Router. This time we had to detect the reason for the bottleneck, i.e. determine why a failure happens.

Our simulator was able to help in this case as well, thanks to advanced monitoring and reporting features. In the graph below, you can see how the heap size (Y-axis) is reaching its maximum as the test progresses (X-axis is the test time).
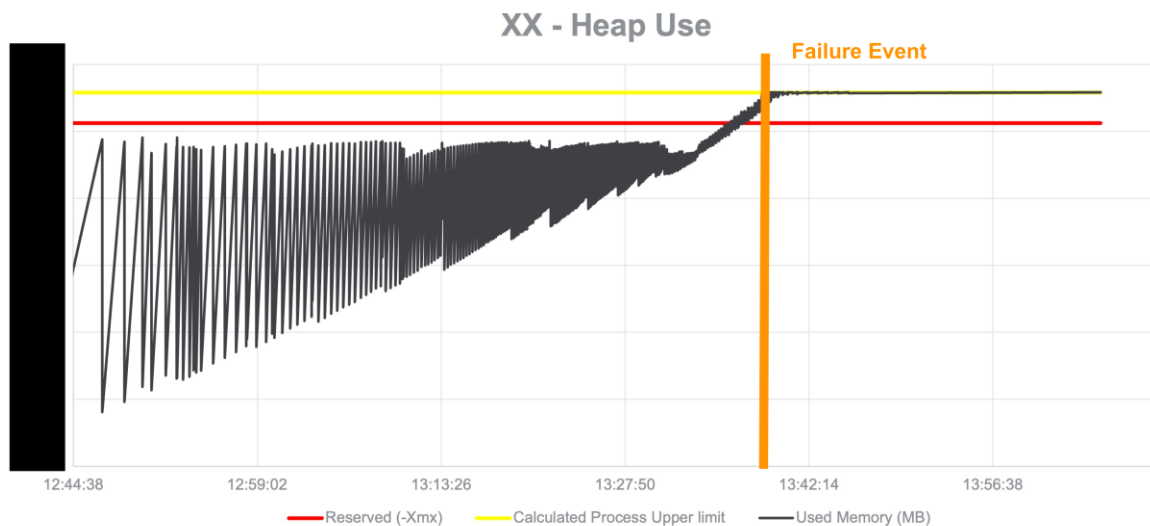
Thanks to this test result, the Smart Order Router memory management has been improved to accommodate more workload.

Contact Allied Testing now, if you need a venue simulator or face SOR testing challenges. We will be happy to analyse your case and create an action plan free of charge.