

Random Testing in a Trading System

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Random Testing in a Trading System

- What is Random Testing?
- Why we should use Random testing
- How Random testing works
- How Random testing is used to test Trading Systems at Cinnober



What Is Random Testing?

- Send randomly generated data to the system under test.
- The input data is generated from a predefined domain
- The output from the System can be analyzed by a test oracle.



Why To Use Random Testing

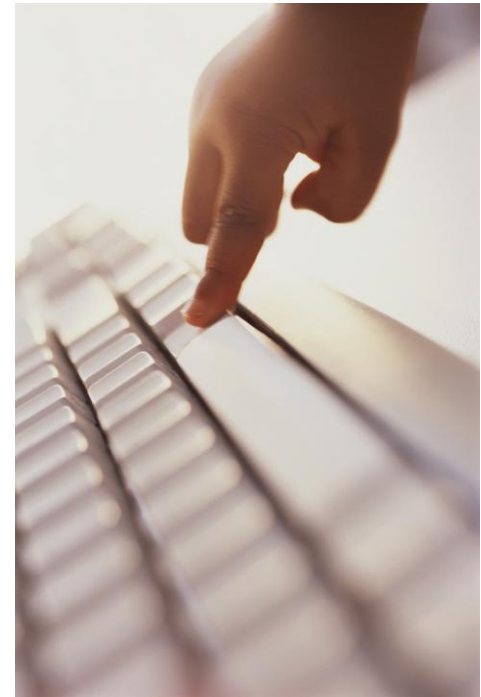
- A powerful tool for finding low frequency bugs with high impact.
- Regular automatic tests do the same thing every time. Random tests can take a new route each time they are run.
- It is impossible to cover everything in a large complex system with other automated tests.
- Helps identify areas that need more testing.
- Easy to implement
- Cost Efficient

How it works

- **Generate Random Data**
- **Test Oracle**
- **Analyze Results**

Generating Input Data

- Random data from a uniform distribution or other distributions.
- Randomized objects, not only numbers
- Realistic or unrealistic



Random Test Oracles

- No Oracle
- Heuristic Oracle
- True Oracle



How we have used Random Testing

- Simulations using several different "Actors"
- No Oracle Strategy
- Simple Heuristic Oracle
- True Oracle Strategy using Constraint programming

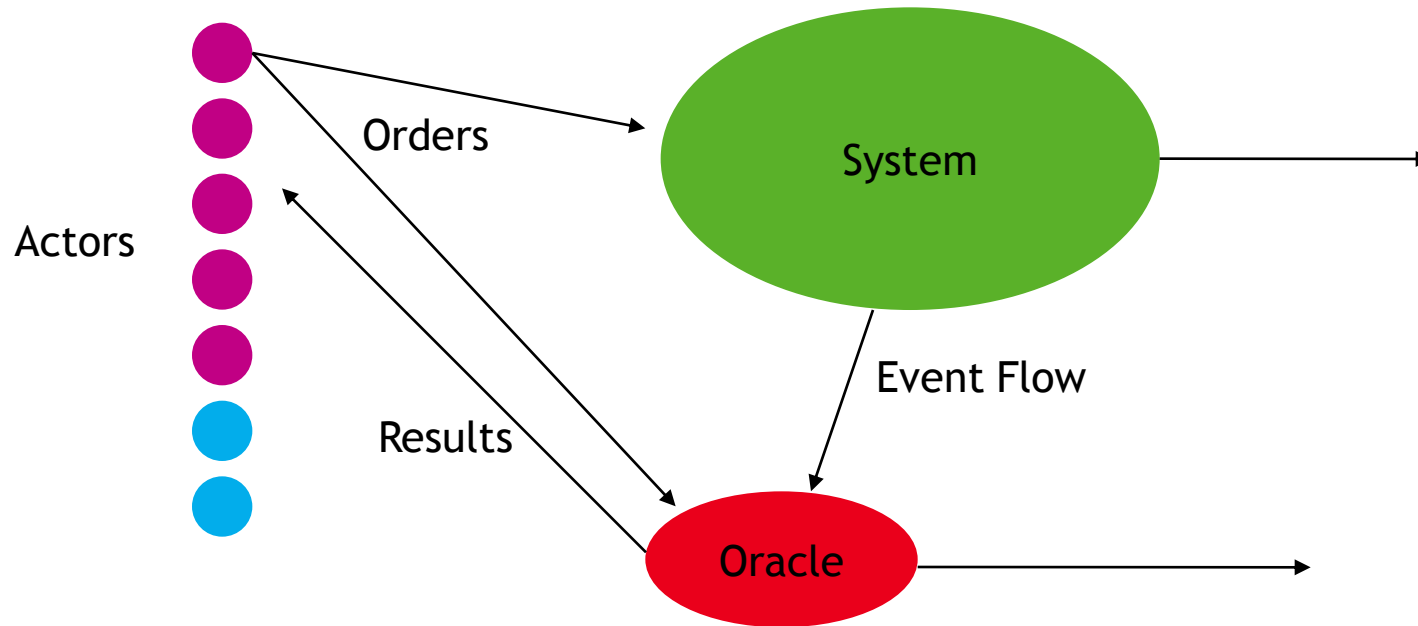
The Trading System



Simulation

- **Actors**
 - Trading Actors
 - Enter different types of orders
 - Iceberg Orders
 - Stop-Loss orders
 - Update, Cancel orders
 - Send queries to system
 - Market Operations Actors
 - Add, Delete Users
 - Send Market Messages

Simulation



Using a No Oracle Strategy

- Finds bugs that cause the system to crash
- Finds bugs that cause the system to throw exceptions
- Can find other bugs as well.



Using a simple heuristic oracle

- **Verify that output conforms to a few heuristics**

Using a true oracle

- Developed a formal executable model of the real order matching mechanism
 - Easy to implement and therefore often correct.
- Example: "if the limit price of a bid order b is lower than that of an ask order a , then their traded quantity must be 0"

$$lp_b \leq lp_a \Rightarrow tq_{b,a} = 0$$

- More costly, but allows to detect more failures

Conclusion

- Random testing finds low-frequency bugs that would not be found with other automated tests
- Random testing is easy to implement and cost efficient

Questions?