Description of Project
CME’s Globex Electronic Trading Platform is the system that powers trading at CME Group. Globex accepts and manages orders from a diverse set of customers including High Frequency Traders, hedge funds, and individual traders. The system determines if and when trades should occur and disseminates this information to our customers and to the rest of the world. Responsible for trillions of dollars worth of transactions per year, Globex accounts for 95% of CME’s annual revenue.

All new developments within trading platforms require rigorous performance testing prior to moving to the production environment. This is a time intensive process. The student team will create an order injector tool delivering increased performance testing efficiency for CME’s developers. The tool will deliver a configurable data stream mimicking the behavior of CME’s high-frequency, algorithmic, and manual trading systems in data structure, speed and volume. The speed and volume of the delivery will be controlled by the tester supporting a wide range of stress testing.

Phase 1
Deliver an order injector that can submit a stream orders to CME’s trade matching engine using a high performance messaging library such as Aeron (https://github.com/real-logic/Aeron). This system will initially utilize archived historical order entry data for replay into a matching engine during development and testing to ensure correctness. The system will then be extended to generate original order flow into the matching engine given configuration parameters (e.g message rate, message types, etc). Systems designed to silently observe order flow in the
matching engine will be used to capture the outputs of the injector and trade results to verify correctness. The system will be designed with speed in mind and performance tracking will be built into the application.

Phase 2
Extend the functionality providing the developer with options to control the speed, volume, and to mix of “trader archetype(s)” (e.g Market Makers, Liquidity takers, large traders, etc.) incorporated into the test stream.

Phase 3 [Stretch Goals] Incorporate one or more of the following desired characteristics into the delivered system:
- Improve performance of the injector such that it can process incoming information and make a trading decision in less than 10 microseconds. (this may require implementation using FPGA’s)
- Implement a trading strategy to quickly identify and act on arbitrage opportunities that exist across multiple markets, possibly utilizing massively parallel architectures such as CUDA.
- Design and implement a simple user interface to control the injector and report on performance

Location
Work will mostly be completed on campus. All development will take place on CME provided laptops. Students will access the CME network via VPN when required. Fast processing will be developed in an emulator mode on laptops and then ported and tested within a Development environment maintained within CME testing servers. Students will travel to Chicago for user interviews / contextual design interviews as well as formal presentations (design reviews)

Project Sponsor Mentor

Project Faculty Mentor
Prof. Quentin Stout, EECS, CLaSSP
My students, collaborators, and I work in parallel computing (using supercomputers for computational science, algorithms for abstract models, complex systems, and points in between); serial algorithms; adaptive clinical trials and active learning; and random other things.
Key Skills & Project Roles

MDP Sponsored Projects are both a professional and academic learning experience for students. By participating in this program, students are actively preparing for graduate school and a professional career. As part of the experience, MDP expects professional behavior. To best prepare you for future professional opportunities, your experiences on this MDP team will be very broad. In addition to key technical skills that you will bring to the team, you will engage deeply in the self-directed learning of new and important concepts, demonstrate flexibility, collaboration, and cooperation, and develop strong professional communication skills. This also means that you will need to be able to work outside of your traditional area of study in the true multidisciplinary nature of our projects. You won’t always be able to anticipate how your skills and expertise will be used, so the MDP Sponsored Project will challenge you to grow and develop as a professional.

<table>
<thead>
<tr>
<th>Project Roles</th>
<th>Key Skills and/or Knowledge</th>
<th>Likely Majors</th>
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<tbody>
<tr>
<td>General Programming (2-3 students)</td>
<td>Java, C++, High performance computing</td>
<td>Computer Science, Computer Engineering Data Science</td>
</tr>
<tr>
<td>Computer Architecture (2-3 students)</td>
<td>CPU architecture, High Performance networking Cache design, linux kernel</td>
<td>Computer Science, Computer Engineering</td>
</tr>
<tr>
<td>Statistics (1 student)</td>
<td>Numeric methods, statistics, stochastic calculus. R or other statistical packages, must have basic coding experience</td>
<td>Statistics, Computer Science, Data Science</td>
</tr>
<tr>
<td>Finance / Market Trading (1 student)</td>
<td>Financial Market knowledge, must have very basic coding experience</td>
<td>BBA, IOE, Mathematics</td>
</tr>
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Desired Additional Knowledge, Skills and Experience:
Interest in financial technology and algorithmic trading, experience with realtime/high-performance systems and networks, team player,
DEVELOPMENT ENVIRONMENT

Students will work on CME provided laptops in emulator mode and then port their work to a development server within the CME firewall (via VPN) to actually test their developed systems. Company Overview

CME Group is the world’s leading and most diverse derivatives exchanges. Our technology drives the global economy by providing leading investment banks, hedge funds, proprietary trading firms and individual traders a venue to manage risk. Software engineers at CME write and maintain ultra-low-latency electronic trading platforms, risk management systems, and front end trading interfaces, all central to CME’s business and the financial industry. Students will gain unparalleled experience in electronic trading and financial technology. We are looking for motivated and talented software engineers that want to help solve some of the most complex challenges in financial technology.

Legal Requirements

Citizenship and Right to Work Options

☐ This project is open to all students regardless of citizenship status

*Please delete non-relevant items above, and add any additional information as needed.*

Intellectual Property Agreements / Non-Disclosure Agreements

☐ Students will sign the standard MDP IP/NDA agreement

Internship Information

☐ Summer Internships may available for students (CS students are preferred), All students with right to work in US will be offered an interview for a summer internship within the first two months of the project (Jan/Feb 2017).