**Virtual Exchange**

Architectural Design

**1. Introduction and Context**

Stock exchanges allow ownership of companies to be transferred through the sale of shares in these companies. These exchanges must provide the resources necessary for this exchange of ownership. The goal of this project is to build a virtual stock exchange (and facilitating components) that allows players to participate in this exchange of ownership of companies. This virtual exchange will attempt to simulate an actual trading environment and allow participants to practice making markets by submitting buy-sell orders based on the actions of other participants.

This project meets the project-selection criteria by the following:

* **Must involve at least three distinctly different kinds of shared resources:**
  + **Order Book** - A component of each matching engine which contains a list of buy and sell orders at given price levels
  + **Matching Engine Registry** - Maintains a list of available matching engine IP addresses for each symbol (a company’s identifier)
  + **Player Details** - Maintains a list of how much cash and stock a player holds as well as their last known IP address
* **Must have at least three different kinds of processes for which you must implement programs:**
  + **Players** - Each player will be its own process. Players submit buy and sell orders to the exchange gateway.
  + **Exchange Gateway** - A process which maintains a list of available matching engines and player holdings
  + **Matching Engines** - A process which matches buyers and sellers for a given symbol by maintaining an order book of resting orders.
* **Must allow multiple process to be instantiated of at least one of the programs:**
  + **Players** - There can be an unlimited number of players

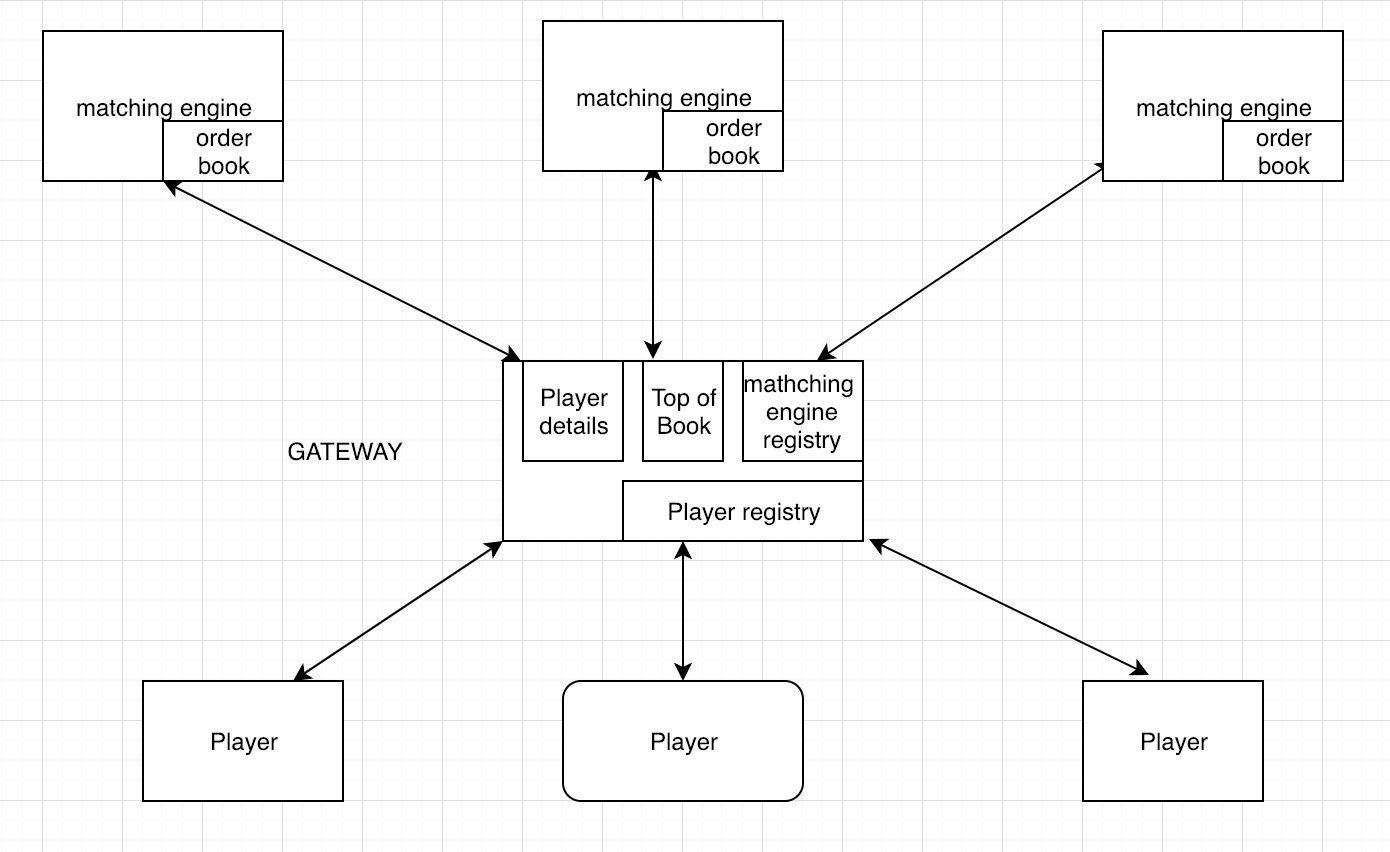
**2. Actors and their Goals**

* **Players:** Starts with some initial sum of money. Buys and sells stocks from other players with the goal of turning a profit. Buying and selling takes place by submitting orders on the stock exchange via the exchange gateway.
* **Exchange Gateway:** All players much register via the exchange gateway. This gateway is responsible for maintaining a list of available matching engines and routing orders to the appropriate matching engine. The gateway also maintains a list of registered players and their holdings (cash and stock). The gateway broadcasts executed trades and order book information to connected players.
* **Matching Engines:** Maintains an order book (list of buy and sell orders) for that specific engine’s symbol. This order book is a list of all outstanding trades which have not yet been executed (these are known as resting orders). Sends executed trade messages to the exchange gateway.

**3. Major Components and Their Relationship**

* This application will involve three types of processes
  + Player
    - Tracks its own ownership of shares and available capital
    - Sends buy or sell requests through the Gateway to Matching Engines
  + Gateway
    - Facilitates communication between Matching Engines and Players
    - Keeps a registry of Players and their details
    - Keeps a registry of Matching Engines and their details
    - Keeps a top of book list containing the top of book for each Matching Engine’s order book
    - Broadcasts the top of book for each symbol to all players on a set time interval
  + Matching Engine
    - Maintains an order book
    - Matches bids and offers on the order book
    - Sends trade confirmations to Players via the Gateway

Fig. 1: Relationships Between Components

****