Stock Exchange's Trading System

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List of authors:

- **Hadar Pur , ID: 308248533**

- **Shiran Sofer , ID: 308535483**

- **Tzah Mazuz , ID: 308107192**

1 System requirements

1.1 Introduction

Provide a brief overview of the function of the system and the reasons for its development, its scope, and references to the development context. Also introduce the objectives and success criteria of the project.

1.1.1 Purpose of the system

Briefly describe the business purpose of the system. What problem is it going to solve?

The purpose of the system is to enable a person who wishes to trade shares to do so simply and efficiently while maintaining all the actions he has performed.
Of course in cooperation with the bank which approves the transactions and transfer money from the trader to the stock exchange and vice versa, managing the investment portfolio against the returns, profits and losses of that trader.

1.1.2 Scope of the system

Briefly describe what is included in the system and what are subjects that are beyond the system's scope.

The Stock Exchange's Trading system will enable bidding and asking actions, it will provide relevant information regarding the trends and statistics of the stock market shares.
The system will produce reports in order to assist the trader in managing his account and informations about his transactions.

1.2 Current system

The current system provide to the trader fast and efficient access to trade in the stocks exchange without external factor like advisor/manager portfolio.
All the trader's actions are performed in front of the trading system.
The system also provides the trader a portfolio interface, which will show the trader's interaction with the market, such as open orders and trading history.
The system plays the role of the interface between the trader and the companies and providing the trader with action such as opening a new order and displaying general information of profits.

1.3 Actors & Goals

Describe the actors of the system, indicate for each actor if it is a major actor, and for every major actor describe the goals that this actors excepts to achieve from the system.

Actor	Major	Description	Goals
Trader	✔	A person or anyone else that is using the system for the overall purpose of stock exchange.	● Buying Stocks ● Selling Stocks ● Managing portfolio
Stock exchange	✗	An external system where the stocks are being held and offered for sale by groups in the market.	
Bank	✗	An external system that connects traders with their bank account and provide the money for trading in the system.	

1.4 Functional requirements

1.4.1 Use case diagram

Draw a use case diagram that summarizes the relationship between the actors and the high level use cases.
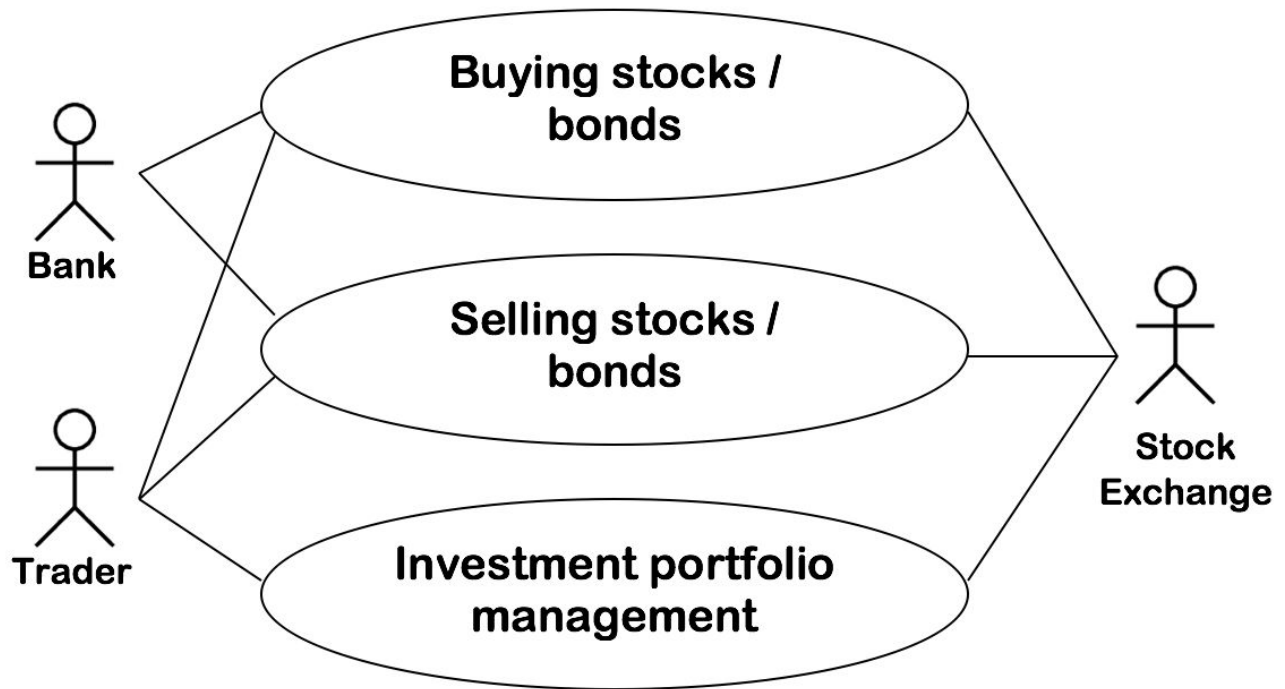
1.4.2 Use cases

Use Case Name: Buying stocks / bonds

Participating Actors: Trader, Bank, Stock Exchange

Goal: Succeed in buying stocks / bonds

Flow of Events (or basic flow activity diagram):

1. The Trader identifies in the system.
2. The System shows all the stocks / bonds currently for sale in the Stock Exchange.
3. The Trader selects the stocks / bonds he wants to purchase.
4. The System requests the Trader for the buying offer information.
5. The Trader enters the amount of stocks / bonds and the price per each.
6. The System sends a request to the Bank to withdraw money from the trader's account and transfers the money to the stock exchange's Bank account.
7. The Bank accepts the request and notifies to the System.
8. The System uploads the buying request to the Stock Exchange and makes a permanent listening over the buying request's status.
9. The System finds a match , removes the buying request from the stock exchange and delivers a message that the purchase has been made successfully.

Alternative flow A:
A.1. At step 2, there are currently no stocks / bonds for sale.
A.2. The System returns a message that there aren't any stocks / bonds for sale.

Alternative flow B:
B.1. At step 7, the Bank decline the request due to insufficient amount of money in the Trader's Bank account.
B.2. The System asks the trader to re-enter a price.

Alternative flow C:
C.1. At step 8, the Trader makes a change in his offer.
C.2. The Trader wants to raise / lower the price / quantity and the change is declined due to insufficient money in the Trader's bank account (in case of raising price) or the Bid has been already sold out.

Use Case Name: Selling stocks / bonds

Participating Actors: Trader, Bank, Stock Exchange

Goal: Succeed in selling stocks / bonds

Flow of Events (or basic flow activity diagram):

1. The Trader identifies in the system.
2. The System displays the Trader's list of stocks / bonds.
3. The Trader selects the stock / bond he wants to sell.
4. The System requests the Trader for the selling offer information.
5. The Trader chooses the amount of stocks / bonds he wants to sell and the price per each.
6. The System sends a request to the Bank to withdraw stocks / bonds from the trader's account and transfers it to the stock exchange's Bank account.
7. The Bank accepts the request and notifies to the System.
8. The System uploads the selling request to the Stock Exchange and makes a permanent listening over the selling request's status.
9. The System finds a match , removes the selling request from the stock exchange and delivers a message that the selling has been made successfully.

Alternative flow A:
A.1. At step 2, the System returns a message that the Trader's list of stocks / bonds for sale is empty.

Alternative flow B:
B.1. At step 8, the Trader makes a change in his ask.
B.2. The trader wants to raise / lower the price / quantity and the change is decline due to insufficient shares in the Trader's bank account (in case of raising shares) or the Ask has been already bought.

Use Case Name: Investment portfolio management

Participating Actors: Trader, Stock Exchange

Goal: Monitoring profit and loss in investments made

Flow of Events (or basic flow activity diagram):

1. The Trader identifies in the system.
2. The System displays the selected period of time the trader wishes to manage.
3. The Trader choose the periodic review he selected.
4. The System displays to the Trader the information of his Investment portfolio (the calculation is explained in attachment A) :
   ● Profit / Loss
   ● Returns
5. The System displays the list of stocks / bonds that the Trader has any interaction with.
6. The Trader selects the stock / bond he wants to manage.
7. The System displays information of the selected stock / bond such as history (the calculation is explained in attachment A) :
   ● Profit / Loss
   ● Returns
8. The Trader has finished managing his portfolio.

Alternative flow A:
A.1. At step 5, there isn't a single stock / bond that the trader is in touch with.
A.2. The System returns a message that the Trader hasn't made any interaction with the Stock Exchange and therefore has no stocks / bonds to manage right now.

Attachment A:

<u>General:</u>
<u>To calculate the general returns on a period of time:</u>
X = Market value of all shares
Y = Purchase value of all the shares at the beginning of period of time.
Z = General returns (%)

$$Z = (\tfrac{X}{Y} - 1) * 100$$

<u>To calculate the general Loss/Profit on a period of time:</u>
X = Market value of all shares
Y = Purchase value of all the shares at the beginning of period of time.
V = General Loss/Profit

$$V = X - Y$$

<u>Single share:</u>
<u>To calculate the specific returns for each share on a period of time:</u>
X = Market value of share
Y = Purchase value of the share at the beginning of period of time.
C = Amount of share
Z = Returns (%)

$$Z = (\tfrac{X}{Y} - 1) * 100$$

<u>To calculate the specific loss/profit of each share on a period of time:</u>
X = Market value of share
Y = Purchase value of the share at the beginning of period of time.
C = Amount of share
V = Loss/Profit

$$V = C * (X - Y)$$

1.5 Non functional requirements

Describe user-level requirements that are not related to functionality. This includes reliability, usability, performance, supportability, implementation, interface, operational, packaging, and legal requirements. Specify at least two non functional requirements for each type, that are relevant to your system.

Requirement name	Requirement type (U/R/P/S)[1]
The System will support two languages (Hebrew, English).	Usability.
The System will be active 95% of the time.	Reliability.
Buying / Selling action will take no more than 10 minutes.	Usability.
The System will support one user at a time.	Usability.
The System will run on Windows OS.	Support.
The System will update according to any action taken.	Performance.
Adding new features will not require re-install.	Support.
Only the trader will be able to make changes in his Investment portfolio management	Security.

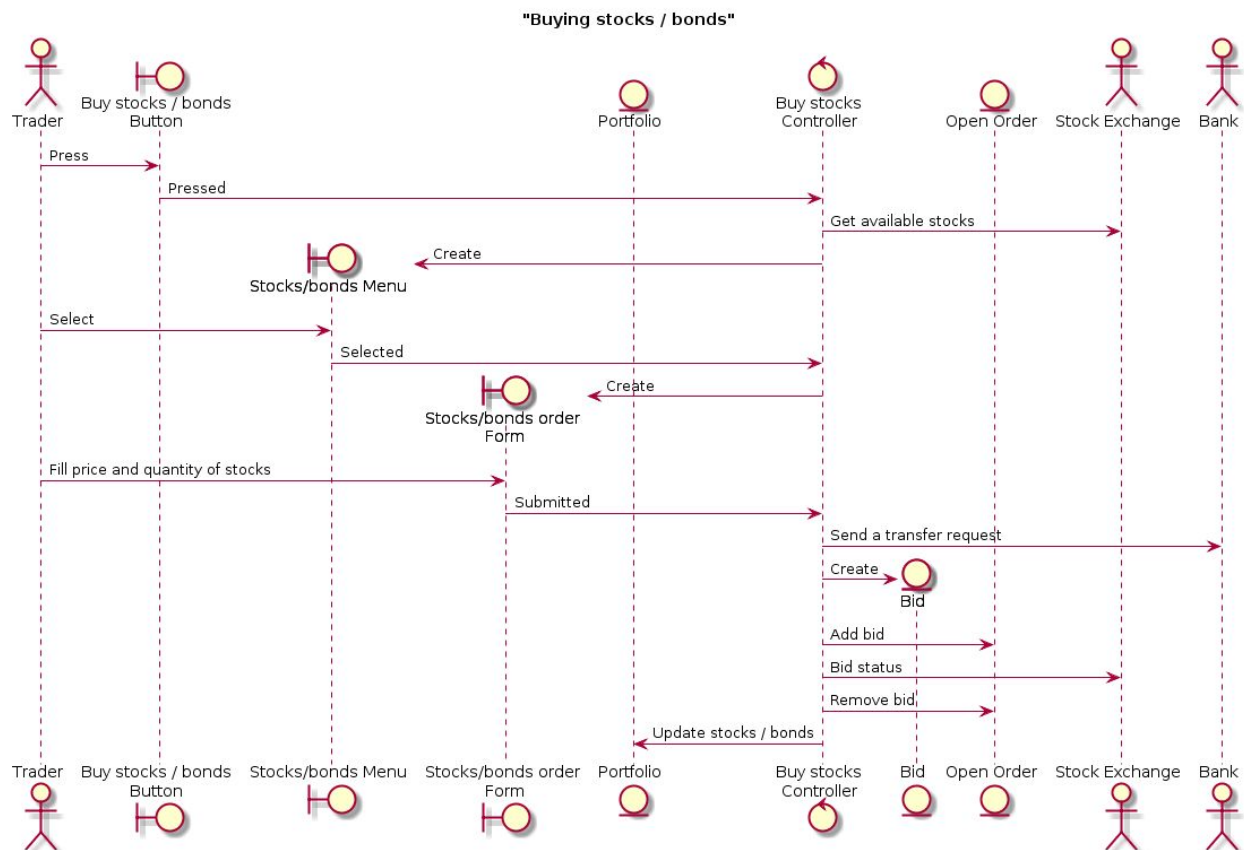[1] Usability/Reliability/Performance/Supportability
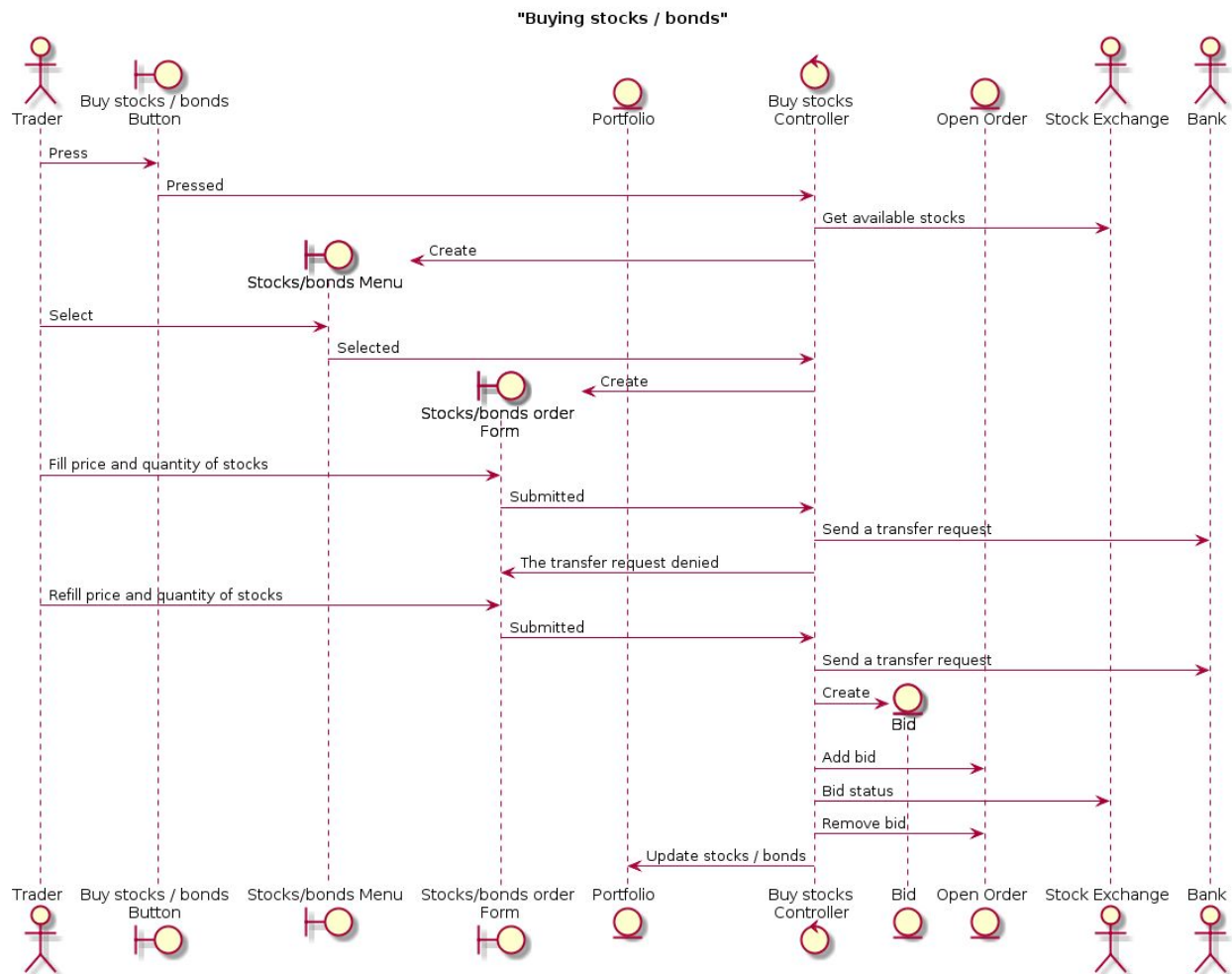
2 System analysis

2.1 Dynamic model

Draw a sequence diagram for each interesting scenario of every use-case. There should be at least one sequence diagram for every use-case. Use the section numbers to refer the diagram to its use-case.

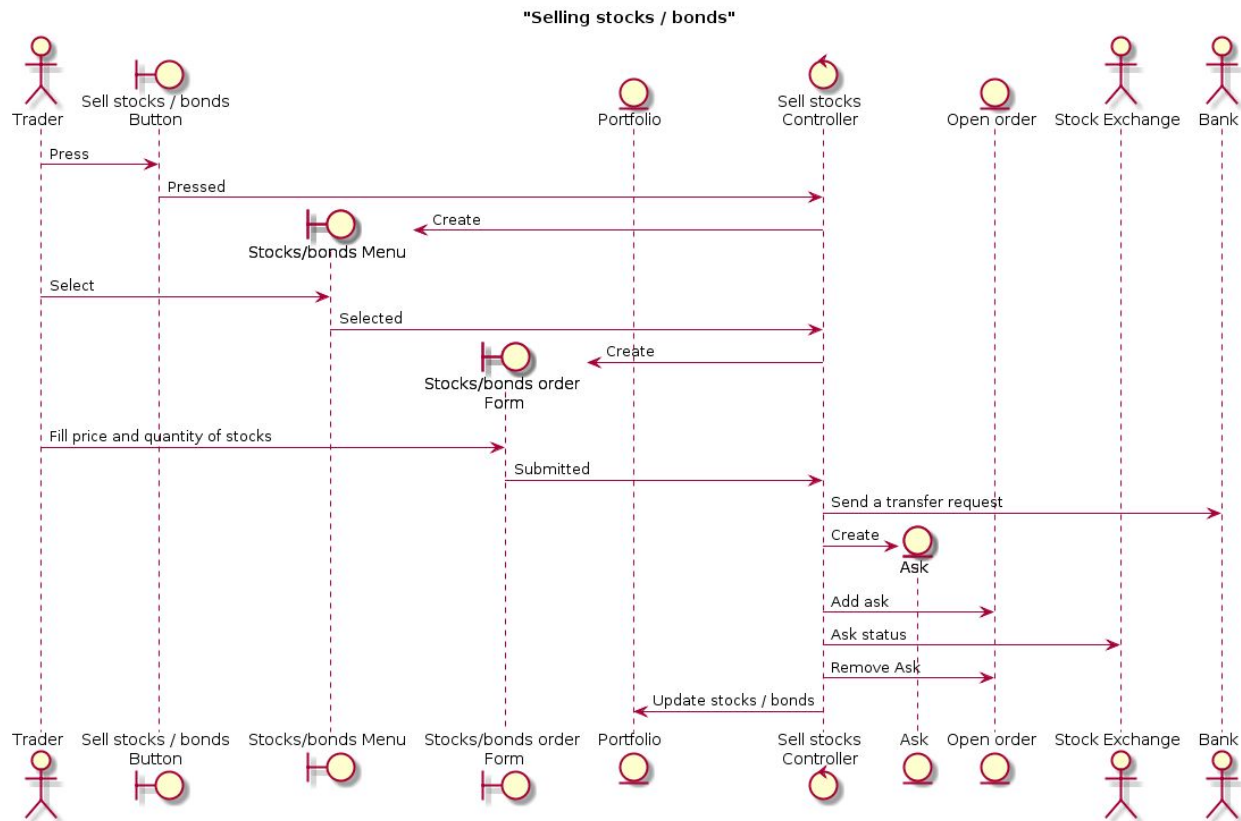**Use Case Name: Buying stocks / bonds**

Sequence diagram:

"Buying stocks / bonds"

Alternative flow B:

"Buying stocks / bonds"

Trader — Buy stocks / bonds Button — Stocks/bonds Menu — Stocks/bonds order Form — Portfolio — Buy stocks Controller — Bid — Open Order — Stock Exchange — Bank

- Press
- Pressed
- Get available stocks
- Create
- Select
- Selected
- Create
- Fill price and quantity of stocks
- Submitted
- Send a transfer request
- The transfer request denied
- Refill price and quantity of stocks
- Submitted
- Send a transfer request
- Create
- Add bid
- Bid status
- Remove bid
- Update stocks / bonds

Use Case Name: Selling stocks / bonds

Sequence diagram:

"Selling stocks / bonds"

Trader — Sell stocks / bonds Button — Stocks/bonds Menu — Stocks/bonds order Form — Portfolio — Sell stocks Controller — Ask — Open order — Stock Exchange — Bank

- Press
- Pressed
- Create
- Select
- Selected
- Create
- Fill price and quantity of stocks
- Submitted
- Send a transfer request
- Create → Ask
- Add ask
- Ask status
- Remove Ask
- Update stocks / bonds

Use Case Name: Investment portfolio management

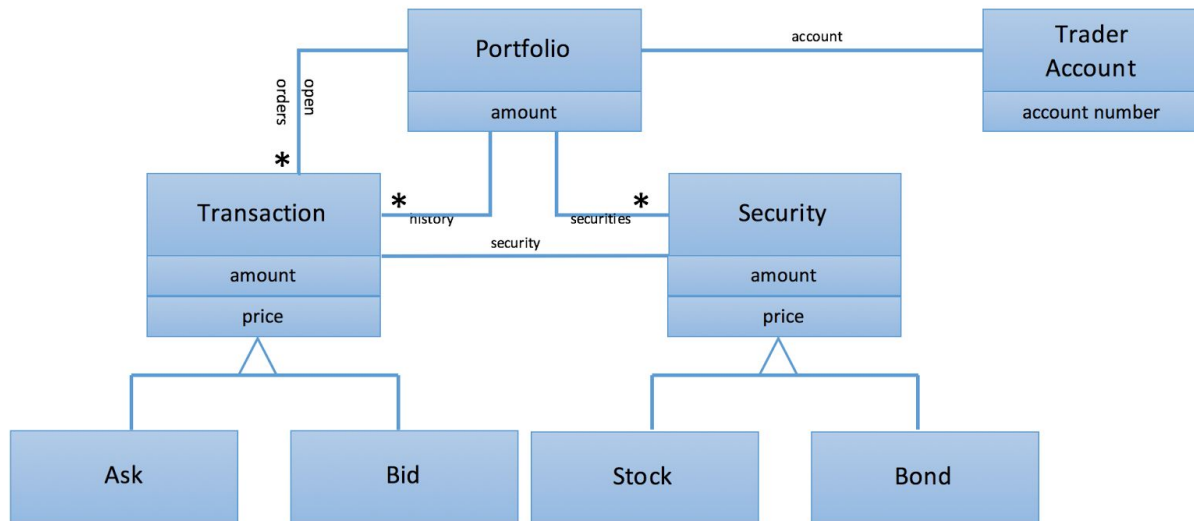Sequence diagram:

"Investment portfolio management"

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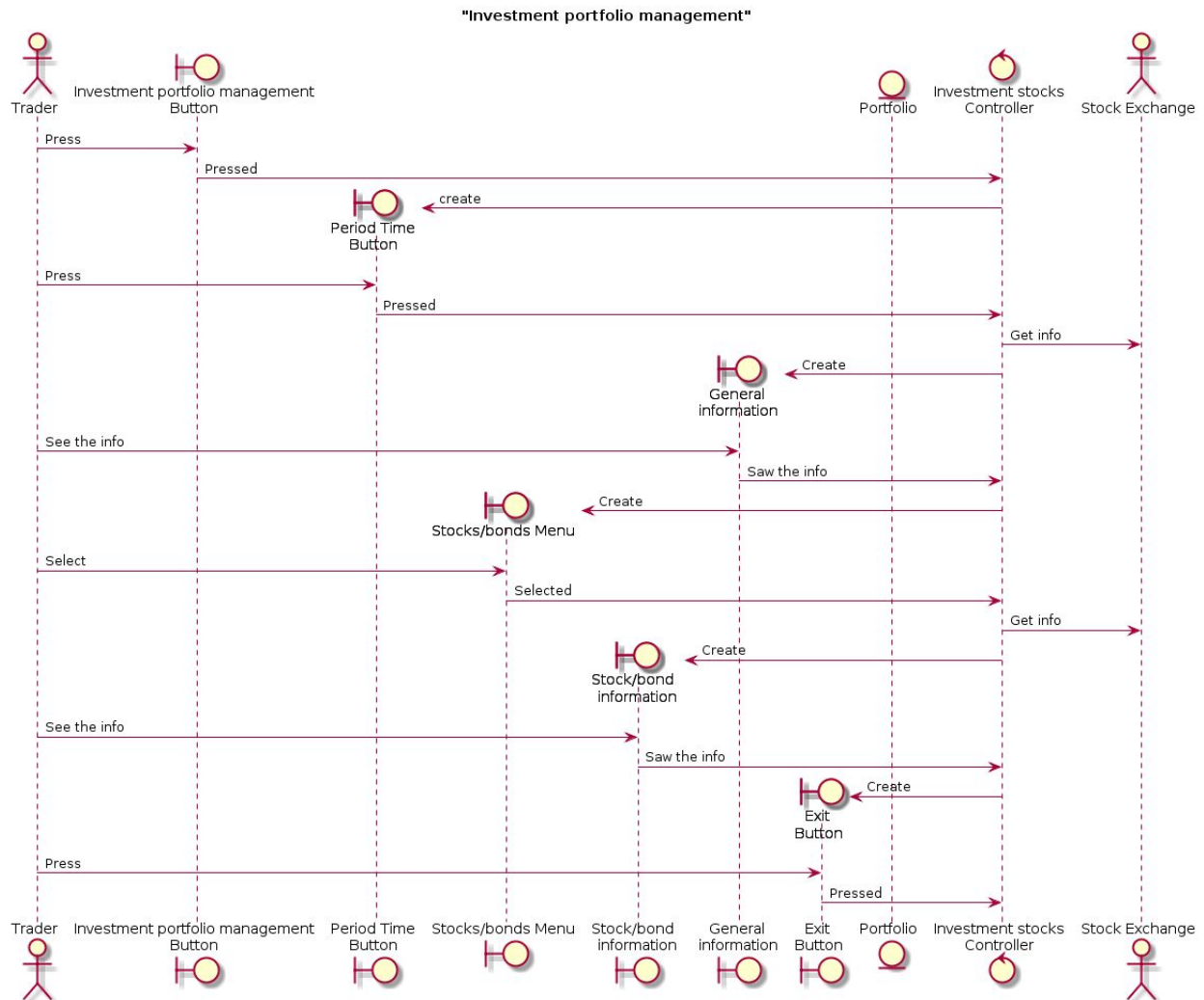
2.2 Object model

Draw a class diagram of the problem domain entity objects and their associations and important problem domain attributes. Make sure that all your associations have roles and multiplicities on each side.

3 System design

3.1 Current system architecture

Describe the architecture of the system being replaced. If there is no previous system this section can be replaced by a survey of current architectures for similar systems. The purpose of this section is to make explicit the background information that system architects used, their assumptions, and common issues the new system will address.

No need to do.

3.2 Proposed system architecture

This section documents the new system design model. It is divided into the following subsections:

3.2.1 Subsystem decomposition

This section describes the decomposition into subsystems and the responsibilities of each. This is the main product of system design. Provide a component diagram that describes the major functional subsystems (components) of the system. The diagram must show the major interfaces of each subsystem and how they are connected together.

Part 1:
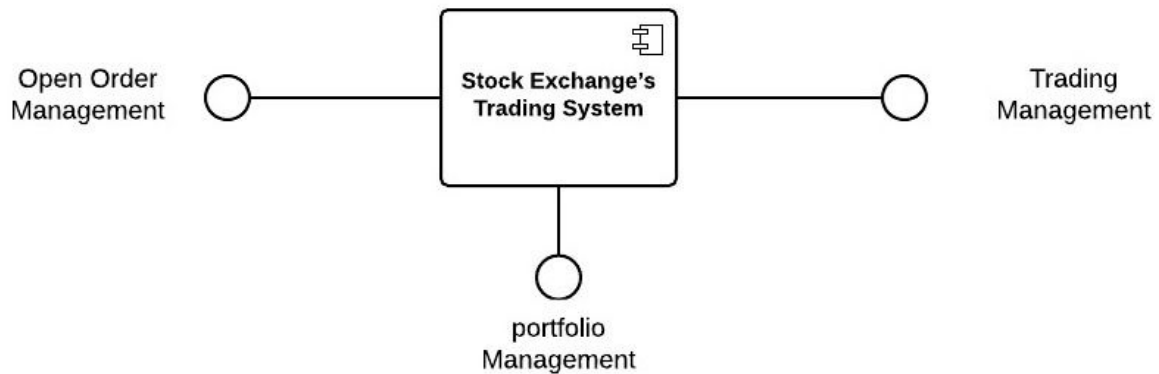
Service	Description
Open Order Management	This service's purpose is to give the Trader the ability to change / adjust existing orders currently open (and live) in the market.
Trading Management	This service's purpose is to give the Trader the ability to open new bid / ask orders. Those orders are now live in the market, and being manage by the Open Order Management.
Portfolio Management	This service shows all stocks / bonds and shows the Trader's profit and loss for each and every one, as well as total returns and overall history.

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Part 2:
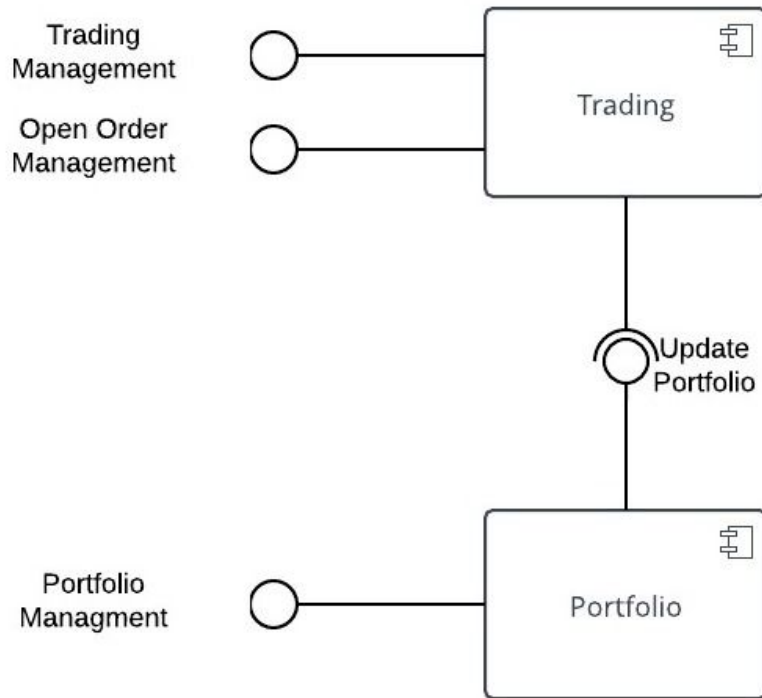
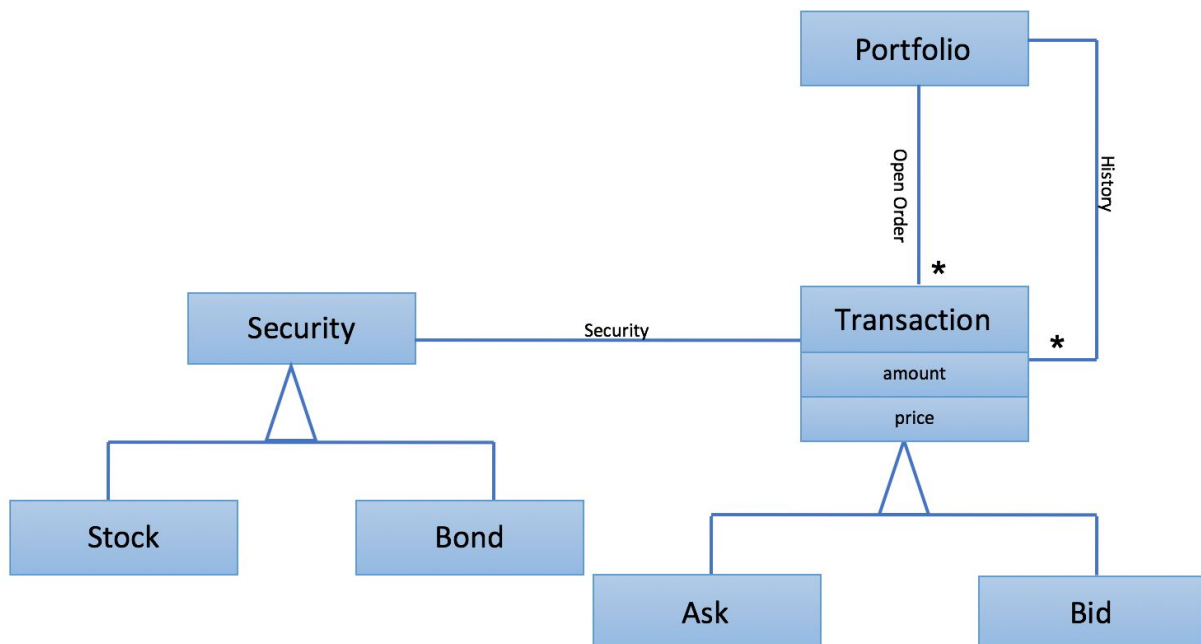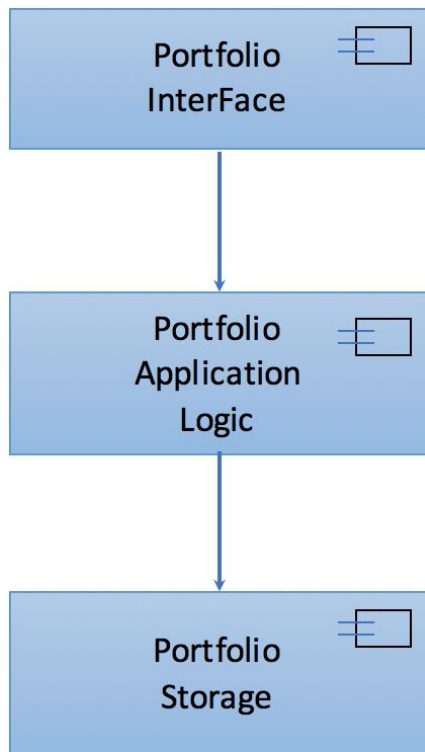| Service	Description
Update Portfolio	This service automatically updates every information shown in the Trader's portfolio every time a change or a new action has been made by the Trader.

Portfolio Class Diagram:
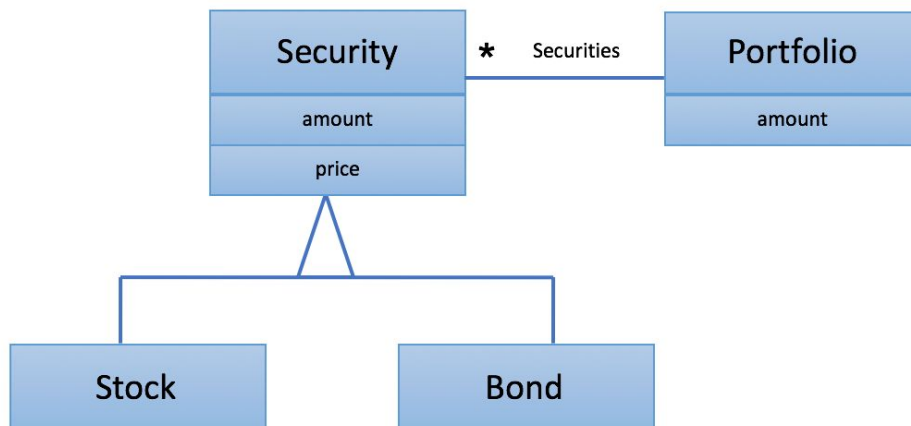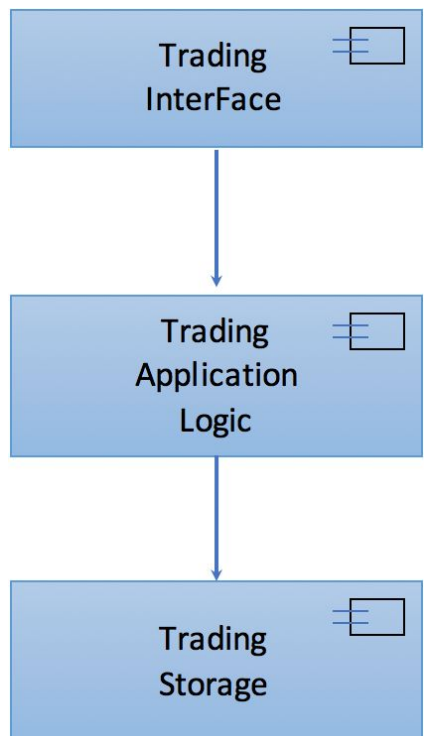

Trading Class Diagram:

Part 3:

Portfolio's tree teer diagram:

```
┌─────────────────────────┐
│     Portfolio        ═□  │
│     InterFace           │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│     Portfolio        ═□  │
│     Application         │
│     Logic               │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│                      ═□  │
│     Portfolio           │
│     Storage             │
└─────────────────────────┘
```

Trading's tree teer diagram:

```
┌─────────────────────────┐
│     Trading          ═□  │
│     InterFace           │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│     Trading          ═□  │
│     Application         │
│     Logic               │
└─────────────────────────┘
             │
             ▼
┌─────────────────────────┐
│                      ═□  │
│     Trading             │
│     Storage             │
└─────────────────────────┘
```

3.2.2 Hardware/software mapping

This section describes how subsystems are assigned to hardware and off-the-shelf components. It also lists the issues introduced by multiple nodes and software reuse. This section should include a deployment diagram that shows how on which physical platforms the subsystems run.

Estimate how many processors and how much memory you will need in order to satisfy the non functional requirements defined in section 1.5.
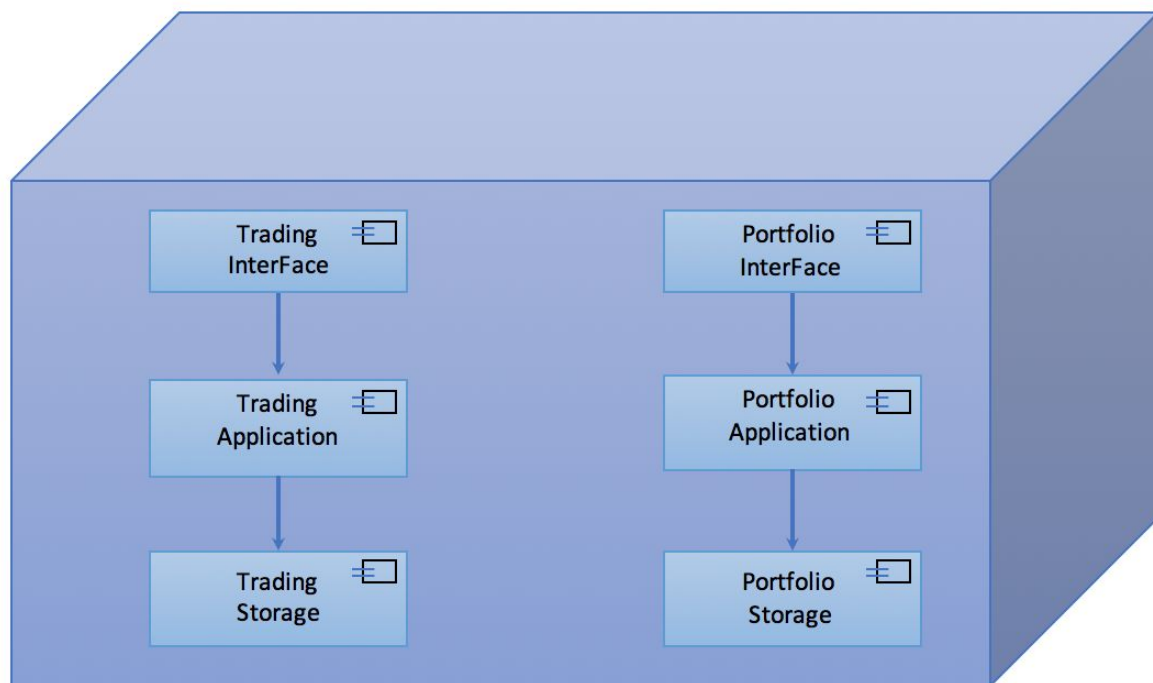
Windows 10 PC + jre 1.8

3.2.3 Persistent data management

This section describes the persistent data stored by the system and the data management infrastructure required for it. Explain your decision for selecting a particular persistent solution. In particular explain why the solution you have chosen fits the problem better than other options.

The System's data will be managed by "Files System", this decision was made on the realization that our System will involve one to few Traders, "Files System" will be enough to store this scope of information.
The advantages:
- Simplicity.
- Efficiency.
- Availability.
- No need for remote access or queries support.

Any other big data DB will be too complex, inefficient and expensive for the current System.
The data we store will be information about the trader such as:
- Account number (int=4 bytes).
- Amount of all stocks / bonds (int=4 bytes).
- Price of all stocks / bonds (double=8 bytes).
- Name of stock / bond (string - 16 chars = 32 bytes).
- Amount per stock / bond (int=4 bytes).
- Price per stock / bond (double=8 bytes).
- History of stocks / bonds that sold (string (stock / bond name) + int + double = 44 bytes)

To support our decision a calculation is made:
Total info size (in bytes):
All other variable's order of magnitude are negligible.
200 (numOfWorkDaysPerYear) * 100(numOfActionsPerDay) * 50 = 1MB (Maximum for each year).

3.2.4 Access control

This section describes the user model of the system in terms of an access matrix. Provide an access matrix for the major problem domain objects and the actors of the system.

No need to do.

3.2.5 Boundary conditions

This section describes installation, startup, shutdown, and error behavior of the system.

3.2.5.1 Use Case Name: Install

Participating Actors: Trader.

Flow of Events (or basic flow activity diagram):

1. The Trader downloads the System installation and executes the .jar file.
2. The System opens.
3. The Trader registers in the System.
4. The System updates its DB with the new Trader's account.

Alternative Flow A:
A.1. At step 2, the file does not execute correctly.
A.2. An error message is shown, either the Trader's OS doesn't match the System supported OS or doesn't own a jre 1.8.

Alternative Flow B:
B.1. At step 4, the Trader's registration process failed.
B.2. The System displays a message why it failed.

3.2.5.2 Use Case Name: Startup

Participating Actors: Trader.

Flow of Events (or basic flow activity diagram):

1. The Trader login to the System.
2. The System verifies the login credentials and continues forward.

Alternative Flow A:
A.1. At step 2, the System failed to verify the login request.
A.2. The System displays a message why it failed.

3.2.5.3 Use Case Name: Shut Down

Participating Actors: Trader.

Flow of Events (or basic flow activity diagram):

1. The Trader exits the System by any given exit button\operation.
2. The System terminates any unfinished actions made by the Trader and shuts down.

3.2.5.4 Use Case Name: Error behavior

Participating Actors: Trader.

Flow of Events (or basic flow activity diagram):

1. The Trader is trying to do an action that requires connecting to an external system.
2. The System approves that the connection has been made successfully.

Alternative Flow A:
A.1. At step 2, The connection establishment to the external system has failed.
A.2. The System cancels the any last actions made and shuts down.

X. Glossary

List all the important problem domain concepts that are relevant to your system. Make sure you use the language used by problem domain experts. Briefly explain each concept.

Term	Description
Bid	Bid is an offer made by the trader in order to buy a security. It stipulates the buyer's price and amount he wishes to purchase.
Ask	Ask is the price the trader is willing to accept for a security, which is often referred to as the offer price. Along with the price, the ask quote might also stipulate the amount of the security available to be sold at that price.
Stock	Stock is a type of security that signifies ownership in a corporation, it represents a claim on part of the corporation's assets and earnings.
Bond	Bond is a debt investment in which the investor loans money to an entity (typically corporate or governmental), the entity borrows the funds for a defined period of time at a variable or fixed interest rate.
Portfolio	Portfolio is a grouping of financial assets such as stocks, bonds and cash equivalents, as well as their funds counterparts, including mutual, exchange-traded and closed funds.
Trader	Trader is an individual who engages in the buying and selling of financial assets in any financial market, either for himself or on behalf of another person or institution.
Security	Securities are stocks, bonds, warrants and commercial securities that usually have a certain monetary value. They may be issued by a corporation (such as a company or a cooperative society) or a government.
Transaction	A transaction is an agreement between a buyer and a seller to exchange goods, services or financial instruments.