ECSE321

Introduction to Software Engineering

ACE

Requirements Specification

Team 6

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1 Introduction

1.1 Purpose of the System

ACE will be a fully automated on-line system for trading foreign currencies and currency derivatives. The system will allow the end-users to buy and sell currencies, take loans, and use derivatives to support their investments.

1.2 System Scope

ACE will be a trading platform that allows its participants to exchange currencies and derivatives. ACE will automatically match the buyers and sellers indiscriminately. The end-users will be companies, banks and other financial institutions that will mostly trade in large volumes. Initially, the system will handle up to 500 end-users but this number can be extended in the future.

1.3 Objectives and Success Criteria

1.3.1. The system will allow the end-users to make transactions.

1.3.2. The system will allow the administrators to add and withdraw funds from an end-user account.

1.3.3. The system will provide a network interface that will allow the end-users to create custom client applications to connect to the ACE server.

1.3.4. The system design will be scalable and will allow for modifications and extensions.

1.4 Definitions

1.4.1. end-user: a person, an organization or a company that holds an account on the ACE server.

1.4.2. account: a data record that contains the end-user's contact information and transaction related data.

1.4.3. administrator: a person that administrate the ACE server through the mean of an ACE client.

1.4.4. ACE server: a centralized software application server that provides transaction services to the end-users and administration services to the administrators.

1.4.5. ACE client: a software application that communicates with an ACE server.

1.4.6. ACE interface: a protocol that allows a the ACE client and the ACE server to communicate through a network connection.

1.4.7. user interface: the set of all visual items (windows, buttons, graphs, etc.) that allow an end-user or an administrator to communicate with the ACE client.

1.5 References

1.5.1. Original ACE system client description

1.5.2. Audio recording of the meeting with the client

1.5.3. Answers to questions sent to the client by email

1.5.4. "Object Oriented Software Engineering: Using UM, Patterns and Java", 2nd Edition, Bernd Bruegge & Allen H. Dutoit

1.6 Overview

This document lists the features of the ACE system. It is based on the original description and on the additional information obtained during subsequent communications with the client.

2 Systems Overview

2.1 Current

The users contact intermediates (brokers) in order to fill and submit orders. The communication channels are conventional (email, phone, fax, etc.) This is often inefficient and time consuming for the client. Also, the presence of the middle-man involves unnecessary expenses and a higher risk of scams.

2.2 Proposed

The clients will be able to interact directly with the trading system via an intuitive and user-friendly interface. The system will be fully automatic. The users will place orders or will do any other operations instantly. The communication channels will be fast, reliable, and secure. The clients will save both time and money and will have improved response times to market events.

3 Functional Requirements

3.1 Inputs (all inputs will be through the ACE interface)

3.1.1. Common to end-user and administrator

3.1.1.1. login credential: an end-user/administrator can establish a secure connection between the ACE client and the ACE server.

3.1.1.2. logout request: an end-user/administrator can terminate an active connection between the ACE client and the ACE server.

3.1.1.3. change password: an end-user can send a request to change his password. The request is automatically processed by the ACE server.

3.1.2. End-user

3.1.2.1. change price range request: an end-user can change the maximum absolute difference between a price he wants to buy/sell at and the actual buying/selling price (applicable to market orders).

3.1.2.2. instant buy/sell request: an end-user can send a buying/selling market order by specifying the currency pair, the desired buy/sell price and the amount of money.

3.1.2.3. limit order request: an end-user can add, modify or cancel a limit order by specifying the currency pair, the buy/sell price, the amount of money to be bought/sold, the time span of the order and the stop loss.

3.1.2.4. trailing stop: an end-user can add, modify or cancel a trailing stop order by specifying the currency pair, the buy/sell price, the amount of money and the percentage from the maximal value.

3.1.2.5. view billing account: an end-user can request his billing account history and the current billing amount.

3.1.2.6. query order: an end-user can retrieve the list of placed orders (limit orders or trailing stop orders).

3.1.2.7. query order history: an end-user can request a history of his transactions over a time interval.

3.1.2.8. check currency balances: an end-user can request all balances in all currencies.

3.1.2.9. price history (for chart): an end-user can request the ask/bid prices history of a currency pair over a time interval.

3.1.2.10. liquidate: an end-user can liquidate all his open positions.

3.1.3. Administrator/Administrator

3.1.3.1. create account: an administrator can create a new account in response to an end-user request by specifying the username, password and contact details.

3.1.3.2. enable/disable account: an administrator can enable/disable an end-user account. Once an account has been disabled, the end-user cannot login and thus perform any operations on his account.

3.1.3.3. delete account: an administrator can permanently delete an end-user account along with all the associated information and transactions.

3.1.3.4. change user contact information: an administrator can edit any end-users contact information

3.1.3.5. deposit funds request: an administrator can deposit funds in response to an end-user by specifying the amount of money and currency.

3.1.3.6. withdraw funds request: an administrator can withdraw funds in response to an end-user request by specifying the amount of money and currency.

3.1.3.7. customize end-user leverage ratio: an administrator can customize the leverage ratio of a specific end-user.

3.1.3.8. customize end-user interest rate: an administrator can customize the interest rate of a specific end-user.

3.1.3.9. change default leverage ratio: an administrator can edit the default leverage ratio. This leverage ratio is set to 1:10 by default.

3.1.3.10. change default interest rate: an administrator can edit the default interest rate.

3.1.3.11. add/modify/remove currency: an administrator can add, modify or remove currencies.

3.2 Outputs

3.2.1. End-User

3.2.1.1. an end-user can display a list of all active limit orders/trailing stop orders sorted by date.

3.2.1.2. an end-user can display a list of recent inactive orders sorted by date.

3.2.1.3. an end-user periodically receives the current market price.

3.2.1.4. an end-user can list of recent market prices on various time scale.

3.2.1.5. an end-user can display a chart of market prices.

3.2.1.6. an end-user is notified when his transaction is committed or has expired.

3.2.1.7. an end-user can display his billing information.

3.2.1.8. an end-user can display his margin account information in every currency.

3.2.2. Administrators

3.2.2.1. an administrator can display any end-user account status.

3.2.2.2. an administrator can display any end-user contact information.

3.2.2.3. an administrator can display any end-user billing information.

3.3 Event flow

3.3.1. Automated system functionalities

3.3.1.1. the system periodically sends the updated market ask/bid price to the connected end-users.

3.3.1.2. the system discards expired orders after 24 hours.

3.3.1.3. the system sends by email a weekly billing to every end-user.

3.3.1.4. the system continuously tries to match orders.

3.3.1.5. the system updates all end-user's billing information based on their loans and interest rates.

3.3.2. Common End-user/administrator functionalities

3.3.2.1. Login

3.3.2.1.1. the ACE client requests a connection to the ACE server.

3.3.2.1.2. the ACE server prompts the ACE client to provide a security component.

3.3.2.1.3. the end-user sends the security component to the ACE server.

3.3.2.1.4. the ACE server authenticates the security component

3.3.2.1.4.1. if the security component is invalidated, the ACE server warn the ACE client.

3.3.2.1.4.2. if the security component is authenticated, the ACE server sends credentials to the ACE client.

3.3.2.2. Logout

3.3.2.2.1. the ACE client requests to close the connection with the ACE server.

3.3.2.2.2. the ACE server closes the connection and warn the ACE client.

3.3.2.3. Change password

3.3.2.3.1. an authenticated ACE client requests to change a password.

3.3.2.3.2. the ACE server responds with an agreement message.

3.3.3. End-user ACE client functionalities

3.3.3.1. Change price range request

3.3.3.1.1. an authenticated end-user's ACE client requests to change the price range he is willing to accept when buying/selling market orders.

3.3.3.1.2. the ACE server updates the end-user's account and sends an agreement message.

3.3.3.2. Market order request

3.3.3.2.1. an authenticated end-user's ACE client requests an instant buy/sell market order.

3.3.3.2.2. the ACE server matches the transaction and sends an agreement message.

3.3.3.3. Limit order request

3.3.3.3.1. an authenticated end-user's ACE client requests a limit order.

3.3.3.3.2. the ACE server registers the order in the transaction queue and sends an agreement message.

3.3.3.3.3. if the ACE server find two matching order requests, the transaction is committed and both end-users are notified.

3.3.3.3.4. if an order request expires, the order is discarded and the end-user is notified.

3.3.3.4. Trailing stop order request

3.3.3.4.1. an authenticated end-user's ACE client requests a trailing stop order.

3.3.3.4.2. the ACE server registers the order in the transaction queue and sends an agreement message.

3.3.3.4.3. if the ACE server find two matching order requests, the transaction is committed and both end-users are notified.

3.3.3.4.4. if an order request expires, the order is discarded and the end-user is notified.

3.3.3.5. Billing account information request

3.3.3.5.1. an authenticated end-user's ACE client requests the information regarding his billing account.

3.3.3.5.2. the ACE server sends the billing account information to the ACE client.

3.3.3.6. Active orders request

3.3.3.6.1. an authenticated end-user's ACE client requests the list of all his active limit orders and trailing stop orders.

3.3.3.6.2. the ACE server sends the list from 3.3.3.6.1 to the ACE client.

3.3.3.7. Inactive orders request

3.3.3.7.1. an authenticated end-user's ACE client requests the list of his recent inactive market orders, limit orders and trailing stop orders.

3.3.3.7.2. the ACE server sends the list from 3.3.3.7.1 to the ACE client.

3.3.3.8. Check currency balances

3.3.3.8.1. an authenticated end-user's ACE client requests the list of all his currency balances.

3.3.3.8.2. the ACE server sends the list from 3.3.3.8.1. to the ACE client.

3.3.3.9. List of market price over a restricted time interval

3.3.3.9.1. an authenticated end-user's ACE client requests the list of market prices for a given currency pair over a restricted time interval.

3.3.3.9.2. the ACE server sends the list from 3.3.3.9.1 to the ACE client.

3.3.4. Liquidate open positions

3.3.4.1. an authenticated end-user's ACE client requests to liquidate all his open positions.

3.3.4.2. the ACE server checks the status of the client's account and if the move is possible (margin account limits, maximum transaction size, leverage) and places the necessary orders. Upon completion of the orders, the system confirms the liquidation, as well as recording the transaction details in the database.

3.3.5. Administrator ACE client functionalities

3.3.5.1. Create end-user account

3.3.5.1.1. an authenticated administrator's ACE client requests to create an end-user account.

3.3.5.1.2. the ACE server ensures the account's name is unique.

3.3.5.1.2.1. if the account's name already exist, the ACE server sends an error message.

3.3.5.1.2.2. if the account's name does not exist, the ACE server sends an agreement message.

3.3.5.2. Enable account

3.3.5.2.1. an authenticated administrator's ACE client requests to enable an end-user account.

3.3.5.2.2. the ACE server sends an agreement message.

3.3.5.3. Disable account

3.3.5.3.1. an authenticated administrator's ACE client requests to disable an end-user account.

3.3.5.3.2. the ACE server closes all open positions and sends an agreement message.

3.3.5.4. Delete account

3.3.5.4.1. an authenticated administrator's ACE client requests to delete an account.

3.3.5.4.2. the ACE server disables the account, deletes all information about the client and sends an agreement message.

3.3.5.5. Change user contact information

3.3.5.5.1. an authenticated administrator's ACE client requests to change an end-user's contact information.

3.3.5.5.2. the ACE server updates the information and sends an agreement message.

3.3.5.6. Deposit funds request

3.3.5.6.1. an authenticated administrator's ACE client requests to deposit funds in an end-user's account.

3.3.5.6.2. the ACE server updates the end-user's balance and sends an agreement message.

3.3.5.7. Withdraw funds request

3.3.5.7.1. an authenticated administrator's ACE client requests to withdraw funds from an end-user's account.

3.3.5.7.2. the ACE server ensures that the end-user has sufficient balance and sends an agreement message.

3.3.5.8. Change end-user-specific leverage ratio

3.3.5.8.1. an authenticated administrator's ACE client requests to withdraw funds from an end-user's account.

3.3.5.8.2. the ACE server ensures that the end-user has sufficient balance and sends an agreement message.

3.3.5.9. Change default leverage ratio

3.3.5.9.1. an authenticated administrator's ACE client requests to change the default leverage ratio.

3.3.5.9.2. if the new default leverage ratio is lower than the current one, the ACE server disables all accounts with insufficient collaterals.

3.3.5.9.3. the ACE server updates the database, warns all authenticated end-users using a default leverage ratio, and sends an agreement message to the administrator's ACE client.

3.3.5.10. Change default interest rate

3.3.5.10.1. an authenticated administrator's ACE client requests to change the default interest rate

3.3.5.10.2. the ACE server updates the database and sends an agreement message.

3.3.5.11. Customize end-user leverage ratio

3.3.5.11.1. An authenticated administrator's ACE client requests to customize the leverage ratio of a specific end-user.

3.3.5.11.2. If the new leverage ratio is lower than the current one, the ACE server verifies that the account has sufficient collaterals.

3.3.5.11.2.1. If the account has insufficient collaterals, the account is disabled.

3.3.5.11.3. The ACE server updates the database and sends an agreement message to the administrator's ACE client.

3.3.5.12. Customize end-user interest rate

3.3.5.12.1. An authenticated administrator's ACE client requests to customize the interest rate of a specific end-user.

3.3.5.12.2. The ACE server updates the end-user's interest rate, prevents this customized rate to be changed by the default interest rate, and sends an agreement message.

3.3.5.13. Add/modify/remove currency

3.3.5.13.1. An authenticated administrator's ACE client requests to add/modify/remove a currency

3.3.5.13.2. The ACE server adds/modifies/removes the specified currency

3.4 Maintenance and support activities

3.4.1. An operator can set the time interval to backup the database. [1,4]

3.4.1.1. The IT support staff at either the customer's location or the provider of the application will have established the backup policy. Also, during the lifetime of the product, there will be specialized personnel that will enforce and maintain the established backup policies. Regardless of whether it is the producer of the software, an internal department or a third-party that provides the maintenance and backup, these are solely the responsibility of the purchaser. [2,4]

3.5 Initialization of the system

3.5.1. A connection between the system and the database will automatically be established.

3.5.2. The login screen will be presented.

3.6 Description of the user interface

3.6.1. End-user user interface

3.6.1.1. The end-user's user interface implements every function described in section 3.1.1, 3.1.2 and 3.2.1.

3.6.2. Administrator user interface

3.6.2.1. The administrator's user interface implements every functions described in section 3.1.1, 3.1.3 and 3.2.2

4 Non-functional requirements (and constraints)

4.1 Usability

4.1.1. The user interface will be straight-forward. [2,2]

4.1.2. The user interface will be customizable. [2,4]

4.1.3. The software will include both concise and extensive versions of the documentation for user convenience. [2,2]

4.2 Reliability

4.2.1. The trading system will be available and responsive 99.99% of the time. [3,3]

4.2.2. The trading system will automatically backup the database over predefined time intervals.

[4,2]

4.3 Performance

4.3.1. The user will not experience latencies over 1 second 99.9% of the time (given a network connection of at least 1Mbps). [3,3]

4.3.2. The user will support up to 500 connected users. [3,2]

4.3.3. The system will work with sums from -9 223 372 036 854 775 807 up to 9 223 372 036 854 775 808, with maximal decimal precision of 8 digits. The smallest monetary division will the the cent. [4,1]

4.4 Adaptability

4.4.1. The system administrators will be able to add and edit system-wide market and end-user parameters. [4,2]

4.4.2. The system administrators will be able to add, enable, and disable end-user accounts. They will also be able to delete accounts. [4,2]

4.5 Security

4.5.1. The system's network connection will be encrypted with an asymmetric cryptographic key. The server will only store specific private keys agreed on when the contract between the software operator and the end-user is signed. This is also when the public key will be provided to the end-user by the server operator. [4,3]

4.5.2. Only authorized end-users/administrators will be able to access the system. [4,3]

4.5.3. The end-user/administrators will be required to follow strict security protocols within the applications developed by themselves in order to connect to the server. [4,1]

4.5.4. The system will use the security component in 4.5.3 to perform authentication. [4,1]

4.5.5. Only authorized personnel will be able to access end-user information. [4,1]

4.5.6. The overall system's security will be periodically evaluated by a third-party. [3,2]

4.6 Maintainability

4.6.1. The system will be maintained and updates will be provided. [3,3]

4.6.2. The deliverables in 4.6.1 will be made available on a dedicated server. [3,1]

4.6.3. Update download can be done automatically (depending on server settings), but for reliability purposes, the update deployment has to be done manually by an administrator. [2,1]

4.6.4. Updates can be undone with a single click, by an administrator. [4,4]

4.7 Portability

4.7.1. The server-side system will function on platforms that conform to the all following requirements:

- OS that supports Java 2 Platform or later [1,1]
- an Intel P4 (or equivalent) or G5 PowerPC (or equivalent) CPU [1,1]
- at least 10GB of hard disk space just for the application [1,1]
- a fast network connection (at least 1 Mbit/s) [1,1]

4.7.2. The client-side system can be implemented on any technology or platforms that can interface with the ACE server.

4.7.3. The system can be adapted to work with different database back-ends. [4,2]

4.7.4. The system works on any operating systems that have an implementation of Java 2 Platform installed.

4.8 Legal issues

4.8.1. The trading system will obey the Canadian and international trading laws and regulations.

5 Glossary

- **username:** a unique user-defined ID used for login purposes.
- **password:** a user-defined identifier, unique to a username, used for login purposes.
- **database:** medium used to store the information about the users, the rooms, and events.
- **backup:** a copy of a file or record, stored separately from the original, that can be used to recover the original if it is destroyed or damaged. (wiktionary.org)
- **latency:** a delay, a period between the initiation of something and the occurrence. (wiktionary.org)
- **mbps:** rate of data transfer, literally mega (millions of) bits per second.
- **session:** an authenticated connection between the ACE server and an ACE client.