System Requirement Specification

Online Stock Exchange

By

Shariq Rizvi 99005003
Sarvjeet Singh 99005029
Alap Karapurkar 99005007
Shrinivas Lakshmikant 99005034

under the guidance of

Professor S. Sudarshan

Department of Computer Science and Engineering
Indian Institute of Technology
Mumbai
March 25, 2001

Contents

1 Introduction

1.1 Overall Description

The Online Stock Exchange is aimed to replace the traditional trading floor of stock exchanges for providing a means of selling/buying equity amongst share holders and brokers. It plans to reduce the stake of brokers in the stock market by allowing the actual sellers/buyers to authenticate with the exchange server and then bid for deals. This system will maintain a database of equity ownership in the market, allow biddings to be made, discover current share prices from the biddings, break deals between clients, update the ownership databases after the transaction is effected and implement safety mechanisms like circuit breaking and margin money.

1.2 Definitions

1. **Stock :** The capital or fund that a corporation raises through the sale of shares entitling the stockholder to dividends and to other rights of ownership, such as voting rights.
2. **Investor :** An individual or a group that owns stock in a business enterprise.
3. **Broker :** An individual who acts as a go-between between actual stock owners by performing stock transactions on their behalf.
4. **Circuit Breaking :** Deciding the maximum permissible swing in the price of the shares of a particular company in a day.
5. **Margin Money :** Token amount deposited by the client with the stock exchange which decides the volume of transactions open to him.
6. **Trading Floor :** The conventional place where the actual trading decisions were made by the stock brokers before the advent of the online paradigm.

7. **Short Selling :** The phenomenon of permitting an equity owner to sell more shares than he owns at any time with a commitment from his side to close the deal before the end of the day.

8. **Portfolio :** A compilation of information regarding the equity ownership of an individual or a group, which indicates his assets and liabilities at any given time.

9. **Exchange Administrators :** The governing body of a stock exchange that decides the overall policies of the exchange like maximum permissible swing in the price of a share etc.

10. **Authenticators :** The panel responsible for verifying the authenticity of the information furnished by potential exchange users and approving their registration with the exchange.

11. **Visitor :**A person who browses through the prices of the shares without the intent of buying/selling equity.

1.3 References

1. Database System Concepts - Abraham Silberschatz, Henry F. Korth and S. Sudarshan

2. Investment and Securities Markets in India by V.A. Avadhani

1.4 Overview of Developer's Responsibilities

1. *Development* : The software will be developed entirely by us.

2. *Installation* : The software package is designed to work on any system which follows the requirements given in section 5. A complete installation package will be provided for Unix based systems.

3. *Training* : The user end interface will be friendly enough to not require any special training. Help files will be provided to acquaint them with the interface. The exchange administrator will have to be trained to

use the facilities provided for tasks like circuit breaking settings, update interval control, adding new corporations to the system.

4. *Maintenance* : We shall undertake the troubleshooting and providing patches in the unlikely event of bugs.

2 General Description

2.1 Product Perspective

This product interfaces with Oracle Database using JDBC and is otherwise standalone. It has the following interfaces:

1. *Registration Interface* : New users will be required to fill out a form providing details about themselves eg. Name, address, etc.
2. *Investors Interface* : All information about the users portfolio is displayed after proper authentication. Options are provided for bidding, viewing current market status and his/her financial history.
3. *Authenticators interface* : Pending registrations are displayed and options are provided for approval or rejection of any registration.
4. *Administrators interface* : Options to set the policies and parameters crutial to the operation of the stock exchange.
5. *Visitors Interface* : Current stock prices are displayed but no options are provided for buying or selling.
6. *Corporate Registration interface* : Interface for a corporation to introduce its stock into the market.
7. *Corporate Management Interface* : Customised interface for registered corporations to pour in information about newly launched shares and updating performance statistics (assets/liabilities, profit/loss etc.).

2.2 Product Functions Overview

1. Login and verfication
2. Portfolio management
3. Auction of shares
4. Viewing current market status.

5. Introduction of new corporations.
6. New users sign up.
7. Approvals/rejection of new registrations.
8. Automated share price determination.
9. Verification of transactions.
10. Constraint checking (like circuit breaking, defaulter penalty etc.)
11. Notification mechanisms.
12. Maintaining security and integrity of crucial system parameters.
13. Report generation for all stocks listed.
14. Checking for fraudulent transactions.
15. Exchange of information with banks to finalise transactions.

2.3 User Characteristics

Our users are of the following types :

1. **Visitor** : A visitor is a casual user who is interested only in viewing current market status, and history of corporate stock. Such users do not participate in buying or selling shares and hence have a very limited view of the system. No product specific training is required.
2. **Investor** : An investor is an authorized user registered with the system. Such users can participate in bidding, buying and selling of shares. These users are interested in the transactions of the stock exchange, and hence need to be given training to use the interface. To use an analogy, these are the people who would be found on the trading floor in a conventional stock exchange. Such users are expected to be well versed in stock market fundamentals.

3. **Authenticator** : Such a user is responsible for verifying the credit and financial histories of new applicants. Hence these users must be well versed with legal matters. No special training is required to use the interface.

4. **Administrator** : The administrator is the super user of the system, and is responsible for all the policies and parameters of the system. The administrator maintains the list of corporations registered with the stock exchange. Special training is required to familiarize the administrator with the various parameters, and the methods used to change them. The administrator must be very well conversant with stock market operations, and should be knowledgeable enough to take quick decisions, eg. circuit breaking, setiing margin money etc.

2.4 General Constraints

This project is to be completed, including coding, testing and loading of the database, by Nov 15, 2001. A prototype demo is due on Oct 22, 2001.

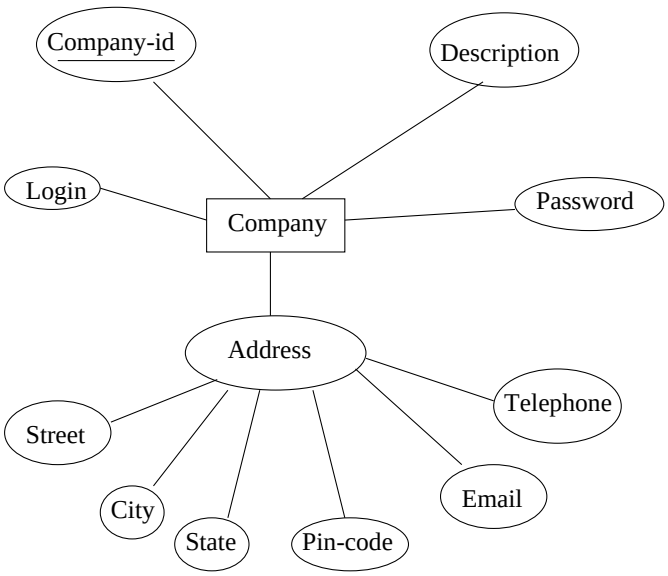
3 Information Description

3.1 Entities and Relationships

3.1.1 Entities

1. **Company**
   Attributes :

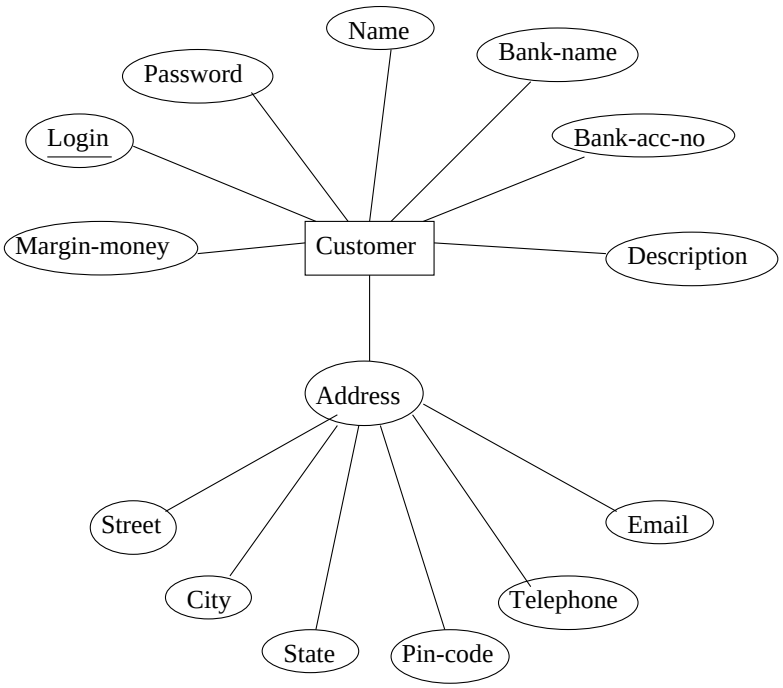
   - **Company-id**
   - **Description**
   - **Login**
   - **Password**
   - **Address**



This entity set represents all participating companies. *Company-id* is the primary key for the set. Also maintained along are the *Description* of the company and its *Address*. The composite attribute *Address* is decomposed into the required atomic fields. The *Login* and *Password* provided to the company are also maintianed as attributes. A customised view shall be drawn from these two columns for looking up the password at login time.

2. **Customer**
   Attributes :

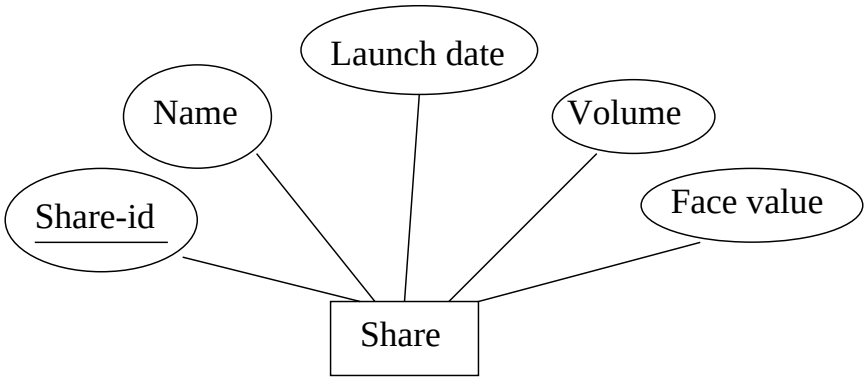
   - **Login** - The login name associated with the user
   - **Name**
   - **Description**
   - **Password**
   - **Bank-name** - customer's bank name
   - **Bank-acc-no** - customer's bank account number
   - **Margin-money** - The threshhold deposit taken from the customer
   - **Address**



The customer entity represents all the registered users of the stock exchange. *Login* is the primary key. The amount of *Margin-money* shall decide the volume of transactions open to the user. A simplified view shall be drawn from this entity set to allow quick password look ups.

3. **Share**
   Attributes :

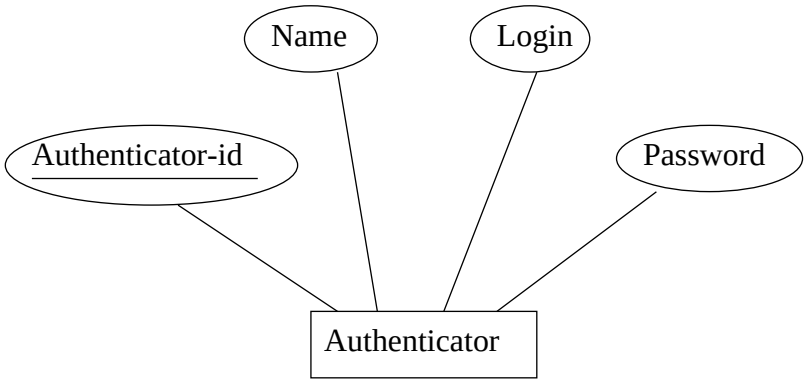
   - **Share-id** - for exchange level identification
   - **Name**
   - **Launch-date** - date when the shares were poured into the market
   - **Volume** - total amount of equity associated
   - **Face-value** - launching price of the share



Each type of share released in the market forms an entity here. Associated with each share will be the launching company. This entity set forms the fundamental unit of stock market transactions.

4. **Authenticator**
   Attributes :

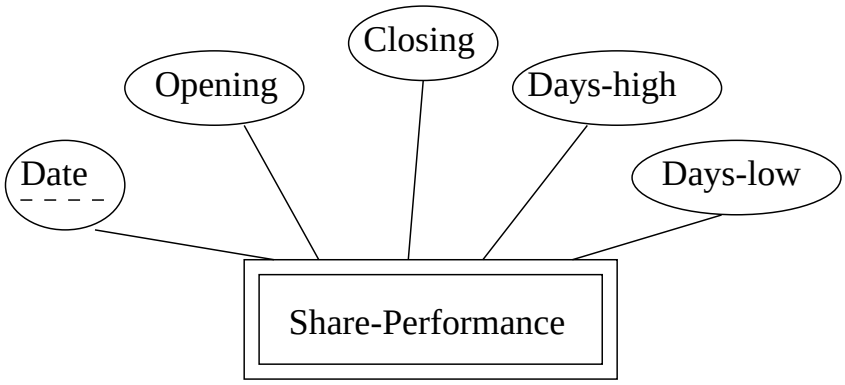
   - **Authenticator-id**
   - **Name**
   - **Login**
   - **Password**



This set represents a class of employees in the stock exchange entrusted with the job of validating the registration of customers and companies. A login interface which is *authenticator*-specific shall be put up.

5. **Share-Performance**
   Attributes :

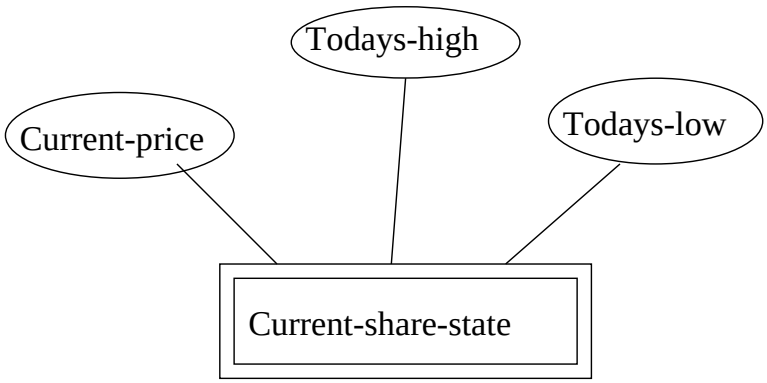
   - **Date** - the discriminator for the weak entity set
   - **Opening** - opening price of the share on this day
   - **Closing** - closing price of the share on this day
   - **Days-high** - highest price attained during the day
   - **Days-low** - lowest share price attained during the day



This week entity set anchors the performace of a share. The identifying strong entity set is the entity set *Share*. The attributes held by this set are fundamental for instantaneous stock market analysis. The set will be used for the reporting of share staus at the end of the day. Also, information will be drawn from this for the anaysis of performance that will be offered to registered users.

6. **Current-share-state**
   Attributes :

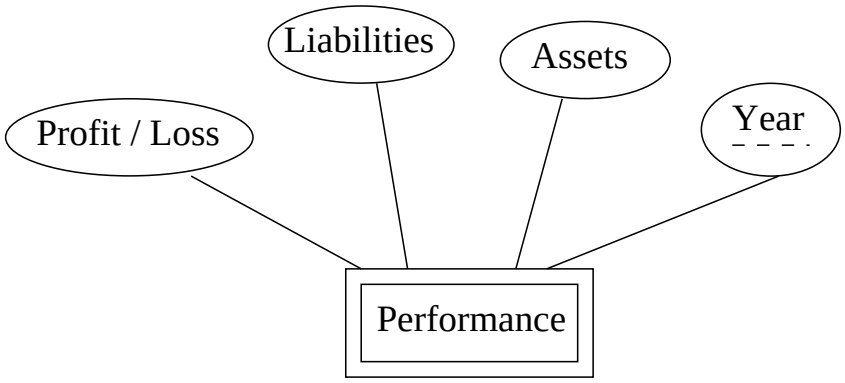
   - **Current-price** - the most crucial indicator of market behaviour
   - **Todays-high** - the maximum price attained today till this moment
   - **Todays-low** - the lowest price attained today till this moment



Each entity in the weak entity set shall be mapped to an element of strong entity set *Share* by a relation. The attributes of this entity set are highly dynamic and shall be updated periodically. views shall be drawn from this to reflect in user portfolios and visitor interface.

7. **Performace**
   Attributes :

   - **Year** - the discriminator of the weak entity set
   - **Liabilities** - The financial onus on the company
   - **Assets**
   - **Profit/Loss** - the net earning of the company

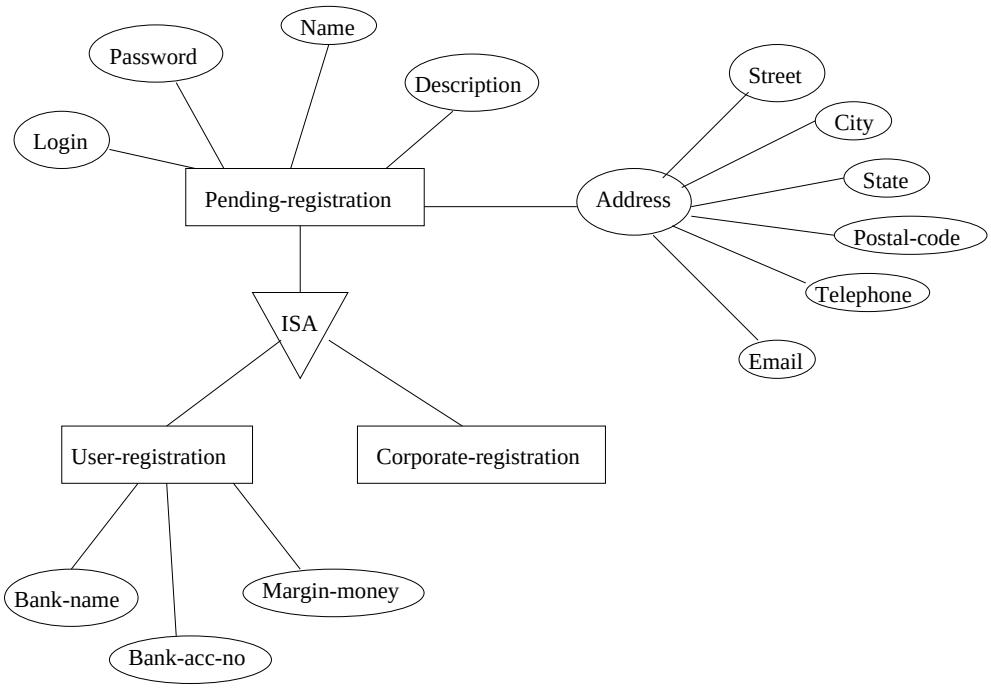


This entity set encapsulates the financial history of a company. it maintains a balance sheet for each year. The identifying strong entity set will be *Company*.

8. **Pending-registration - User-registration & Corporate-registration**
   Attributes :
   - **Login**
   - **password**
   - **Name**
   - **Description**
   - **Address**

   (a) **User-registration**
   Attributes :
   - **Bank-name**
   - **Bank-acc-no**
   - **Margin-money**

   (b) **Corporate-registration**



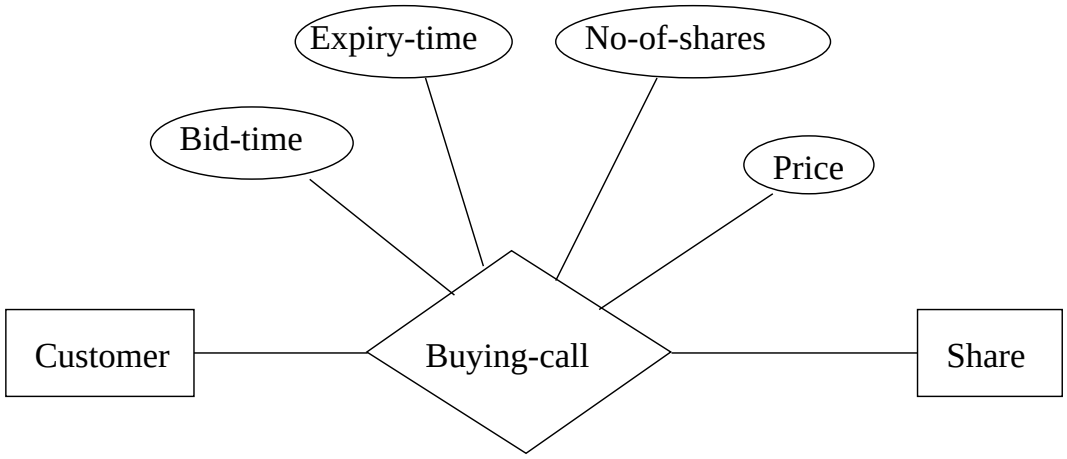
The set encapsulated pending registrations that have to be cleared by authenticators. It specialises into the two types of registrations possible - user and corporate.

3.1.2 Relationships

1. **Buying-call**

   Attributes:

   - **Bid-time** - time of the day when the bid was placed
   - **Expiry-time** - time limit specified by the user for the call to expire
   - **No-of-shares** - volume of the bid
   - **Price** - call price

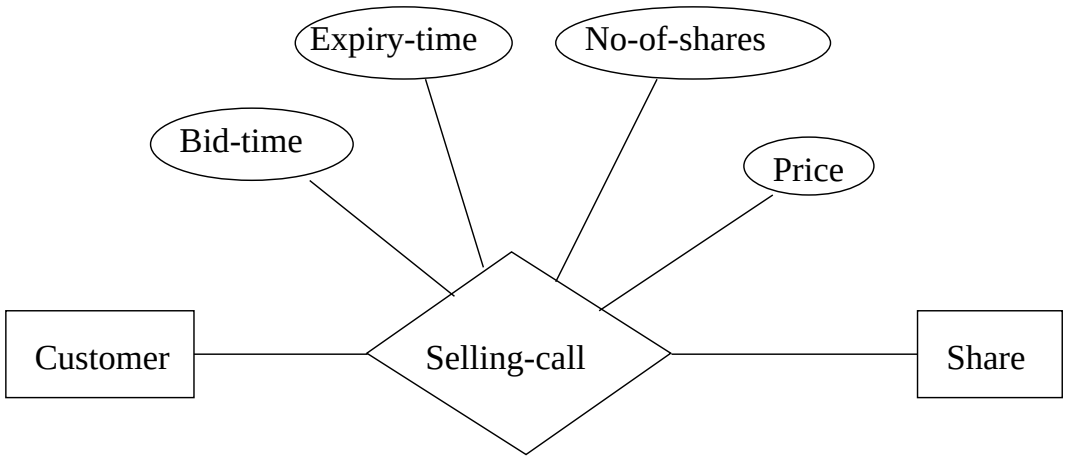


   The relationship maps customers to the shares they have called to buy. Additional attributes represent properties of the call. The bid will be the basis for breaking of deals.

2. **Selling-call**

Attributes:

- **Bid-time** - time of the day when the bid was placed
- **Expiry-time** - time limit specified by the user for the call to expire
- **No-of-shares** - volume of the bid
- **Price** - call price

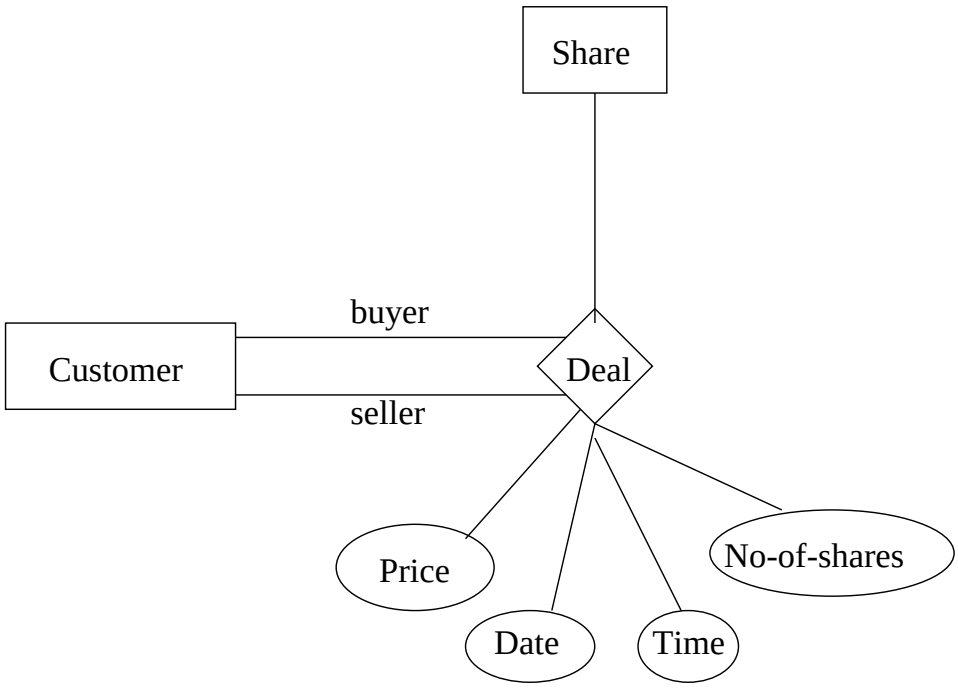


The relationship maps customers to the shares they have called to sell. Additional attributes represent properties of the call. The bid will be the basis for breaking of deals along with the buying-calls.

3. **Deal**

Attributes:

- **Price** - the mutually agreed price of transaction
- **Date** - date of deal
- **Time** - time of deal
- **No-of-shares** - volume of the deal

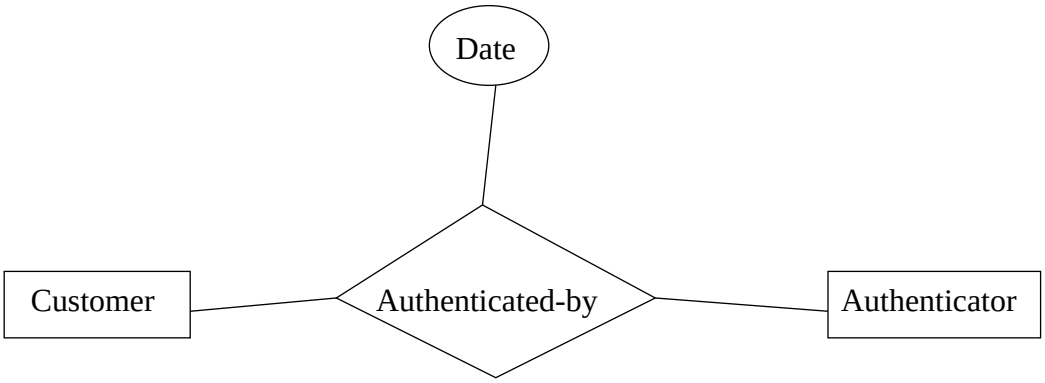


Encapsulation of a broken deal. The relationship is ternary - involving two customer entities (the buying and selling parties) and the share type involved. This represents the basic unit of stock market transaction.

4. **Authenticated-by**

Attributes:

- **Date** - date when the registration was validated

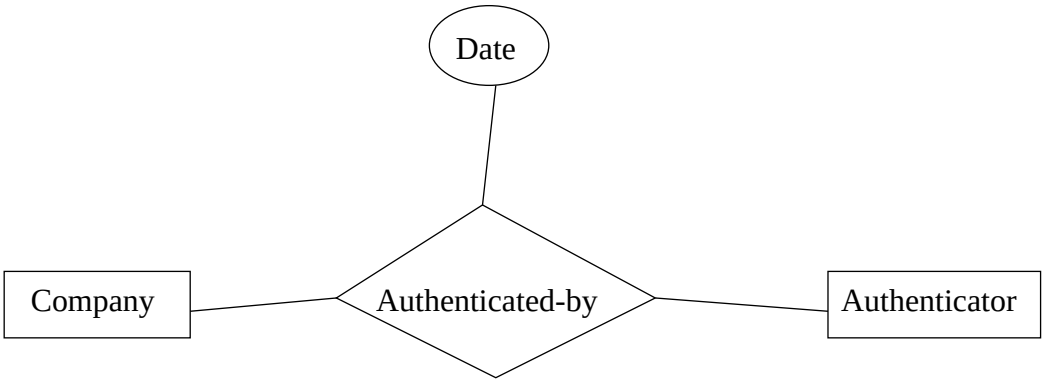


The relationship maps a customer to the authenticator who validated his registration. A customer becomes a user only after he is registered.

5. **Company-authenticated-by**

Attributes:

- **Date** - date when the registration was validated

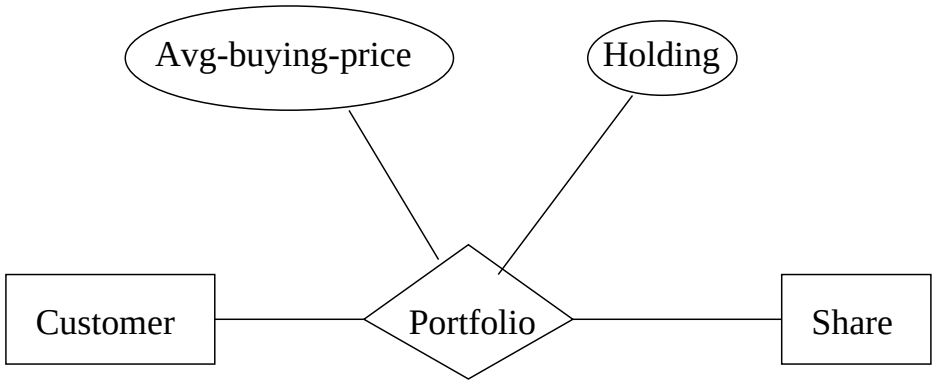


The relationship maps a company to the authenticator who validated its registration. A company can go through the *corporate registration interface* only after its registered.

6. **Portfolio**

Attributes:

- **Holding** - number of shares held
- **Avg-buying-price** - average amount spent on buying a unit of that equity



The portfolio draws a mapping between a customer and various types of shares that he holds. This will form an indispensable part of the user interface. A comparison between the *Avg-buying-price* and current share price will indicate the profit/loss on this share type.

3.2 Data Dictionary

3.2.1 Company

Attribute Name	Data Type	Constraints	Description
Company_id	varchar(10)	Primary Key	Identifying Name
Description	varchar(200)	-	Description
Login	varchar(10)	Candidate Key	Login ID
Password	varchar(16)	not null	Password
Street	varchar(50)	not null	Street
City	varchar(50)	not null	City
State	varchar(50)	not null	State
Pincode	integer	not null	Pin Code
Email	varchar(50)	not null	E-mail address
Telephone	integer	not null	Main telephone number

3.2.2 Customer

Attribute Name	Data Type	Constraints	Description
Login	varchar(10)	Primary Key	Login ID
Name	varchar(50)	not null	Customer Name
Description	varchar(200)	-	Description
Password	varchar(16)	not null	Password
Bank_Name	varchar(50)	not null	Customer's Bank
Bank_acc_no	varchar(20)	not null	Customer's bank a/c no.
Margin_money	numeric(15,2)	not null	Threshhold deposit
Street	varchar(50)	not null	Street
City	varchar(50)	not null	City
State	varchar(50)	not null	State
Pincode	integer	not null	Pin Code
Email	varchar(50)	not null	E-mail address
Telephone	integer	not null	Main telephone number

3.2.3 Share

Attribute Name	Data Type	Constraints	Description
Share_id	varchar(10)	Primary Key	For unique identification
Name	varchar(50)	not null	Name
Launch_date	date	not null	Date of market launch
Volume	integer	not null	Total shares released
Face_value	numeric(8,2)	not null	Unit price at launch

3.2.4 Authenticator

Attribute Name	Data Type	Constraints	Description
Authenticator_id	varchar(10)	Primary Key	ID for the employee
Name	varchar(50)	not null	Name
Login	varchar(10)	Candidate Key	Login ID
Password	varchar(16)	not null	Password

3.2.5 Share_Performance

Attribute Name	Data Type	Constraints	Description
Share_id	varchar(10)	=>Share	ID of the share
Date	date	not null	Date of assessment
Opening	numeric(8,2)	not null	Day's opening price
Closing	numeric(8,2)	not null	Day's closing price
Days_high	numeric(8,2)	not null	Day's highest price
Days_low	numeric(8,2)	not null	Day's lowest price

3.2.6 Current_share_state

Attribute Name	Data Type	Constraints	Description
Share_id	varchar(10)	=>Share	ID of the share
Current_price	numeric(8,2)	not null	Current share price
Todays_high	numeric(8,2)	not null	Today's highest price
Todays_low	numeric(8,2)	not null	Today's lowest price

3.2.7 Performance

Attribute Name	Data Type	Constraints	Description
Company_id	varchar(10)	=>Company	ID of the company
Year	integer	not null	The year of analysis
Liabilities	numeric(15,2)	not null	Company's liabilities
Assets	numeric(15,2)	not null	Company's assets
Profit_Loss	numeric(15,2)	not null	Company's net status

3.2.8 User_registration

Attribute Name	Data Type	Constraints	Description
Login	varchar(10)	Primary Key	Login ID
Password	varchar(16)	not null	Password
Name	varchar(50)	not null	Name
Description	varchar(200)	-	Description
Bank_name	varchar(50)	not null	Name of user's bank
Bank_acc_no	varchar(20)	not null	Account number
Margin_money	numeric(15,2)	not null	Threshhold deposit
Street	varchar(50)	not null	Street
City	varchar(50)	not null	City
State	varchar(50)	not null	State
Pincode	integer	not null	Pin Code
Email	varchar(50)	not null	E-mail address
Telephone	integer	not null	Main telephone number

3.2.9 Corporate_registration

Attribute Name	Data Type	Constraints	Description
Login	varchar(10)	Primary Key	Login ID
Password	varchar(16)	not null	Password
Name	varchar(50)	not null	Name
Description	varchar(200)	-	Description
Street	varchar(50)	not null	Street
City	varchar(50)	not null	City
State	varchar(50)	not null	State
Pincode	integer	not null	Pin Code
Email	varchar(50)	not null	E-mail address
Telephone	integer	not null	Main telephone number

3.2.10 Buying_call

Attribute Name	Data Type	Constraints	Description
Customer_id	varchar(10)	=>Customer	ID of customer
Share_id	varchar(10)	=>Share	ID of share
Bid_time	time	not null	Time of bidding
Expiry_time	time	not null	Time of expiry
No_of_shares	integer	not null	Transaction volume
Price	numeric(8,2)	not null	Price of deal

3.2.11 Selling_call

Attribute Name	Data Type	Constraints	Description
Customer_id	varchar(10)	=>Customer	ID of customer
Share_id	varchar(10)	=>Share	ID of share
Bid_time	time	not null	Time of bidding
Expiry_time	time	not null	Time of expiry
No_of_shares	integer	not null	Transaction volume
Price	numeric(8,2)	not null	Price of deal

3.2.12 Deal

Attribute Name	Data Type	Constraints	Description
Buyer_id	varchar(10)	=>Customer	ID of buyer
Seller_id	varchar(10)	=>Customer	ID of seller
Share_id	varchar(10)	=>Share	ID of share
Time	time	not null	Time of deal breaking
Date	date	not null	Date of deal
No_of_shares	integer	not null	Transaction volume
Price	numeric(8,2)	not null	Price of deal

3.2.13 Authenticated_by

Attribute Name	Data Type	Constraints	Description
Customer_id	varchar(10)	=>Customer	ID of customer
Authenticator_id	varchar(10)	=>Authenticator	ID of authentcator
Date	date	not null	Date of validation

3.2.14 Company_authenticated_by

Attribute Name	Data Type	Constraints	Description
Company_id	varchar(10)	=>Company	ID of company
Authenticator_id	varchar(10)	=>Authenticator	ID of authentcator
Date	date	not null	Date of validation

3.2.15 Portfolio

Attribute Name	Data Type	Constraints	Description
Customer_id	varchar(10)	=>Customer	ID of customer
Share_id	varchar(10)	=>Share	ID of share
Holding	integer	not null	Shares held
Avg_buying_price	numeric(8,2)	not null	Average price for share

3.3 Work Flow

New users register with the stock market so that they can commence with buying and selling shares. This request is sent to the authenticator, who then verifies the users background, and decides whether or not to approve the registration. If the registration is approved, then the user becomes an official investor at the stock exchange. The user can then modify his portfolio, and engage in bidding and buying of shares. This information is recorded in the stock exchange database, after verifying that the transaction satisfies the constraints of the exchange. The user is notified if his transaction violates any constraints, and the transaction is scrapped. The user is helped in his decision by easy access to the history of any requested shares.

Corporations that wish to be listed in the stock exchange will fill out an online application form specifying the number of shares released and the initial offering price, that is then sent to the authenticator. The authenticator then checks the financial integrity and reliabilty of the corporation, and decides to approve or reject the application. If the application is approved, then the company is listed in the system database, and transactions are enabled.

The administrator monitors the functioning of the market, and intervenes if necessary. Dynamic modifications of the parameters such as permissible swing in prices is an essential function of the administrator. In the event of crashes, he has the ability to freeze all trading.

4 Functional Requirements

Given below is a description of the various options that a user sees on connecting to the system :

4.1 Investors Domain

On connecting to the website, the user is presented with the default Visitors interface, i.e options to view current share prices, history of share prices, company information, view of sensitive indices.

Options are provided for existing users to log in, and for new users to sign up. If a new user signs up, he is required to fill in a form, giving details like name, address, bank account details etc. This form is then forwarded to the authenticator, who does a background check on the user, and then has the option of approving or rejecting the registration. When the registration is accepted, an account is created for the user. When an authorized user logs in, he is provided with a display of his current portfolio. There are options for him to engage in trading, i.e bidding or buying. One important functionality that is provided is Alerts, i.e the user can specify events upon whose ocurrence he should be notified.

4.2 Administrators Domain

When the administrator logs in he is provided all the information available to normal users, except trading and portfolios. In addition, he will be provided a control panel from which he can control parameters crucial to the stock exchange. There will be an option to freeze all trading, in the event of a catastrophe.

4.3 Authenticators Domain

When an authenticator logs in, he is presented with all pending user and corporate registrations. His job is to do actual verification of the authenticity of users and corporations. This is more important in the context of corporations, to stop fraudulent companies from cheating investors.

5 External Interface Requirements

5.1 User Interfaces

The Web is used as the user interface

5.2 Hardware Interfaces

No special hardware interfaces are required

5.3 Software Interfaces

1. JDK 1.3
2. JSDK 2.2
3. JDBC
4. Oracle 8i SQL server
5. Mail service
6. J2EE
7. EJB server

6 Performance Requirements

Although exact figures are not known at this stage, expected figures for performance in the real world are :

1. 2 administrators
2. 20 authenticators
3. 100000 estimated users
4. 6 billion potential visitors
5. 3 powerful machines - one for share database and logic, one for user database and logic, one for a web server

7 Design Constraints

7.1 Standards Compliance

Not Applicable

7.2 Hardware Limitations

Expected throughput is very high, since stock trading volumes are very high. Hence very powerful machines are needed to store and update the database in real time. We may implement this using real time databases.

8 Validation Criteria

We will simulate the system with the following number of users :

1. Administrator : 1
2. Authenticator : 1
3. Users : 5
4. Visitors : 1
5. Stocks : 50

9 Other Requirements

Not Applicable