Lecture # 30
Object-Oriented Static Modeling of the Banking System - I

Steps in Object-Oriented Analysis

- Identify classes within the problem domain
- Define the attributes and methods of these classes
- Define the behavior of those classes
- Model the relationship between those classes

Identification of Objects and Classes - 1

- Examine structures in the real world
- Identify other systems with which the current or proposed system will interact
- Identify those things in the real world that need to be remembered for later retrieval

Identification of Objects and Classes - 2

- Identify specific roles played by individuals
- Identify physical locations that need to be known
- Identify organizations that humans belong to

Identification of Objects and Classes - 3

- Identify catalogs that have to record quantities of repetitive, static information about things

Structure

- Classification
- Assembly

External Device I/O Objects - 1

- A concrete entity in the application domain is an entity that exists in the real world and has some physical attributes

- For every concrete entity in the real world that is relevant to the application domain, there should be a corresponding software object in the system

External Device I/O Objects - 2

- Each software object hides the details of the interface to the real world entity that it receives input from or provides outputs to. However, a software object models the events experienced by the concrete entity to which it corresponds. The events experienced by the entity are inputs to the system, particularly to the software object that models the entity

External Device I/O Objects - 3

- Examples
  - › Engine sensor
  - › Brake sensor
  - › Buttons

User Role Objects - 1

- A user role object models a role played in the application domain, typically by a user. A role is a sequence of related actions performed sequentially by a user

- If a user can play two or more independent roles, then this may be represented by a different object for each role

User Role Objects - 2

- Examples
  - › Machine Operator
  - › Loan Officer

Control Objects - 1

- A control object is an active abstract object in the problem domain that has different states and controls the behavior of other objects and functions. A control object is defined by means of a finite state machine, which is represented by a state transition diagram

NED LMS

Control Objects - 2

- A control object receives incoming events that cause state transitions

- It generates output events that control other objects or functions

- In a real-time system, there are usually one or more control objects

Control Objects - 3

- Examples
  - › Elevator control

Data Abstraction Objects - 1

- For every entity in the application domain that needs to be remembered, there should be a corresponding data abstraction object. These objects model the real world entities by encapsulating the data that needs to be remembered as well as supporting the operations on that data

Data Abstraction Objects - 2

- Locations and organizations are examples of objects that need to be remembered

- A data abstraction object is a passive object

- The basis for a data abstraction object is a data store

Algorithm Objects - 1

- An algorithm object encapsulates an algorithm used in the problem domain
- This kind of object is more prevalent in real-time domains
- Example
  - Scheduler object

Banking System Case Study

Problem Description - 1

- A bank has several automated teller machines (ATMs), which are geographically distributed and connected via a wide area network to a central server. Each ATM machine has a card reader, a cash dispenser, a keyboard/display, and a receipt printer. By using the ATM machine, a customer can withdraw cash from either checking or savings account, query the balance of an account, or transfer funds from one account to another. A transaction is initiated when a customer inserts an ATM card into the card reader. Encoded on the magnetic strip on the back of the ATM card are the card number, the start date, and the expiration date. Assuming the card is recognized, the system validates the ATM card to determine that the expiration date has not passed, that the user-entered PIN (personal identification number) matches the PIN maintained by the system, and that the card is not lost or stolen. The customer is allowed three attempts to enter the correct PIN; the card is confiscated if the third attempt fails. Cards that have been reported lost or stolen are also confiscated.

Problem Description - 2

- If the PIN is validated satisfactorily, the customer is prompted for a withdrawal, query, or transfer transaction. Before withdrawal transaction can be approved, the system determines that sufficient funds exist in the requested account, that the maximum daily limit will not be exceeded, and that there are sufficient funds available at the local cash dispenser. If the transaction is approved, the requested amount of cash is dispensed, a receipt is printed containing information about the transaction, and the card is ejected. Before a transfer transaction can be approved, the system determines that the customer has at least two accounts and that there are sufficient funds in the account to be debited. For approved query and transfer requests, a receipt is printed and card ejected. A customer may cancel a transaction at any time; the transaction is terminated and the card is ejected. Customer records, account records, and debit card records are all maintained at the server.

Problem Description - 3

- An ATM operator may start up and close down the ATM to replenish the ATM cash dispenser and for routine maintenance. It is assumed that functionality to open and close accounts and to create, update, and delete customer and debit card records is provided by an existing system and is not part of this problem.

Observations - 1

- A bank has several ATMs

- Each ATM has a card reader, a cash dispenser, a receipt printer, and a user who interacts with the ATM through a keyboard/display unit

- The card reader reads an ATM card - physical thing

Observations - 2

- Dispensed cash and receipt are also physical entities
- ATM operator maintains an ATM

Possible Objects in the ATM Domain - 1

- External device I/O objects
  - Card Reader
  - Cash Dispenser
  - Keyboard/Display
  - Receipt Printer
- External user
  - ATM Operator

Possible Objects in the ATM Domain - 2

- User role/entity objects
  - › ATM Customer
  - › ATM (ATM Info)
  - › Debit Card
  - › ATM Card
  - › Bank Account
  - › ATM Cash
  - › ATM Transaction

Possible Objects in the ATM Domain - 3

- User role/entity objects (contd.)
  - › PIN Validation Transaction
  - › Withdrawal Transaction
  - › Query Transaction
  - › Transfer Transaction
  - › Checking Account
  - › Savings Account

Summary

- Discussed the logical steps to be performed in Object Oriented Analysis
- Discussed different kinds of Objects and Classes to be considered in Object Oriented Analysis
- Started analysis of the problem description of the case study