Unit 4 - Building Client-Server model

Reflection Questions

You should review the following questions to make sure you understand the outcomes from previous unit and potentially document lessons learned for submission (with final unit of configuring the Car). You do not submit these questions for grading.

- What is the best way to setup multithreading in an Enterprise Class application?
- What strategy is used for synchronizing, so you end up with a scalable application?
- What implementation strategy can be used for creating a race condition for testing Multithreading?
- How does Synchronization work in JVM? What are the performance consequences of Synchronizing?

Requirements

In this assignment, you are going to build on previous unit and create a client server application using java.net API.

Server will have following capabilities:

- Host all Automobiles in a single data structure - LinkedHashMap.
- Receive a Properties object, when client parses it and builds an Automobile Object on Server.
    - Properties object contains Optionsets (including Options) for one Automobile (~ to the contents of Textfile from Assignment 1). It does not contain any car configuration information.
- Respond to client request for configuring a car by passing an instance of Automobile object. The object would be serialized to the client.

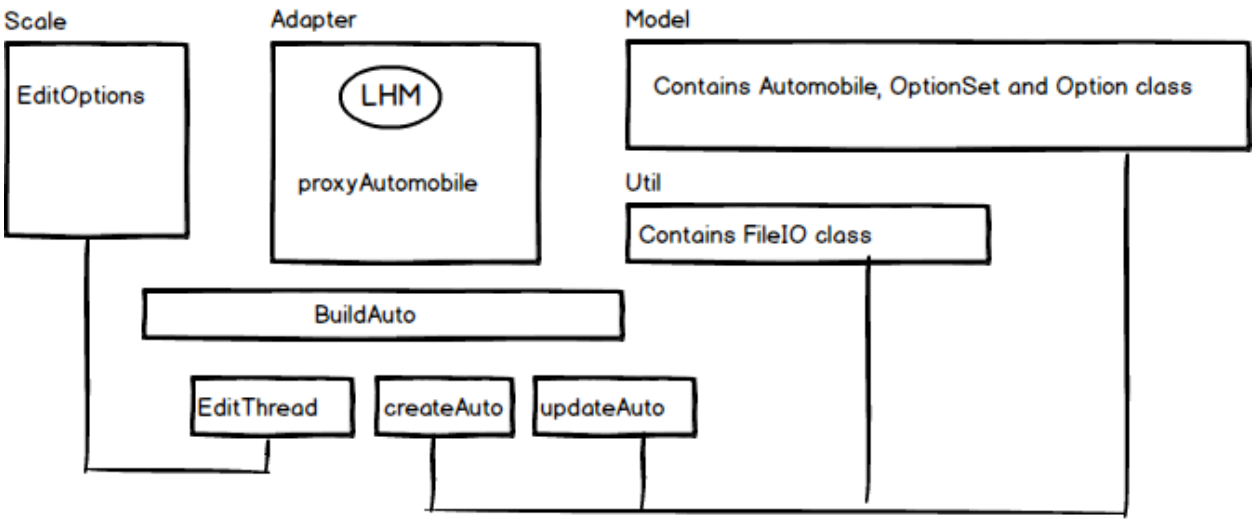
Client will have following capabilities:

- When Client starts, provide a menu for following::
    - Upload Properties file.
    - Configure a car.
- For 1a, user will be prompted to provide a path to Properties file. Once the path is provided, the client will load the Properties Object, using Serialization and send it to the Server.
    - What will the server do in response to this step? Server will parse the Properties file and create an Automobile Object. This object will be added to the static LinkedHashMap Automobile object in proxyAutomobile class.

- For 1b - user will be prompted with a list of available models on the Server. A Client can select an Automobile and configure a car.
    - What will the server do in response to this step? First, server will provide a list of available Automobiles. When user has selected an Automobile, then server will serialize that instance to the client. Client can then use that instance and configure the car on the client. Keep in mind, there should be no back and forth communication between client and server for car configuration. The configured car information only has to be printed to the screen and does not need to be saved on the server or the client.
- Server in this context only acts as an in-memory storage repository for Automobiles.

Plan of Attack

Let's start with a recap of what we have built so far:



The above context diagram represents what you have done by the end of Unit3.

You have four packages:

1. Model containing Automobile, OptionSet and Option class.
2. Util containing some FileIO class.
3. Adapter containing proxyAutomobile, BuildAuto, createAuto and updateAuto.
4. Scale with EditOptions and Editthread interface.

createAuto and updateAuto are external API's, which means that if we are KBB.com, we will give this to our clients like Toyota, Ford to upload the models and update. ediitThread is an internal API that can be used by KBB.com for executing operations.

TIP - Please keep in mind that external and internal API's have nothing to do with public, protected or private scope in Java. It merely represents the exposure of methods from a business perspective.

By creating these separations, it is likely we may have similar operations in both (external and internal API's) but implemented differently.

Design

Step 1:

Enable the usage of Properties file. Add a new function in file IO class in Util package, in which you will parse the Properties file.

How to read data from a text file using a Properties Object?

Here is how properties file can be created and read.

Sample Properties file

```
CarModel=Prius
CarMake=Toyota
Option1=Transmission
OptionValue1a=Manual
OptionValue1b=Automatic
Option2=Brakes
OptionValue2a=Regular
OptionValue2b=ABS
```

Here is the code for reading a properties file, which reads into some local variables.

```
Properties props= new Properties(); //
FileInputStream in = new FileInputStream(filename);
props.load(in); //This loads the entire file in memory.

String CarMake = props.getProperty("CarMake"); //this is how you read a
property. It is like gettting a value from HashTable.
if(!CarMake.equals(null))
{
      String CarModel = props.getProperty("CarModel");
      String Option1 = props.getProperty("Option1");
      String OptionValue1a = props.getProperty("OptionValue1a");
      ……
}
```

Enable access to this method, using the existing create function for Automobile in createAuto method. You should add an additional parameter called fileType in this method..

Step 2:

Before working on this step make sure you have learned the creation of Client Server interaction by reviewing KnokKnockServer example covered in the class (also uploaded on the class site).

Create a Server

Create a package called ***server*** that contains the following:

1. New interface called AutoServer implemented by BuildAuto. You will need to add methods in the Server interface, based on the functionality given below.
2. Add a class BuildCarModelOptions class, which has methods to do the following:
    a. Accept properties object from client socket over an ObjectStream and create an Automobile.
    b. Then add that created Automobile to the LinkedHashMap. This method will be declared in the AutoServer interface.
    c. AutoServer interface should be implemented in BuildAuto and BuildCarModelOptions classes.
    d. Based on the current structure, this method will be implemented in proxyAutomobile class and called in a method of BuildCarModelOptions.
3. Setup a Java ServerSocket, which will run an instance of BuildCarModelOption class to build Automobile using the Properties file.

Step 3:

Create a Client

Create a package called **client** like this::

1. Design and create a class called CarModelOptionsIO that can:
    a. Read data from the Properties file; create properties object, using the load method, which transfers the object from the client to server, using ObjectStream.
    b. Receive a response from the Server, verifying that the Car Model object is created successfully.
    c. Use CreateAuto interface to build Automobile and handle different type of files, passed in filetype.

Test the client and server interaction. Make sure that Properties file created in client is uploaded, parsed in server and then added in LinkHashMap object. You should upload multiple models for testing purposes.

Please be sure to incorporate the usage of DefaultSocketClient class in both Server and client implementation. The code for this class can be borrowed from the powerpoint deck, on Socket Programming.

Step 4:

Enhancing the client:

In the **client** package design, create a class called SelectCarOption, which:

1. Prompts the user for available models.
    a. Tip: Use Socket Class to interact with Server to find the available models.
2. Allows the user to select a model and enter its respective options.
3. Displays the selected options for a class.

As part of this enhancement you will need to add new methods in **AutoServer** interface to:

1. Provide a list of available models to the client.
2. Send the object (using Serialization) to the client, upon selection of an Automobile.

TIP - You should make two projects (one for client and another for server), which contain the following packages: model, adapter, scale and util. Additionally project for server/client will contain **server/client** packages respectively.

Your deliverables for this project include:

1. Updated classes.
2. Class Diagram.
3. Test program showing successful implementation of these classes.

Tips

How to use DefaultSocket Client class in Server class?

1. Building a Server:

You can follow the KnockKnockServer example for building your server; write a constructor, which instantiates ServerSocket class.

```
ServerSocket serverSocket = null;
  try {
      serverSocket = new ServerSocket(4444);
  } catch (IOException e) {
      System.err.println("Could not listen on port: 4444.");
      System.exit(1);
  }
```

2. You need to write a method, which can take an incoming request and process it in its own thread. For this you can use DefaultSocketClient class

```
DefaultSocketClient clientSocket = null;
```

```
try {
    clientSocket = serverSocket.accept();
} catch (IOException e) {
    System.err.println("Accept failed.");
    System.exit(1);
}
```

You will need to setup (create references) stream type in DefaultSocketClient class, which are needed. You will be using ObjectStream. This can be best done as follows:

3. You will need to link to the stream objects of the incoming requests.

```
PrintWriter out = new PrintWriter(clientSocket.getOutputStream(), true);
BufferedReader in = new BufferedReader(
                    new InputStreamReader(
                    clientSocket.getInputStream()));
```

4. You will need to override handleSession method in DefaultSocketClient class, to handle the incoming request.

How to use DefaultSocketClient class for client?

You can simply modify DefaultSocketClient class and add the necessary Object Streams for communication.

Grading your submission

Total points 40

1. Program Specification/Correctness (25 points)
    a. Class diagram is provided.
    b. No errors, program always works correctly and meets the specification(s).
    c. The code could be reused as a whole or each routine could be reused.
    d. Packages are created as described in the Plan of Attack.
    e. Exposure to LinkedHashMap object is done only through interfaces.
    f. BuildAuto class has no methods defined in it.
    g. Client and Server classes use Object streams only.
    h. Server is not storing any information about class configuration.
    i. DefaultSocketClient class is used in Server implementation. DefaultSocketClient class has to be modified to create a proxy (return value from accept() method) inside the implemented server.
    j. DefaultSocketClient class is used in Client implementation.

2. Readability (5 points)
    a. No errors, code is clean, understandable and well-organized.
    b. Code has been packaged and authored based on Java coding standards.

3. Documentation (5 points)
    a. The documentation is well written and clearly explains the functionality implemented by the code.
    b. Detailed class diagram is provided.

4. Code Efficiency (10 points)
    a. No errors; code uses the best approach in every case. The code is extremely efficient, readable and understandable.