Politecnico di Milano

Scuola di Ingegneria Industriale e dell'Informazione

M.Sc. in Computer Science and Engineering

myTaxiService

Software Design Document

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1 Overview

myTaxiService is a taxi service that will operate in a big city; the main purpose is to simplify the access of passengers to the service and to guarantee a fair management of the taxi queues.

The main stakeholders of the system are the *Users*, the *Taxi Drivers* and the *Operators* as highlighted in *section 1.3* of the *RASD*.

The system is composed of four main core applications :

- Mobile Application (User)
- Web Application
- Mobile Application (Taxi Driver)
- Back-End Application

as stated in *section 1.2.* of the *RASD* It's important to highlight that in this document the design of mobile application is based on the Android platform.

2 High Level Components

The system could be divide in three main high level components that do not necessarily correspond only to one real application:

Server

The Server component is the kernel of the service we want to provide, it incorporates most of the *business logic*, it stores most of the *data* and it provides programmatic interfaces to the clients.

User Client

The User Client components is an high level representation of the real clients available to the users of our service. It's modeled as a *thin client* and it relies on the *Server* to fulfill its tasks.

Taxi Driver Client

The Taxi Driver Client component is an high level representation of the real clients available to the taxi drivers registered to the service. It's modeled as a *thin client* and it relies on the *Server* to fulfill its tasks.

2.0.1 Components Interaction

From a high level perspective the system is design following the well known *client-server* paradigm.
The interaction between the components is handled by the Server that provides a programmatic interface that is able to receive remote call from the clients.
The clients never communicate directly with one another.

3 Component View

This section highlights the main features and roles of every component of the system. Moreover it describes the internal interfaces between different classes of every component.
External interfaces between components are described in *section 6*

3.1 Server

The Server is composed of:

Back-End Application

As stated in *section 1.2.2* of the *RASD*, the *Back-End Application* is the system component that handles most of the business logic.
The application is written in *Java EE* and to fulfill its tasks (see *section 3.5.3* of the *RASD*) it needs to interface with the Internet network using the *HTTPS protocol* and the *JAVA API for RESTful Web Service*[1], with a *MySQL database* and with external Google Maps API.

Back-End Internal Interfaces

The *Back-End Application* is built to be very modular and to grant *interchangeability* between components.
There are four main classes that constitute the kernel of the application :

- **QueueManager** Handles queue policies.
- **RideManager** Creates and manage rides. Is connected to the *RequestManager* via the *RideManagerInterface* and directly depends on *QueueManager*
- **ActorManager** Create and update data about users an taxi drivers. Is connected to the *RequestManager* via the *ActorManagerInterface*
- **PositionManager** Update taxi drivers position. Is connected to the *RequestManager* via the *PositionManagerInterface* and directly depends on *QueueManager*
- **RequestManager** Get and build *Request* object from the requests received via *HTTP*

[1] See `https://jax-rs-spec.java.net/`

MySQL Database

The MySQL database fulfill the task off storing and granting access to all the data generated and used by the service.
A *database dump* is performed daily during the period of minor activity of the service [2].
The connection between the *Java EE* application and the databased is supported by the *JDBC connector*[3]

3.2 User Client

Different real clients are available to the end users of the system.
As stated in *section 1.2.2* of the *RASD* a native mobile application is developed for Android, iOS, Blackberry and WP.
Moreover a Web Application is also available.
To fulfill the requirements expressed in *section 3.5.1* and *section 3.5.2* of the *RASD*, all the clients need to communicate with the Server making calls to the REST API using platform specific API for REST HTTP calls.

3.3 Taxi Driver Client

Different real clients are available to the taxi driver registered to *myTaxiService*.
As stated in *section 1.2.2* of the *RASD* a native mobile application is developed for Android, iOS, Blackberry and WP.
To fulfill the requirements expressed in *section 3.5.1* and *section 3.5.2* of the *RASD*, all the clients need to communicate with the Server making calls to the REST API using platform specific API for REST HTTP calls.

3.4 Clients Internal Interfaces

Mobile clients are composed mainly by subclass of platform specific components.
Interfaces between components are therefore specified in the SDK of each platform. However it's important to highlight that every mobile application has to interface with a *Network Component* that handles *HTTP* requests.

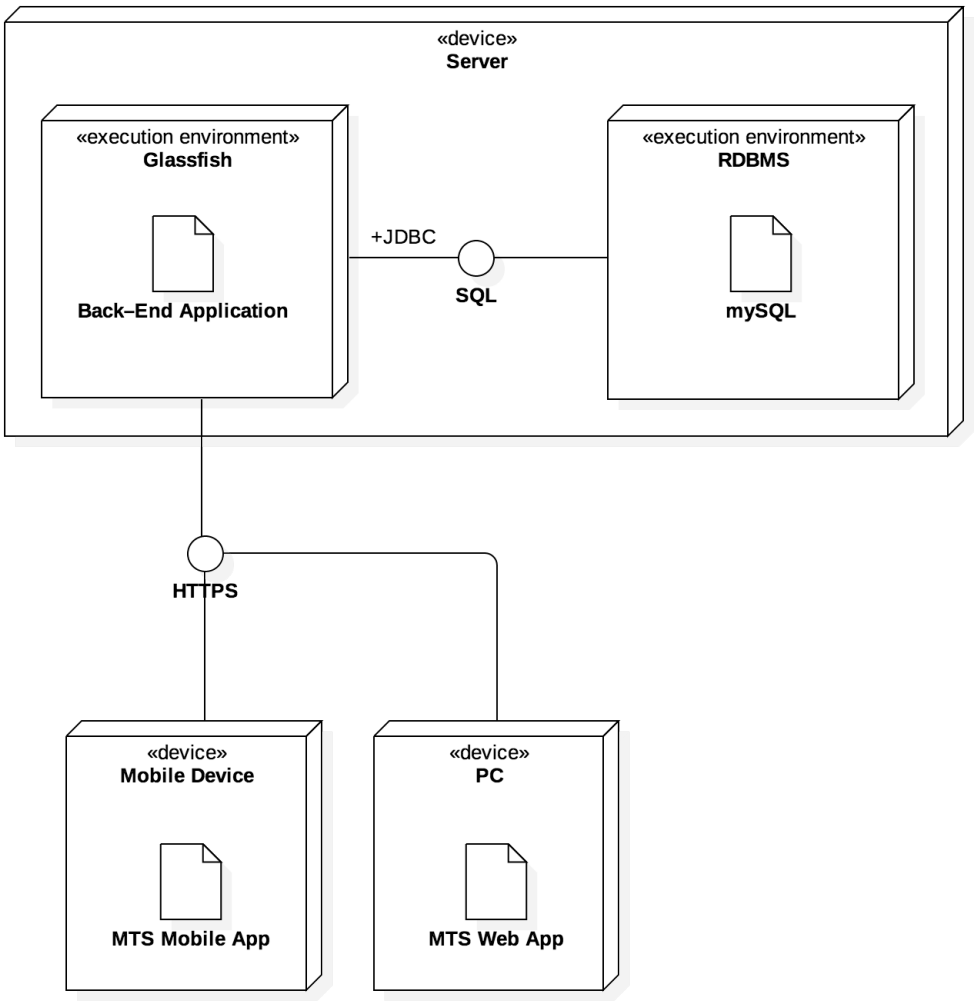
[2] At first, when no activity data is available, the dump will be performed at 04:00 A.M
[3] See `http://dev.mysql.com/downloads/connector/j/`

4 Deployment View

In this section we analyze the *Deployment View*, meaning that a presentation of the deployment point of view is provided.

In order to have a successful deployment an in depth analysis of the main components that will have to be deployed is required. For this reason here is a graph showing the deployment view:

Figure 1: Deployment Diagram



A main server is deployed, in which the *DBMS* is run. Here also the *Back-End Application* is run via the Glassfish server.

Both mobile applications, the *User* one and the *Taxi Driver* one, interface with the *Back-End Application* through *HTTP* protocol.

Also the PC application, namely the *Web Application*, connects to *Back-End Application*.

5 Runtime View

5.1 Server View

In this section we focus on the *Runtime View* of the system.
While the system is up and running, the *Server* receives many *HTTP* requests from different clients that are handled by a *Load Balancing* component that distributes the calls uniformly to every real machine.
Every request from the users are registered by the server and saved in the *MySQL* database.
From the *internal* point of view of the *Back-End* application, request are at first parsed by the *Request Manager* and the dispatched to Java object that is in charge of computing the result of that request. Three diagrams are provided to better exemplify the flow of events.

5.2 Client View

From the client point of view, when a *User* or a *Taxi Driver* open his app, the client starts a first *"handshake"* to check for basic authentication data and if it's successful, the client can proceed with requests.
The flow of a request start from a *UI* component (like a *button*) and is finally handled by the class that implements the *HTTP* interface.

6 Components Interfaces

This section provides a description of the interfaces between the main components of the system.
Internal interfaces between different objects of every component are described in *section 3*

6.1 Back-End Application - Database

The *Back-End Application* uses *SQL* language to query the *Database*. Queries from *Java* are supported by the *Java Database Connectivity (JDBC) API* which is the *API is the industry standard for database-independent connectivity between the Java programming language and a wide range of SQL databases*[4].
This choice is made in order to exploit the *"Write Once, Run Anywhere"* feature of the *JDBC*.

6.2 Back-End Application - Client User

The connection between the *Back-End Application* and the *Client User*is provided by the Internet network and based on the *HTTP* protocol and supported by a *RESTful API* service.
The two components use different internal interfaces to connect to the network[5]

6.3 Back-End Application - Client Taxi Driver

The connection between the *Back-End Application* and the *Client Taxi Driver*is provided by the Internet network and based on the *HTTP* protocol and supported by a *RESTful API* service.
The two components use different internal interfaces to connect to the network.

[4]See `http://www.oracle.com/technetwork/java/javase/jdbc/index.html`
[5]See *section 3*

7 Architectural styles and patterns

This section highlights both hardware and software selected styles and design patterns.
It's important to underline that the rules described below are just a general guideline for the actual developers of the project.
During the development phase it's often required to switch style or rely on other patterns to carry on.
Developers should not recur to *hacks* in order to comply with design rules provided while the *system to be* is not fully specified.

7.1 Software styles and patterns

The overall software system must follow the *Object Oriented Paradigm*.
In particular, developers should follow the principles of *encapsulation*, *composition*, *inheritance*, *delegation* and *polymorphism*.
Developers should promote code reuse and should try to solve programming problems using common *OO Design Patterns*[6].
Code produced by develpers, must be fully commented and documented in order to promote simple refactoring and maintenance.

7.2 Harwdare styles and patterns

As outlined in *section 4*, our hardware system is based on a *2 tier* architecture:

- **First Tier** The first tier is composed by *clients* devices. Such as mobile phone, tablets, and browser enabled computers.
- **Second Tier** The second tier is composed by a rack of *Servers* controlled by a load balancing component.

From the logical point of view, our system is divided in *3 layers*:

- **Presentation Layer** This layer is responsible for displaying data to the users and for transmitting input data to the *business logic layer*. The *presentation layer* is deployed in the *First Tier*
- **Business Logic Layer** This layer is responsible for receiving data from the *presentation layer*, for computing and transmitting a response

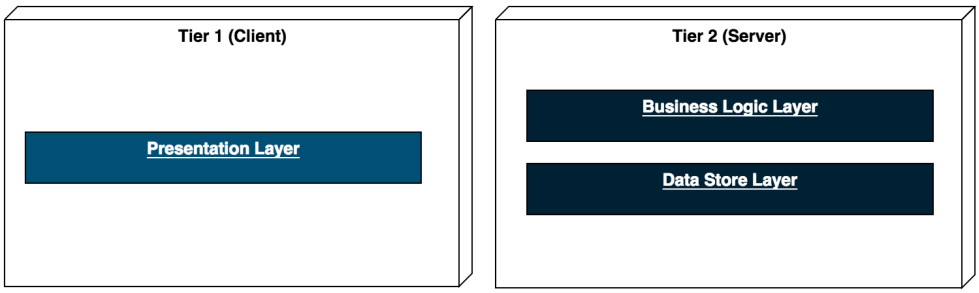
[6] *See Design Patterns: Elements of Reusable Object-Oriented Software* by Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides

(using also data provided by the *data store layer*) to the presentation layer.
This layer implements most of the business logic and is deployed in the *second tier*,

- **Data Store Layer** This layer is responsible for storing all the data meaningful to the system. This layer is deployed in the *second tier*.

A schema of the overall architecture is provided below.

Figure 2: Deployment Diagram



Appendices

A Tools

- *Sublime Text 2* as editor
- *LatexTools for Sublime Text 2 + MacTex* to build
- *Trello* for team coordination
- *Git + Git Flow* for version control

B Hours of work

- Angelo Gallarello : 30 hours
- Edoardo Longo : 30 hours
- Giacomo Locci : 30 hours