

INFORMATION MODELING OF ONLINE AIR TICKETS RESERVATION SYSTEM

ИНФОРМАЦИОННО МОДЕЛИРАНЕ НА СИСТЕМА ЗА ОНЛАЙН РЕЗЕРВАЦИЯ НА САМОЛЕТНИ БИЛЕТИ

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Abstract: Modern society brought high demands on the quality of information systems, which require the use of modern methodologies and software to automate the process and reduce development time of the project and raise its quality. One of the most promising approaches in this direction is the Model Driven Development (MDD), that is an innovative approach for development of different software applications using models at different levels of abstraction and applying model transformation to code generation. The main objective of this paper is to present an approach for model-driven development of online air ticket reservation system based on UML. UML use case diagrams and class diagram are used to model the main requirements and data model of the system respectively in order to achieve reusable and portable models of the system. The developed UML conceptual data model is implemented in a MySQL based database. Finally, some conclusions are made.

Keywords: INFORMATION SYSTEM, DATABASES, MODEL DRIVEN DEVELOPMENT, MYSQL, UML, TICKET RESERVATION

1. Introduction

Nowadays, the Internet is very popular all over the world. Information systems are evolving very rapidly and dynamically. It should be noted that with the development of information technology, the use of e-commerce increases considerably [1]. For majority of people, e-commerce began to occupy an integral part of their lives. In addition to ordinary goods, the shopping list includes also trips, insurance and tickets. In recent years, new factors began to change the structure of sales in the ticketing process. Modern society is plunged into the world of information technology, which contributes to the emergence of various technological solutions. That is why information systems are gaining momentum and becoming more popular. With the progress in communications there is a need of such information systems as online ticket reservation systems. The desire to travel and explore the world is inherent to people. The main task of online reservation system is to provide the possibility of buying tickets without outside help.

The development of information systems is impossible without carefully consideration of an effective methodological approach. For successful project implementation, the subject of design should be adequately described. Recent research and experience on modeling information systems show that it is logically difficult, laborious and lengthy task. For qualitative modeling, it is very important to use Model Driven Development (MDD) approach, where the model becomes the primary development artifact from which code can be automatically generated in the future [2, 3]. This method is highly effective and reliable for the development of such information systems as an online reservation ticket system. The Model Driven Architecture (MDA) [4] is one of the most successful implementations of MDD, based on Unified Modeling Language (UML) [5] and is offered as standard by the Object Management Group (OMG).

The main aim of the paper is to present an approach for application of MDD and MDA to the development of online air ticket reservation system. The paper is organized in 5 parts. After the introduction, in part 2, the requirements to the developed system are proposed. Part 3 illustrates a short review of the applied techniques. In Part 4 of the paper the suggested approach is described based on the UML use case and class diagrams. Finally, some conclusions are made.

2. System requirements

With the development of information technology, the requirements to the electronic reservation systems are getting higher. Reservation is the act of reserving a place or passage, or engaging the services for a person or group. First of all, the ordinary purchases go to online mode and the same is situation with the travel products. Online reservation of tickets is carried out with a view to reserving a certain category of tickets for a specific date, a specific customer request, transmitted through the Internet. After using reservation system, customer gets the electronic ticket (e-ticket), which is an electronic document certifying the contract of carriage between the passenger and the airline. Unlike paper ticket, e-ticket is a digital record in the airline database. Passenger receives confirmation by e-mail with receipt, which contains all the information about the purchased ticket. It is not necessary to print it, as the airport employees have a reliable database. For identification and payment confirmation the passenger is only required to provide a passport.

It is worth pointing out that there are plenty of advantages in booking ticket online. One of the main advantages of this process is time saving, which means that customer can book an air ticket from any place, such as home or office. What is more, booking ticket online allows customers to see all the information about all possible flights and fares. Airline reservation system makes it possible to get a ticket not only for themselves but also for their loved ones. Customer can visually check the correctness of the data entered. Another advantage of this purchase is the fact that a person does not need to carry large sums to pay. Booked tickets can be redeemed online through credit card or electronic money. Those who trust only paper money, after the reservation can pay for the ticket in the nearest terminal. Each of these advantages makes online reservation system convenient and unique of its kind. It goes without saying that nowadays there are a lot of ticket offices, but the human factor becomes a negative point in buying there. Of course, booking office manager is interested only in quick sell of tickets. The sellers are not interested in client's needs, like lower price ticket or more convenient connections. Through the online booking, the customer can see all available flights per day. Customer can choose the best offer, airline ticket price, departure time, a place in the cabin, as well as to determine the type of food. Due to the lack of office purchase, the online one will be cheaper. The practice shows that more and more people prefer online flight booking. Internet users consider

that online booking system is the best solution for acquisition of tickets.

3. Short review of the applied techniques

3.1. MDD and MDA

Model-driven development (MDD) is an approach that is changing the way of software development, through moving the center of gravity from the direct writing of source code to using models, reflecting different perspectives and levels of abstraction [2, 3]. In [6] the MDD is considered as architectural meta-programming in which models are values and transformations map models to models. One of the most popular and successful technology for MDD is the Object Management Group (OMG)'s Model Driven Architecture (MDA) standard providing a powerful conceptual framework for development and transformation of three interconnected types of models - Computation Independent Model (CIM), Platform Independent Model (PIM) and Platform Specific Model (PSM) towards executable applications as shown in Fig.1 [4]. The main features of the models are:

- CIM – is also known as business or domain model that uses vocabulary to present the basic expectation from the system and to bridge the gap between domain experts and developers. This abstraction hides all specifications connected to the system implementation.
- PIM – is a view of the system without any details about implementation. Basic tasks of the PIM model are to model logical data, to establish dependencies and defining workflows and processes. Furthermore, PIM models must be sufficiently complete and accurate to ensure a higher degree of automated implementation of the models in the next layer (PSM).
- PSM – combine the PIM specifications with concrete platform information needed for enabling system execution, i.e. the basic role of this model is to ease the code generation using PIM and selected execution platform.

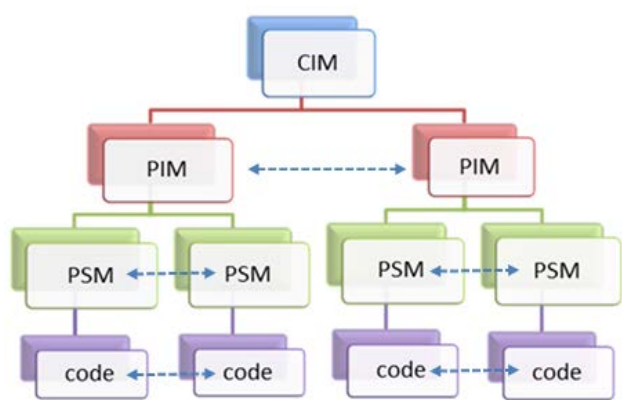


Fig.1: MDA conceptual framework

3.2. UML and UML diagrams

In order to achieve the goals of MDD and MDA, Unified Modeling Language (UML) is used. UML is a general purpose graphical modeling language for specification, visualization, design and documentation of artifacts created in the development of software systems [5]. A comprehensive UML modeling tool like "Visual Paradigm" is an ideal way to take control of a software or a business project. UML diagrams are used for displaying models and their components [7]. UML 2.0 contains 13 types of charts, grouped in the following groups:

- **Structural diagrams** emphasize the structural elements that must be presented in the modeled system. These diagrams are frequently used to document the architecture of software systems. Class diagrams, object diagrams, component diagrams, composite structure diagrams, package diagrams, and deployment diagrams all fall under the umbrella of structural diagrams. Class diagram shows the classes, their attributes and

relationships between classes (Fig.2). Component Diagram shows the components and their relationships. Block diagram shows the internal structure of the classes and the communications with the outside world. Deployment Diagram shows how the software is placed on hardware (servers, workstations). Object diagrams show the structure of the system, objects and their attributes at a particular time. Package Diagram shows how the system is expanded to major components and the connections between these parts.

- **Behavior diagrams** visualize, specify, construct and document the dynamic aspect of the modeled system. They are often used to describe functionality of software systems. Use case diagrams, activity diagrams, and state machine diagrams are all subsets of behavior diagrams [8]. Activity diagram shows the flow of information in the system. State diagram is a state machine illustrating the flow of an object from one state to another. Use Case Diagram shows the operation of the system in terms of users and use cases.

- **Interaction diagrams**, which are technically a specialized type of behavior diagrams, emphasize the flow of control and data throughout the modeled system. Sequence diagrams, communication-, timing-, and interaction diagrams are kinds of interaction diagrams. Diagram of cooperation shows the structural organization of the objects involved in the interaction. Interaction diagrams show the interactions between objects and their relationships. Sequence diagram shows the time ordering of events. Timing diagram is associated with the timeframe of the project.

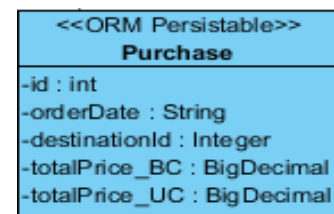


Fig.2: Example of a class in Class Diagram

3.3. Databases and MySQL

As it was noted earlier, all the information that is used in the site is taken and stored in a database. A database is an organized collection of data [9]. It is a collection of schemas, tables, queries, reports, views and other objects. The data are typically organized to model different aspects of reality in a way that supports processing the required information. Database management system (DBMS) is a combination of language and software, which provides access to the data, allowing the user to create, change and delete data, provides data security, etc. Data can be accessed using Data Manipulation Language (DML) such as SQL (Structured Query Language). SQL is Structured Query Language, which main task is to provide a simple way to read and write data to the database.

The proposed e-commerce application for online ticket reservation requires dynamic web pages providing interactive features with the customers. The web program, executed on the middle-tier web server, as shown in Fig.3, must submit a query to the database through the DBMS (MySQL) resided on the bottom-tier database server, retrieve the required information and display it. For this purpose, different techniques may be used. In our case the open source scripting language PHP [10] is used. The PHP interpreter provides a hypertext preprocessor executing PHP commands, creating the corresponding HTML and sending it to the client-tier. MySQL is used as DBMS and is one of the most popular and widely used DBMS over the Internet. An important factor is that this DMBS is open-source and is distributed under the general license GNU (GPL, GNU Public License). MySQL has good speed, reliability, flexibility and is not difficult to work with it.

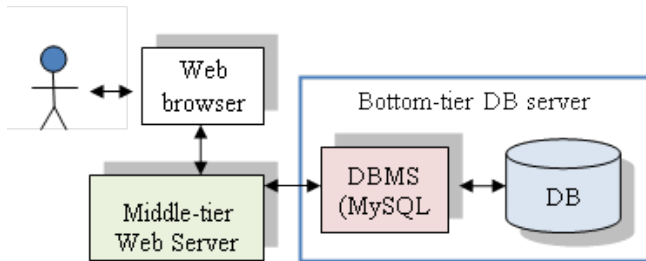


Fig.3: Scheme of database work

The task of long-term storage of information is very common in development of Web-based applications: visitor's count in the counter, holding posts in the forum, remote management of information content on the site, etc. The volume of code is greatly increased as well as the chance to make a mistake. All these problems can be solved by the use of a database. Databases take care of data security, modeling of data, and information can be retrieved or updated using a single line of code. Retrieving data from a database is much faster than from a file.

4. Description of the suggested approach

The development of an online air ticket reservation system is chosen as an example of the suggested approach, based on the idea of Model Driven Development. The operation of the system in terms of actors and use cases is represented in Fig 4 and Fig 5.

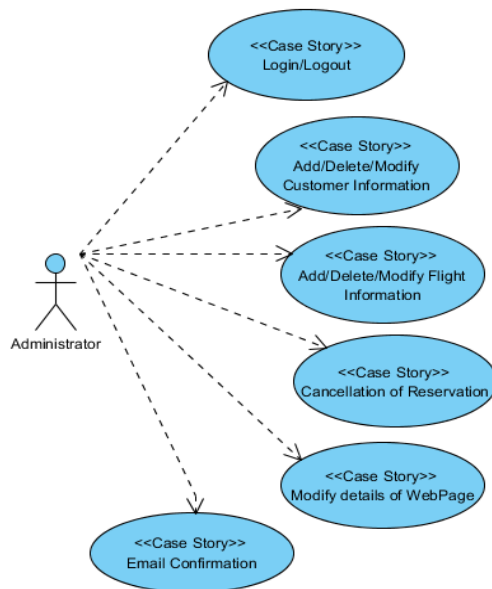


Fig.4: Use Case Diagram in respect to Administrator actor

The static description of the system (in terms of its design) and its structure are represented through class diagram shown on Fig.6. To build the class diagram, special software, named "Visual Paradigm" was used. "Visual Paradigm" is software design tool, tailored for agile software projects. The diagram describes in detail the process of ticket reservation. The process, where the customer reserves the air ticket, chooses the cities of departure and arrival, fares and company is illustrated in this class diagram.

The next step after modeling is to generate the database. The database stores all information about flights, schedule, destinations, departures, arrivals, customers, planes, companies. In this project MySQL Workbench was used, which is a visual database design tool that integrates SQL development, administration, database design, creation and maintenance into a single integrated development environment for the MySQL database system. MySQL Workbench provides the opportunity to create the "entity-relationship" model which main components

are entities (elements) and relationships between them. As shown in Fig.7, the "entity-relationship" diagram clearly shows the main relations between tables. For instance, the table "reservation" is related with many other tables, which means that they depend on each other. The table "reservation" stores the data about customer, prices of tickets, and seats.

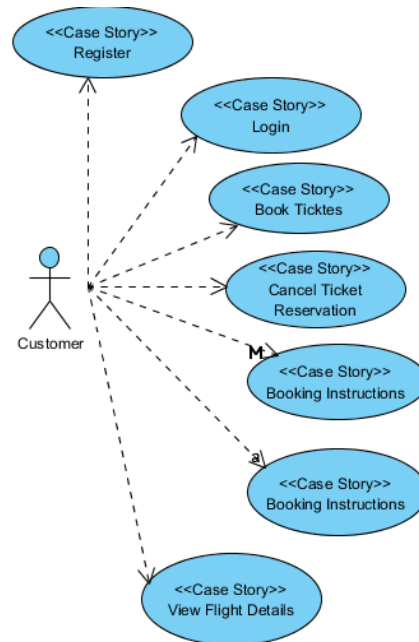


Fig 5: Use Case Diagram in respect to Customer actor

5. Conclusions

The transition from approaches based on a directly code creation to model-driven software development poses the modelling as one of the first most important things in all field of engineering. Ticket reservation system is an embodiment of information technologies which is connected with the needs of nowadays society, where the need to travel is integral part of life. With regards to the development of a reservation system, it should be mentioned that one of the most important parts of the project is the modeling of the process, which was successfully demonstrated in this article using UML and MySQL. It should be noted that in future, the represented information model can be implemented on different platforms, which makes this project relevant and fast-growing.

6. References

1. Chrusciel D., The Internet Intermediary: Gateway to Internet Commerce, JIBC, Jan., vol.1, no.3, 2001.
2. Sellic B., The Pragmatics of Model-Driven Development, IEEE Software, vol.20, no. 5, pp. 19-25, 2003.
3. Banerjee M., Roy S. R., Singh S. N., Model Driven Development: Research Issues and Opportunities, International Journal of Advanced Computer Research, Vol.4 No 2 Issue 15, June, 2014.
4. OMG-MDA (2003). MDA Guide version 1.0.1. OMG document omg/2003-06-01, 2003.
5. Fowler M., UML Fundamentals, Third Edition / M. Fowler, M.: Symbol-Plus, 2006, 192 pp.
6. Batory D., Program Refactoring, Program Synthesis, and Model-Driven Development, In ETPAS Compiler Construction Conference, vol. 4420 of LNCS, pp. 156-171, Springer, 2007.
7. Leonenkov A.V., Teach UML, Second edition, St. Petersburg: BHV Petersburg 2004.
8. Booch G., Rumbaugh J., Jacobson I., The Unified Modeling Language Reference Manual, Second Edition, Addison-Wesley, 2004.
9. Garcia-Molina H., Ullman J.D., Widom J., Database Systems – the complete book, Pearson Prentice Hall, New Jersey, 2008.
10. Kuznetsov M., Simdyanov I., Teach Yourself PHP 5/6, St. Petersburg, BHV-Petersburg, 2009.

