# АКТУАЛЬНІ ПРОБЛЕМИ СЕКТОРАЛЬНОЇ ЕКОНОМІКИ

# PRIORITY PROBLEMS OF INDUSTRIAL SECTORS' ECONOMICS

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## INFORMATION MODELING WITH MODEL-DRIVEN DEVELOPMENT TECHNOLOGY

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*Соколовська З.М., Гребеньщіков І.І. Інформаційне моделювання з використанням технології Model-driven development.*

Розроблено модель інформаційної системи, яка дозволяє купувати авіаційні квитки онлайн. Використаний стиль "model-driven development" (розробка, керована моделями), в якому модель є ключовою ланкою розробки, з якої в подальшому генерується код. Доведені переваги використання даного стилю розробки програмного забезпечення. Також було розглянуто важливість інформаційної системи та її переваги на підприємстві.

*Ключові слова:* інформаційні системи, model-driven development, модель, розробка, програмне забезпечення

*Соколовская З.Н., Гребеньщиков И.И. Информационное моделирование с использованием технологии Model-driven development.*

Разработана модель информационной системы позволяющая приобретать авиационные билеты онлайн. Использован стиль "model-driven development" (разработка, управляемая моделями), в котором модель является ключевым звеном разработки, из которой в дальнейшем генерируется код. Доказаны преимущества использования данного стиля разработки программного обеспечения. Также была рассмотрена значимость информационной системы и ее преимущества на предприятии.

*Ключевые слова:* информационные системы, model-driven development, модель, разработка, программное обеспечение

*Sokolovska Z.M., Grebenshchikov I.I. Information modeling with Model-driven development technology.*

A model of information system was developed, which allows to purchase airline tickets online. Style "model-driven development" was used (model driven development), where the model is a key design element from which code will be generated in the future. The benefits of using this software development style was proved. Also significance of information system and their advantages on enterprise were considered.

*Keywords:* information systems, model-driven development, model, design, software

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, 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 include also trips, insurance and tickets. It should be mentioned that 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 development of information communications there is a need of such information systems as an online ticket reservation system. The desire to travel and explore the world is inherent to people. Therefore, nowadays society is interested in such information systems. 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 careful consideration of the methodological approach. For successful project implementation, the object of designing should be first described adequately. Recent research and experience of modeling information systems shows that it is logically difficult, laborious and lengthy work.

For qualitative modeling, it is very important to use Model Driven Development (MDD) style, where the model becomes the primary development artifact from which code can be auto-generated in the future. This method is highly effective and reliable in the development of such information system as a reservation ticket system.

**Analysis of recent researches and publications**

Technology centers for budgeting responsibility in modern conditions is studied by many domestic and foreign scholars, such as Hrutskyy V.E, Siegel D.G, D.K. Shim and others [1-3]. In the works of these authors considered objects budgeting, types of budgets, the scheme of consolidation and budgeting . Simultaneously emerging scientific papers [4-5], which proposes to use concepts, alternative budgeting centers of responsibility. The most famous of these was process-oriented budgeting. Formation of process oriented enterprise budget should be in accordance with a specific methodological approach, but this approach has not yet been developed.

Theoretical and methodological aspects of information modeling is covered in many fundamental scientific works, including much emphasis on the development of a process approach in the works of A.P. Magalhaes, J.M.N. David; R.S.P. Maciel; B.C. Silva. In practical direction, foreign authors such as Jon Whittle, John Hutchinson, Mark Rouncefield got significant research results.

Despite the significant achievements of predecessors the formation of rational technology based on the improvement of its structure has not yet received sufficient development.

*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

**The main part**

In order to make effective administrative decisions in the conditions of dynamic development of the market economy, the company is required to ensure expedient system of information, objectively reflects the current economic situation

This theme is most relevant today, as good information support is not only the success and competitiveness of firms, but also sometimes acts as means of survival in a competitive environment.

It should be noted that In modern conditions it became an important area of information security, which is to collect and process the information needed to make informed management decisions.

Information Transmission on the status and activities of the company to a higher level of control and information exchange between all interconnected units of the company are carried out on the basis of modern computer technology, and other technical means of communication

Today, the effectiveness of management activities depends primarily on the automation of administrative processes. Successful business management automation will depend on the correct choice of the automated system.

As a result of the society informatization process, it should be noted that demand for the use of information technologies increased rapidly. What is more, the ordinary purchases goes to online mode. The same situation is mentioned with the travel products. Online reservation 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 [2]. 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's database. Passenger receives confirmation by e-mail with receipt, which contains all the information about the purchased ticket, then customer simply prints it out and takes it to airport. 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 [3]. 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. One must remember that customer can visually check the correctness of the data entered. 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 [4]. 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 of the offers: airline ticket price, departure time, as well as to determine the type of food, a place in the cabin. Due to the lack of office purchase, the online will be cheaper.

The main advantage of this purchase is the fact that a person does not need to carry large sums to pay. Booked tickets can be redeemed in the same way online (credit card, electronic money). Those who trust only paper money, after the reservation can pay for a ticket in the nearest terminal.

Modern banking and financial system, information technology level, enabling them to fulfill the entire range of financial services on the basis of the regulatory framework, provide a level of information security and are generally, are not difficult to understand and support, but require constant attention from the information security [5].

After the online booking and payment, customer gets the electronic version of the ticket by email. 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.

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.

As it was noted earlier, all the information that is used for sites is taken and stored in databases. A database is an organized collection of data. It is a collection of schemas, tables, queries, reports, views and other objects [6]. The data are typically organized to model aspects of reality in a way that supports processes requiring information, such as modelling the availability of rooms in hotels in a way that supports finding a hotel with vacancies.

By itself, the database would not be interesting if it was not for database management systems (DBMS) [7]. Database management system is a combination of language and software, which provides access to the data, allowing the user to create, change and delete, provides data security, etc. Database is not a system, it's a collection of information that's easily organized so that it can easily be accessed, managed and updated. Data can be accessed using special language SQL (Structured Query Language).

SQL is Structured Query Language, whose main task is to provide a simple way to read and write data to the database. The simplest scheme of work with database is illustrated in Fig. 1.

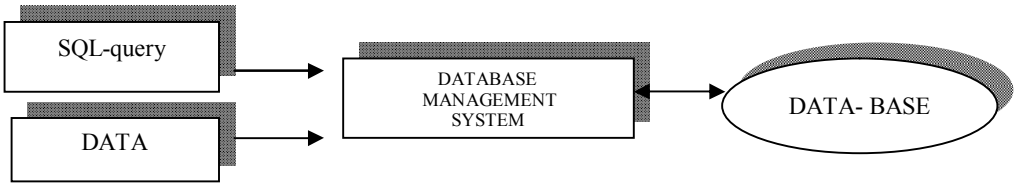


Fig. 1. Scheme of database work
*Source: Own elaboration*

MySQL is one of the most popular and most widely used DBMS (database management system) on the Internet [8].

MySQL has good speed, reliability, flexibility. It is not difficult to work with it. Support for the MySQL server is automatically included in the delivery of PHP. Another important factor is that this DMBS is open-source. MySQL is distributed under the general license GNU (GPL, GNU Public License).

The task of long-term storage of information is very common in development of Web-based applications: visitor' 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 [9]. All these problems can be solved by the use of the database. Databases take care of data security, modeling of data, and information can be retrieved or updated using a single line of code. Code using the database is a more compact, and debug it much easier. Also, do not forget about the speed - sample information from the database is much faster than from a file.

It should be noted that the application in PHP, used to store information database (eg MySQL) is always running faster than applications built on the files. The fact that the databases are written in C++, and to write a PHP program that would work with hard disk performance of the database is a problem unsolvable by definition, since the program in PHP, in principle, are slower than a program in C ++, because PHP is interpreter and C++ is compiler.

Thus, the main advantage of the database is that it takes on the job with a hard drive and doing it very effectively.

For business process modeling, we use UML (Unified Modeling Language) [10]. UML is a general purpose graphical modeling language for specification, visualization, design and documentation of artifacts created in the development of software systems. A comprehensive UML modeling tool like Enterprise Architect is the ideal way to take control of your software or business project now. UML allows us to describe a system of the following models:

— Operation model (shown as described functionality of the system from a user perspective).
— Object Model (shows what it looks like the system design from the point of view of the objective approach).
— Dynamic Model (shows how to interact with each other in the dynamics of the system components over time). It demonstrates what processes occur in the system.

UML diagrams are used for displaying models and their components [11].

While working on this article, as an example, the development of the air ticket reservation system was chosen.

As it was decided to use the Model Driven development, the first thing that should be done is to design a model of the project. It is generally considered that business process modeling is an important part of any project, where the most convenient and widespread method of system design is to build a class diagram. This type of diagram is a form of static description of the system in terms of its design, which also shows its structure. The best way to model the process is to use UML, which helps to understand the process of the system. It is well-known fact that class diagrams are central to the methodology of object-oriented analysis and design.

The class diagram shows the classes and their relationships, thereby presenting a logical aspect of the project. A separate class diagram represents a particular view of the class structure. At the stage of the analysis class diagram is used to highlight the general roles and responsibilities of the entities providing the desired behavior of the system. At the design stage of the class diagram is used to convey the structure of the classes that form the system architecture (Fig. 2).

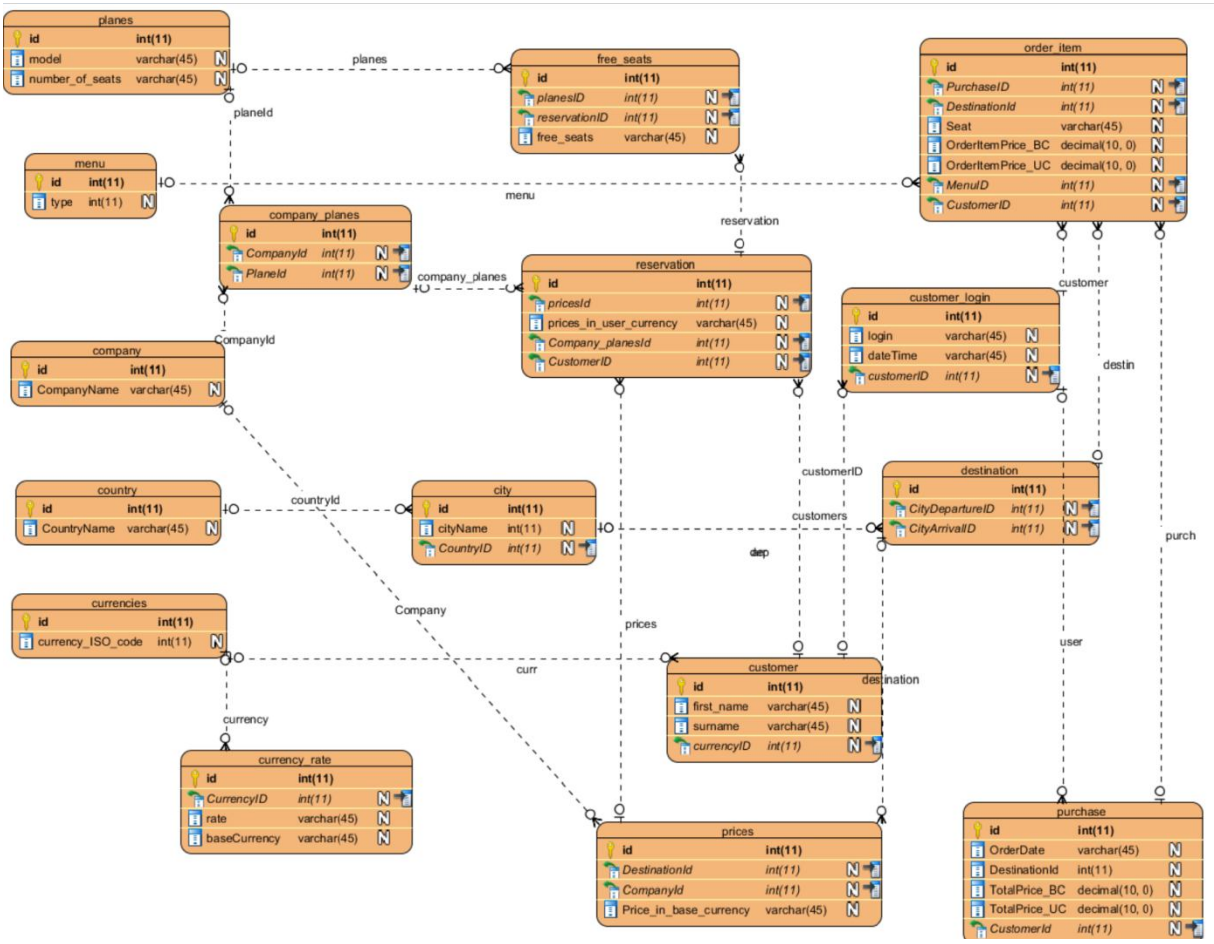


Fig. 2. Class diagram
*Source: Own elaboration*

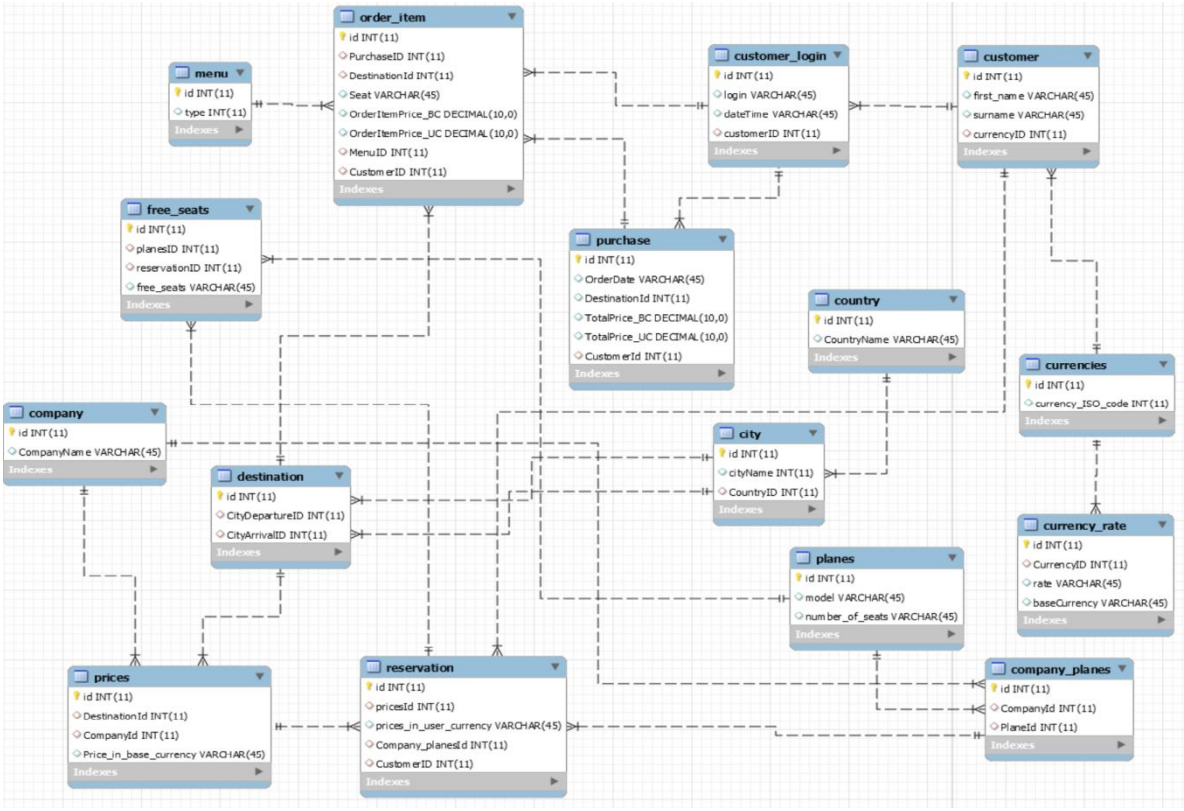


Fig. 3. EER – model
*Source: Own elaboration*

To build the class diagram, the 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, choosing the cities of departure and arrival, fares and company is illustrated in this class diagram. Every step of booking is clearly seen and what is more, it would not be difficult to understand the whole process of operating system.

The next step is to design the database. It goes without saying that the system should contain a database that stores all information about flights, schedule, destinations and arrivals. Using MySQL, the database was created with all tables which are required for an appropriate understanding the essence of the project.

After the creation of a database, the important point is the development of data models and provide a method for determining the data and the relationships between them.

In this project it was appropriate to use MySQL Workbench, 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. What is more, MySQL Workbench provides an opportunity to create the "entity-relationship" model. It is intended for detailed data warehousing of system design and documented nature of the system and how they interact with each other (Fig. 3).

From the "entity-relationship" diagram it is clearly seen 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 data about customer, prices of tickets, and seats. Thus, every table has a relation with other one or more than one, which shows clearly the whole process of ticket reservation system. The main point of the EER-diagram is to understand the connection between tables and to see what kind of information is stored in each table.

**Conclusions**

Working on the basis of Model Driven development is a good beginning and a huge step in the deepening of the development of such an information system as ticket reservation system

It should be noted that in the future this information model can be developed on different development platforms, which makes this project relevant and fast-growing.

One could draw the conclusion that intensive development of wireless technology, which is observed during the last five years, the trend has clearly defined that in the near future, numerous telecommunication services will be provided with incredible ease and in a free mode. One must remember that ticket reservation systems is an embodiment of information technologies which are connected with needs of nowadays society, where the needs to travelling are integral part of their lives. With regards to development an reservation system, it should be mentioned that one of the most important parts in the project is the modeling the process, which was successfully demonstrated in this article using such technologies as MySQL and UML

**Abstract**

Today, the global network provides a wide range of services related to the use of different information systems. With the development of information technology, the demand in electronic reservation is getting higher. Reservation is the the act of reserving a place or passage, or engaging the services of a person or group. The process of information system development is a time-consuming process, where modeling plays an important role. System modeling is the basis of software development, without which it is very difficult to achieve success in the project. Now, the most wide-spread way of system development is Model Driven Development, which has a lot of advantages over other systems and draws attention to the model. This style of software development was chosen in the project. An integral part of the modeling is the collection and processing of information. The information about all products can be extracted from a database. MySQL is an open-source relational database management system (RDBMS). Its surrounding is based on SQL (structured query language). UML (Unified Modeling Language) diagram was used to represent the structure of the model.

*JEL Classification: O3, O31.*

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