Model-driven development of event management system

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Electron Beam Technologies Conference is an international conference, which originated in 1985. The challenge for the management of this event, as well as the numerous such events that are organized every year around the world, is to provide improved (easier) way for the accomplishment of the process for both the participants and the organizers. One of the most promising approaches in the quality improvement of an information system is the Model Driven Development (MDD). It implements models at different levels of abstraction and applies the model transformation into a generated code. The main objective of this paper is to present an approach for model-driven development of event management system based on UML. The main requirements and data model of the system are modelled with UML use case diagrams, class diagrams and activity diagrams in order to achieve portable and reusable models of the system. The conceptual data model is implemented in a MySQL based database.

**Keywords** – Event management system, databases, model driven development, MySQL, UML.

Modelno bazirana razrabotka na sistema za organiziranе na sobvtija (Цветелина Иванова, Елена Колева Идилия Бачкова, Добрин Николов). Конференцията за електронно-лъчеви технологии е международна конференция, стартира през 1985 г. Предизвикателството за управлението на това събитие, както и на многообройните такива събития, организирани всяка година по света, е да предостави подобрен (по-лесен) начин за реализирането на процеса както за участниците, така и за организаторите. Един от най-обещаващите начини за подобряване на качеството на информационната система е използването на Моделно Базирана Разработка (MDD). Този подход използва модели на различни нива на абстракция и прилага трансформация на модела в код. Основната цел на тази публикация е да представи моделно базиран подход за разработване на система за управление на събития, основаващи се на UML. Основните изисквания и модели на данните са моделирани чрез UML диаграмите "случай на използване", "клас" и "активност", за да се постигнат преносими и многократно използваеми модели на системата. Концептуалния модел на данни е имплементиран в MySQL база данни.

**Introduction**

Nowadays the information systems develop very rapidly and dynamically. Modern society lives into the world of information technologies, which contributes to the emergence of various technological solutions. The key task of an event management system is to provide user-friendly and effective environment for: (i) the participants to make registration for any of the available events, uploading abstracts, uploading papers, applying for visas, requesting accommodation, etc. and (ii) the organizers to elaborate the event program, posting of documents, publishing materials, arranging the accommodation and the supporting events etc.

In order to develop such information system, effective methodological approach should be used. The subject of design should be adequately described in order to have a successful project implementation. This task is logically difficult, lengthy and laborious. Model Driven Development (MDD) approach is required for qualitative modeling, especially when the model is the primary development artifact [1, 2]. This method is highly effective and reliable for the development of such information systems as an event management system. The Model Driven Architecture (MDA), which is offered as a standard by the Object Management Group (OMG), is one of the most successful implementations of MDD [3] based on Unified Modeling Language (UML) [4].

This paper aims to represent an approach, based on MDD and MDA for the development of an event management system. The requirements for the developed system and the applied techniques are presented. The suggested approach based on UML use case, class and activity diagrams as well as on the long-term experience for the management of the
International Conference on Electron Beam Technologies [5] and other scientific events is illustrated.

**System requirements**

Currently the web page of the International Conference on Electron Beam Technologies [5] is based on a static model. Static pages represent the information from the server without additional modification. This creates a number of inconveniences in processing of the provided by the participants information.

With the development of information technology, the requirements to event management systems are getting higher. Online registration should provide a simple step by step process, which gives the registrar an easy way to simultaneously register for a conference, request a VISA and accommodation. The participant will also have access to his previous applications. This system will ease administrators by giving them an option to directly send emails, run reports, etc. It will improve the process of approving abstracts, papers, registrations and accommodation. The administrators will be able to use dynamically generated email templates, based on participant’s data, for VISA invitations, accommodation details, payment confirmations and invoices.

An important part of each information system is the ability to generate real time reports. Which helps the accountability especially for events requiring payment. Administrators will be able to generate real time financial reports, including invoices; reports for participants’ accommodation; initial event schedule, etc.

**Short review of the applied techniques**

1. **MDD and MDA**

Model-driven development (MDD) approach changes the way a software is developed by moving the focus to the use of models, which reflect different perspective and levels of abstraction [1, 2]. MDD is architectural meta-programming, which represents models as values and transformations map models to models [6]. Model Driven Architecture (MDA) is one of the most successful implementations of MDD. It is the Object Managements Group (PMG)’s standard for 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, shown in Fig. 1 [3].

The main features of the models are:

- **CIM** – is a business/domain model, which uses vocabulary to represent the basic expectation from the system and overcomes the difference between the domain experts and developers. It hides all specifications about the system implementation.
- **PIM** – is a system view without any implementation details. Its tasks are to model logical data, to define workflows and processes and to establish dependencies. In order to ensure higher degree of automated implantation of the models in the next layer (PSM), PIM models have to be complete and accurate.
- **PSM** – this model combines PIM specifications with the information of a specific platform, needed to enable system execution. The main role of this model is to ease the code generation through the implementation of PIM and the selected execution platform.

![MDA conceptual framework](image)

**Fig.1. MDA conceptual framework**

2. **UML and UML diagrams**

Unified Modeling Language (UML) is used to meet the requirements of MDD and MDA. UML is a graphical modeling language for visualization, design, specification and documentation of products created during development of software systems [4]. “Visual Paradigm” is a tool, which supports UML, SysML and Business Process Modeling Notation (BPMN). Models and their components are displayed with UML diagrams [7]. UML 2.0 consists of 13 types of charts, grouped in the following way:

- **Structural diagrams** show the static structure of the modeled system and its parts on different abstraction levels. These diagrams include class diagrams, component diagrams, package diagrams, object diagrams, deployment diagrams and composite structure diagrams.

Class diagram represents classes, their attributes and relationships between classes (Fig 2). Block diagram illustrates the internal structure of classes and communication with the outside world. Object diagram shows instance specification of classes and interfaces (objects), it also represents the static view of a system at a particular time. Component diagrams model the physical aspects of a
system and show components with their relationships. Deployment diagrams describe the static deployment view of a system, they show where the software components are deployed. Package diagram shows packages (semantically related elements) and their dependencies.

- **Behavior diagrams** show the dynamic behavior of the objects in a system. They describe the functionality of the software systems. Behavior diagrams include use case diagrams, activity diagrams, state machine diagrams, etc. [8]. Use case diagrams capture the dynamic aspects of a system, gather requirements of a system including internal and external influences, get an outside view of a system and show the operation of a system in terms of users and use cases. Activity diagrams are flowcharts of a system and illustrate the operational flow. State machine diagram describes the discrete behavior of a part of the modeled system from one state to another.

- **Interaction diagrams**, describe interactions among different elements in the model. The interactive behavior is described by two diagrams sequence and collaboration. Sequence diagrams such as communication-, timing- and interaction-focus on time sequence of messages. Diagram of cooperation (collaboration diagram, diagram of communication) focuses on structural organization of objects which are involved in the interaction. Timing diagram shows the timeframe of the project.

### 3. Databases and MySQL

All the information in the site is stored and previewed from a database. Data is a specific piece of information that is formatted in a concrete way. Data are also all the elements, which are stored in a database, separately or as a set. Database is an organized collection of logically related data that are structured in a specific way [9]. Databases are separated to different fields of application. Database management system is a set of programs, which manages multiple databases. It combines language and software to provide access to data; gives the user the ability to insert, modify and delete data; provides data security; eases backups; provides integrity which is facilitated by creating logs, locking, triggers; provides user interface such as SQL interface for relational databases. Data can be accessed through Structured Query Language (SQL), which main task is to provide a simple way to read and modify data and database structure.

The proposed event management system requires dynamic web pages providing interactive features with the users. The web site, which is executed on the middle-layered web server, as shown in Fig. 3, has to submit a request to the database through the DBMS (MySQL). It abides on the data storage server, retrieves the desired information and displays it in a human readable way. In the given example, the open-source scripting language PHP [10] is used. The PHP interpreter provides a processor for executing PHP commands, creating the corresponding HTML and sending it to the client. MySQL is used as DBMS. It is open-source and distributed under the General License GNU (GPL, GNU Public License).
Fig 5. Use Case Diagram in respect to Customer actor

Fig 6. Activity Diagram for Conference Registration

Fig 7. UML class diagram
**Description of the suggested approach**

The development of an event management system for EBT conferences is chosen as an example of the suggested approach, based on Model Driven Development. The dynamic aspects of the system in terms of users and use cases are represented in Fig 4 and Fig 5.

The activity flow for the registration for a given event is described through the activity diagram on Fig 6.

The static structure of the system (in terms of classes and their relationships) is illustrated through class diagram shown on Fig 7. The diagram describes the processes of registration of a user; registration for a conference; requesting a VISA invitation; requesting accommodation; sending emails with VISAs invitations or with invoices; uploading and approving abstracts and papers.

Generation of the database is the step after modeling. The database stores all the information for users, conferences, accommodation, VISA details, abstracts, papers, organizations, users’ conferences, modifications of titles, authors. MySQL Workbench was used in the project. It is unified modeling tool for data modeling, SQL development, server configuration, user administration, etc.

The logical structure of the database is represented through “entity-relationship” diagram, shown on Fig 8. This diagram illustrates the tables and their relationships. “Visual Paradigm” was used to build all of these diagrams.
Conclusions

The modelling is one of the first most important things in all fields of engineering based on the transition from a directly code creation to model-driven development. With regards to the development of an event management system for EBT conference, it should be mentioned that some of the most important parts of the project are the modellling of the process and the structure of the system, which were successfully demonstrated in this article using UML and MySQL. The represented information model can be implemented on different platforms, which makes this project relevant and fast-growing.

REFERENCES


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