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Applications

Development Environment for Building Common Catalogue for Representation of the Culture-Historical Heritage of Bulgaria*

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Abstract: *This paper presents the current state of development environment for building common catalogue for representation of our culture-historical heritage. To achieve this, we choose model-driven development approach (MDDA), which is based on the ideas of Object Management Group (OMG) for flexible evolution and standartization of software. In the paper the basic ideas and principles for building a UML-based platform independent model (PIM), based on the CCO (Cataloguing Cultural Objects) standard are presented, and the development environment BECC as well.*

Keywords: *CCO, UML, modeling, BECC, electronic catalogs, MDA, MDDA, PIM.*

1. Introduction

Cultural-historical heritage is the immanent values of the society, whose importance is increasing constantly. In the current state of globalization, our choice of surrounding and quality of life will be determined by our heritage. It is powerful and irreplaceable resource for cultural survival and firm advancement. Due to its unique geographical location, our region was crossroad for many tribes for thousands of years. It was cradle for one of the oldest cultures in Europe and the world. This enormous cultural heritage is little known outside Bulgaria. Modern information and communication technologies are not used in their full potential to promote and advertise this cultural heritage.

The goal of this paper is to present the current state of development environment for building common catalogue for representation of our culture-historical heritage [11]. It contains mainly a common meta-catalogue [7] for presentation of classification

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of cultural works, based on proposition of UNESCO. A major aspect for assurance the interoperability of the catalogue is the usage of appropriate standard, which facilitates homogeneous description, efficient search, shared usage and management of cultural-historical works. The employment of such a standard makes possible sharing of information between different cultural institutions, museums, universities, etc, usage of the catalogue in different areas and its inclusion in European and worldwide cultural networks. In this paper we will describe in detail the development of a platform-independent model of the catalogue, which is based on the CCO (Cataloguing Cultural Objects) [1] standard. Also we will present in brief the development environment, which was used for creating this model.

2. The CCO standard

A working version of the CCO standard is first published in February 2005 by *Visual Resources Association* [17]. It is specially designed for communities and organizations, which deal with description and documentation of work of art, cultural artifacts and their reproductions such as museums, libraries, galleries etc. Specialized bibliographic references are used as information sources. The authenticity of the references from which the information is gathered is very important, regardless of its nature – publication, the Internet, or unpublished expert's opinion. The respective institutions are responsible of taking decision about determining of the authenticity of the references. The possible choices for citation of these references are writing the citation into the created ontology's text field, or creating a link to the reference (using bibliographical reference files).

The standard mainly focuses on four control authorities, one work record and one image record.

- *Work record* – the data is stored using required and additional recommended elements that give concrete information about the cultural-historical work.
- *Subject authority* – contains subjects from the iconographic terminology, names from literatural, mythological and religious nature, historical events.
- *Concept authority* – contains terminology, needed for the description of work of art, the material that the work is made of, the activities involved with the work, style, role of the creator, etc.
- *Geographic place authority* – contains information about geographical locations of the cultural works and their creators.
- *Personal and corporate name authority* – contains information about architectural work, the individuals and corporations, connected with the cultural-historical work.
- *Image record* – contains an image of the cultural work.

Some of the standard advantages are:

- enhances the interoperability of the catalogue – it is possible to exchange information about our cultural-historical heritage with third party systems, that are compatible with CCO;
- eases the shared usage of information resources of different subject catalogues;
- offers unification of the data structures;
- eases the design of the databases, that will store the information;

• enhances the possibilities of parameterization of the catalogue;

• simplifies the interfaces with Web Services, designed for working with the catalogue and servicing the users.

The standard has its disadvantages, for example it is big in size, which makes it difficult to use. In addition, a major obstacle in its employment in computer system is the fact that it is not fully formalized and cannot be used for development of supporting software. Thus a major task is the creation of formalized model, describing the basic conceptions of CCO.

The above mentioned authorities to be created independent of each other, is an essential requirement of the standard. They have to be created by experts in the field, so that the containing information is authentic. At the same time particular catalogue components have to be used autonomously, shared or synchronously, keeping the integrity and the consistency of the catalogue. We try to solve this problem by help of intelligent agents [12,13].

CCO application presumes keeping a large variety of structures and relationships. In order to investigate an effective approach we intend to use different kind of ontologies [13].

3. Our approach

The development of the architecture of an electronic catalogue of the cultural-historical heritage of Bulgaria that can be easily adopted and personalized for convenient usage of different groups of users is a complex problem. In addition the catalogue has to conform to the CCO standard. The main difficulty about using this standard is the fact, that there is no convenient formal representation available for it. Another serious problem is the lack of homogenous middleware, which can provide sufficient flexibility of the desired architecture. By these reasons we have adopted a systematical approach, resulting from Model-Driven Architecture (MDA), which is created by Object Management Group (OMG) [15]. MDA [6] addresses two basic components:

• platform Independent Models (PIM) – a PIM provides formal specifications of the structure and function of the system that abstracts away technical details;

• platform Specific Models (PSM) – a PSM is expressed in terms of the specification model of the target platform. PSM have to use the platform concepts of exception mechanisms, parameter types (including platform-specific rules about objects references, value types, semantics of call by value, etc.), and component model.

Based on the MDA principles our approach includes the following development steps:

• development of a UML-based [14] PIM of the catalogue, which includes a formalized presentation of the CCO standard;

• development of a PSM of the catalogue by means of appropriate mappings to a Service-Oriented Architecture;

• enhancing the architecture by intelligent agents, supporting creation and usage of the catalogue;

• creating and integration of classification ontologies of the provided culture-historical objects.

4. UML-based PIM for the electronic catalogue

In this part we will describe briefly the PIM catalogue, which is one formalized representation of a specification of the CCO standard. For formal notation we have chosen UML [9,10,16] and XML [4].

4.1. General model of the standard

The standard mainly focuses on four authorities, one Work record and one Image record for every cultural-historical work (Fig. 1). The authorities are: Geographical places authority, Personal and Corporate name authority, Concept authority and Subject authority. A Work record is created for every cultural-historical work that will be contained in the catalogue. The authorities are shared among all the works and contain terminology, which is used during the classification and categorization of the work and its image, i.e. information about people, locations, works and conceptions connected to the works in the catalogue.

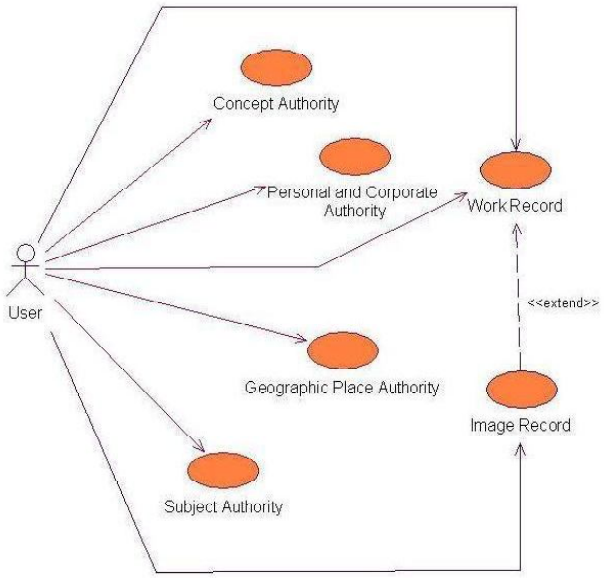

Fig. 1. General functionality of the standard

4.2. Modeling of Work **Record**

In a Work Record the data are stored as entries in the *"Required elements" & "Additional recommended elements"* fields. These elements give brief and accurate information about the catalogued cultural-historical work. Every required element has its own functionality, which stores concrete data, characterizing different aspects of the information available for the work. The information in each of these elements is entered using strictly followed, well defined rules for sustaining exact and correct terminology. The Required elements (Fig. 2) define the most important information

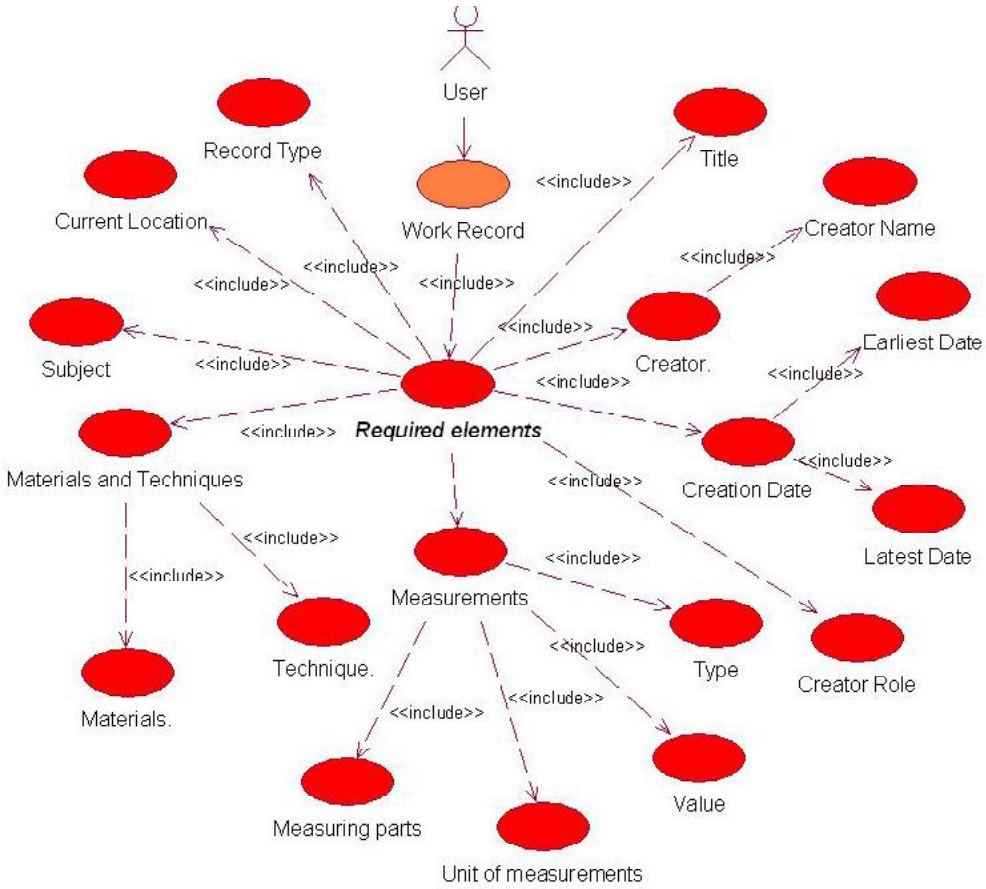

Fig. 2. Required elements of a work

for a cultural-historical work, such as: ***Work Type, Title, Creator Display, Role, Measurements (****Type, Unit, Value), Measuring Parts*, ***Materials and Techniques, Creation Date, Current Location*** etc.

Some of the Additional recommended elements include (Fig. 3)***:****Type of title (additional element to Title)*; *Language of the title (additional element to Title)*; *Sources (additional element to Title)*; *Record Type*; *Shape (additional element to* ***Measurements****)*; *Format (additional element to* ***Measurements****)*; *Color (additional element to* ***Materials and Techniques****)*; *Prints (additional element to* ***Materials and Techniques****); Physical Description Note (*additional *element to* ***Materials and Techniques****)*; *Examination History (additional element to* ***Materials and Techniques****)*; *Treatment History (additional element to* ***Materials and Techniques****)*; *Style*; *Culture*; *Creation Location*; *Discovery Location*; *Former Locations; Class; Description*; *Description Note; etc.* The elements *Relationship Type* and *Related work* are used for detailed description of the relationship between two records of a work.

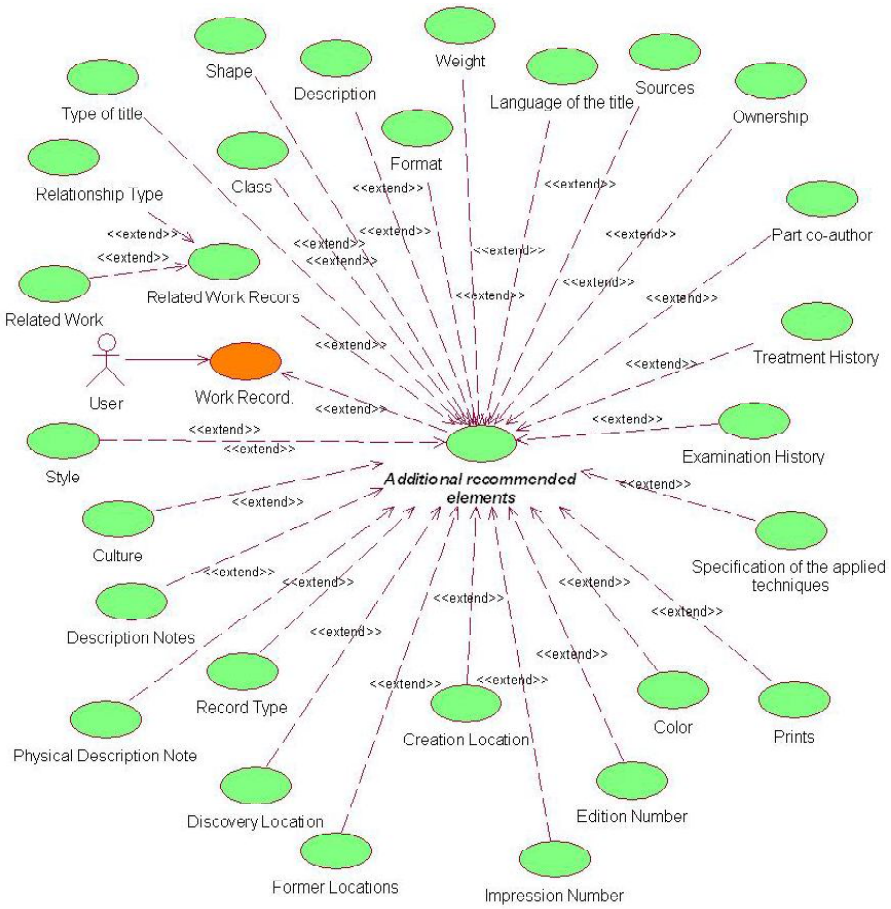

Fig. 3. Additional recommended elements of a work

4.3. Modeling of the subject authority

The Subject Authority Model (Fig. 4) should be reserved for iconographical terminology, including proper names of literary, methodological, or religious characters or themes, historical events and themes, and any other terminology needed for subjects that fall outside the scope of the other three authorities. The Subject Authority is union of records, whose elements are qualified as required and additional. Required elements represent the minimal amount of information that must be present in the fields of a record, such as *Subject Name*; *Sources*; *Display Border Context*; *Indexing terms*; *Related Subjects*. Additional recommended elements represent fields, which are populated, only when there is information about them. They are not mandatory, but their filling is desirable for completeness of the record. Some additional elements are *Record type*; *Relationship Type*; *Related Geographic places*; *Related People and Corporate Bodies*; *Related Subjects*; *Dates*; *Notes.* The subject authority performs some controlling functions as well. It is responsible for *Controlling the elements of the record for a work, Controlling the "Subject" element of a work,* and *Mutual control between the subjects in the authority*.

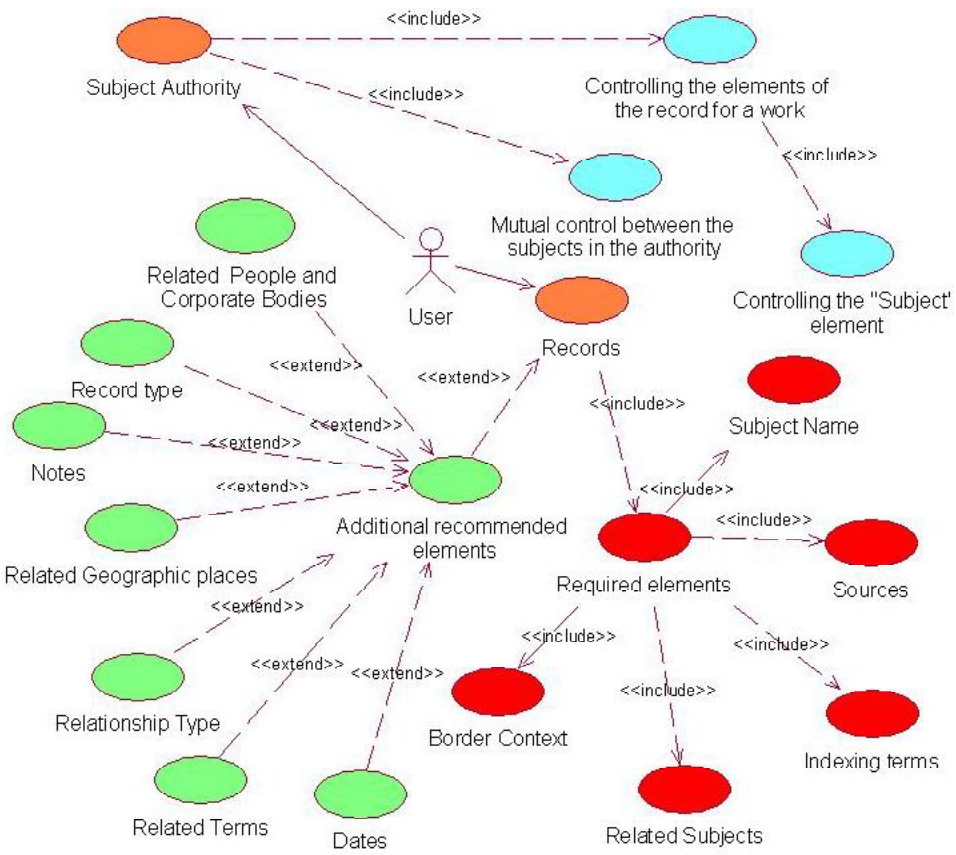

Fig. 4. Model of the subject authority

4.4. Modeling of the Concept Authority

In the Concept Authority Model, dividing terms into various logical categories (called facets in the field of thesaurus construction) will make the authority more useful and easier to maintain. Terminology could fall into the following categories: works, materials, activities, agents, style, periods, and cultures, physical attributes, associated concepts. This authority contains much of the terminology needed for the works and the description archives, excluding the characterizing names. In this way it can be described as authority, containing information about family concepts. This authority may include terminology to describe the type of work (e.g., sculpture), its material (e.g., bronze), activities associated with the work (e.g., casting), its style (e.g., Art Nouveau), the role of the creator (e.g., sculptor), and other attributes or various abstract concepts (e.g., symmetry). It should not include proper names of persons, organizations, geographic places, named subjects, or named events. The Concept Authority reveals the general functionality as an authority file, logically structured as an encyclopedia. Required elements comprise the minimum (required) elements, needed for the creation of a correct record in the Concept Authority. Examples of such elements are: Terms, Notes, Source. Additional recommended elements are used for a more detailed

description of a cultural-historical work. These elements are recommended, but are not mandatory for creating a correct record in the Concept Authority. Examples: *Record type, Border Context, Related concepts, Relationship Type, Date, Reciprocal control, Current control, Control lists, Source Authority.* The control over the elements of a record for a cultural work by the Concept Authority ensures consistent usage of the data, stored in the record.

4.5. Modeling of the geographic place authority

The Geographic Place Authority Model contains information about geographic places important to the cultural works and the creators. Geographic places in this authority include administrative entities and physical features. Physical features include entities that are part of the natural physical condition of the planet, such as continents, rivers, and mountains. In the context of this authority, administrative entities include man-made or cultural entities that are typically defined by political and administrative boundaries, such as empires nations, states, districts, townships, and cities. Required elements are used for storing information about all the essential elements of the geographical place that is being catalogued. Examples: *Names, Preferred, Alternates, Place Type, Broader Context, Sources.* Additional recommended elements are used to add additional information about the geographical place, on discretion of the author. Examples: *Related Place, Dates, Notes, Relationship Type, Coordinates, Record Type.* The Geographic Place Authority controls five elements of the work record.

4.6. Modeling of the personal and corporate authority

The Personal and Corporate Name Authority Model contains names and other information about artists, architects, studios, architectural firms, and other responsible for the design and production of cultural works. This authority may also contain information about patrons, repositories, and other people or corporate bodies important to the record for the work. This authority includes records for single individuals (persons) or two or more people working together (corporate bodies). Required elements are used to store information of the essential elements. Examples: *Name, Preferred name, Alternates name, Display biography, Birth Date, Death Date, Nationality, Life Role, Source.*Additional recommended elements are using to store nonessential, but descriptive information about the persons or the corporations. Examples: *Record t*ype, *Person, Corporate Bodie, Broader Context, Gender, Date of activity, Earliest Active, Latest Active, Events, Relationship Type, Related People, Place/Location, Birth Place/Location, Death Place/Location, Related People and Corporate Bodies.*

5. BECC development environment

One of the purposes of the BECC (Bulgarian Electronic Cataloguing Cultural) development environment is aiding in building the PIM of the catalogue of cultural-historical heritage, using the CCO standard. In a next step the generated catalogue structures will be integrated in the catalogue architecture according PSM. The development environment is shown in Fig. 5. The user can use the following editors while using the environment:

• *editor for work record* – for creating the cultural-historical work that will go in the catalogue. (Fig .6);

• *editor for Concept Authority* – for creating of the Concept Authority (Fig. 7);

• *editor for Personal and Corporate Authority* – for creating of the Personal and Corporate Authority;

• *editor for Geographic Place Aauthority* – for creating of the Geographic Place Aauthority;

• *editor for Subject Aauthority* – for creating of the Subject Aauthority;

• *editor for the ontology* – used for the creation of ontologies (metacatalogue);

• *editor for user profiles* –used for creation of user profiles, based on the user model.

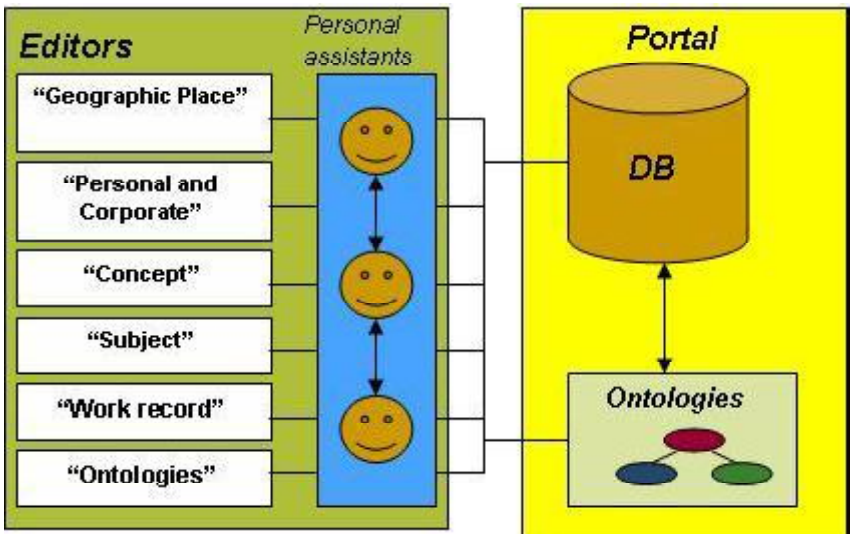

Fig.5. Architecture of the development environment

Each of the editors works in autonomous mode. If needed, the communication is carried by their corresponding agents that service them. In example, if while entering information about certain work in the work record the user wants to enter a historical person, then the corresponding agent needs to communicate with the agent of the Historical Persons Authority, which in turn will check the authenticity of the entered information. This way we are providing a controlled access to the information in the catalogue. The usage of agents gives us outstanding opportunities for building distributed configurations of the catalogue, in which different editors can be deployed on different servers.

The presence of agents is transparent to the users – they perceive the editors as monolithic software. Agents track the actions of the users and try to aid them. Such helper software can provide invaluable orientation in the vast volume of information, offered by the catalogue, in preparation of correct queries for selection of the desired objects, in using information from the authorities, etc.

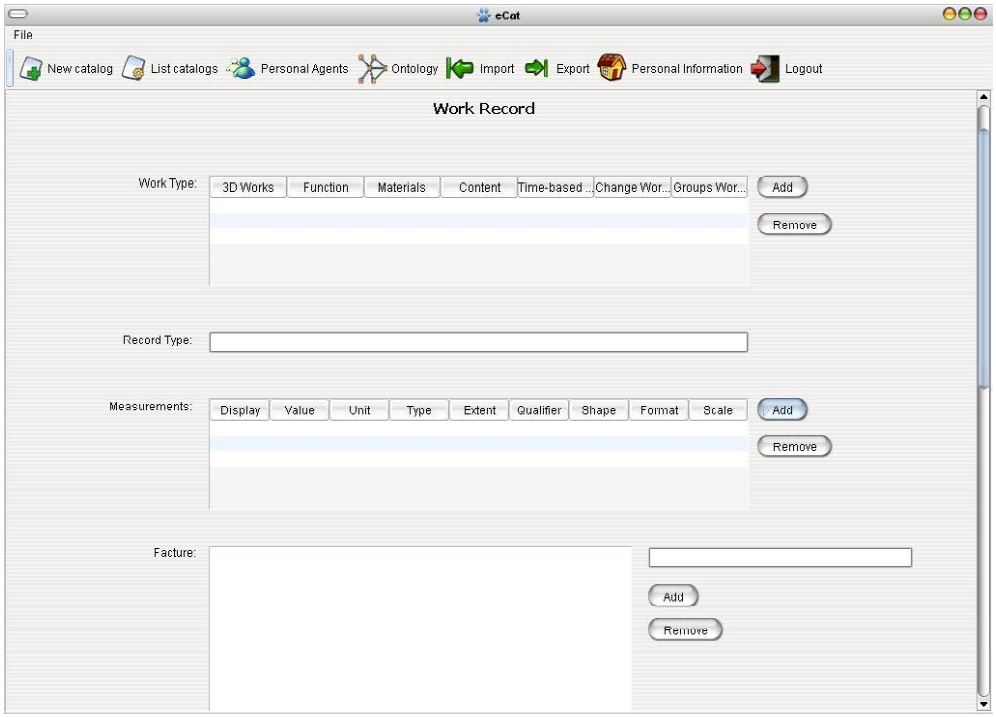

Fig. 6. Work record editor

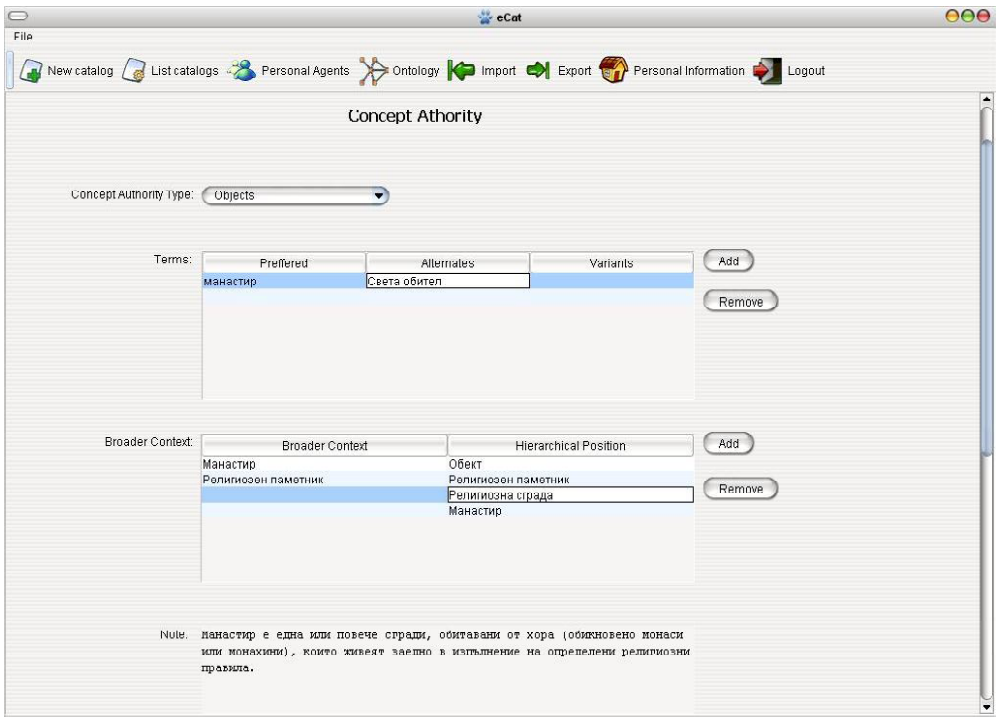

Fig. 7. Concept authority editor

6. Conclusion

This paper presents in detail the development of a platform-independent model of the catalogue of Bulgarian Cultural-Historical Heritage that is based on the CCO standard. The development environment BECC is also shown in brief. Currently we are developing the first version of the catalogue in J2EE [3, 2] development environment. Agents are developed using the JADE tools [5] and the catalogue ontologies are created by help of Protege editor [8].

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