ONTOLOGY SUPPORT FOR MANAGEMENT OF PUBLIC AUTHORITIES

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ABSTRACT
The paper introduces a pattern for issuing an identity card using ontology, exemplified in a case study starting from the current state and improving the model using top technology and the experience of EU Member States in this area of activity with reference to public administration. The importance of the paper stems from the need of more efficient electronic services demanded by increasing needs of the citizens in terms of costs and time, which can be achieved through the efficiency and the effectiveness of a modern management. The contribution of the paper will be based on the pattern developed as a starting point for further research aimed to improve the management of transparent, secure and efficient electronic services for the citizen and the business environment.

KEYWORDS
Ontology, management, electronic services, ID card, mobil ID, public authorities.

INTRODUCTION

Nowadays, the modern economy is experiencing continuous transformations in order to adapt to the information society where the citizen is the priority of the public authorities supported by a dynamic and continuous developing information technology. Current forecasts increasingly support the imminence of a new financial crisis caused by certain factors which influence the economy. This crisis, which would take by surprise the information society, has determined the public authorities' management to develop flexible and optimal strategies that can provide efficient electronic services as soon as possible, with low costs . In hard times determined by certain factors such as a crisis, the quality of management performance and the ability to use all resources for serving the citizen is paramount. This aspect emphasizes the importance of this paper to support decision-makers with a conceptual model on issuing an identity card using an ontology pattern. Furthermore, the necessity of the study comes also from the fact that ontology is being used on a wider scale, including different fields of activity such as the management of public authorities, eGovernment or electronic services, which justifies the interest in this field, the exploitation of the ontology and the development of a new conceptual model for decision-makers.

The purpose of the research is to improve the management of public authorities using tools and resources that allow an efficient supply of electronic services. The effectiveness of this management is achieved when the interest of decision-makers is in line with the goal of public authorities.

The main purpose of the paper is the conceptual, generic modeling of a life event, (ie. the release of an identity card) which would allow the authorities to meet the needs of the citizens and of the business environment, in particular. The specific objectives are circumscribed to this model by optimizing some processes and representing them with different graphical tools.

The result of this paper is based on the opportunity of the public authorities' management to optimize the activities that, in the process of continuous improvement, can exploit this conceptual model, thus becoming the starting point for further developments in this field.

1. ONTOLOGY – concepts

The field of ontology has evolved over the last period and its contribution to many areas has drawn the attention of important actors to the improvement of the management of public authorities. The term ontology has its origin in philosophy, from the Greek word „□v", which means existence and refers to the nature of existence (WOOLF, 1981). This concept penetrates the field of computer science where it shapes the domain of knowledge, using classes, properties and relationships between class members (Hayes, 1985). In the 80's, the artificial intelligence community (IA) adopted the concept to refer to a modeling of knowledge systems (Sowa, 1984).

Ontology develops as a consistent conceptual basis that allows the building of classes with specific properties in different domains and the relationships between them, which refers to citizens and computing systems. The most frequently quoted is Gruber T.R. which defines ontology as a „program by defining a set of representational terms" or "explicit specification of a conceptualization" (Gruber,1993). Several years later, Borst presented ontology as a „formal specification of a shared conceptualization" (Borst,1997) and Studer et al. (1998) explained it as „a formal, explicit specification of a shared conceptualization".

Another definition is presented by Berners-Lee et al. (2001) as a term already adopted by the IA and the Web domain, "document or file that formally defines the relations between terms".

Taking into account the evolution of ontology, these concepts have developed in relation to the level of generality, and so we have several types of ontologies such as domain, upper and hybrid (Andone, 2005). A domain ontology is a worldwide concept. This type of ontology uses very specific concepts and this is why we could speak about the incompatibility between these concepts. Upper ontology is a model that contains concepts like space or time . These concepts can be applied in domain ontologies. The last type of hybrid ontology describes concepts that depend on the other two ontologies. Based on these concepts, a number of methodologies have been developed that can become the starting point for building other ontologies for different areas of activity. Below we will present three more relevant methodologies.

The first methodology was developed by Ushold and King proposing an ontology that contained the purpose, construction, evaluation and documentation, but it did not contain details and recommendations about formalizing ontology (Ushold and King, 1995).

Another methodology has been proposed by Grueninger and Fox regarding the creation of an ontology for enterprise models, which provide a framework used to evaluate the adequacy of ontology. The disadvantages of this methodology refer to the techniques used (Grueninger and Fox, 1995).

The third methodology, called Methontology, was originally created as an ontology for the chemical profile which doesn't have the disadvantages of the other two methodologies and is built using the following steps: specification, conceptualization, formalization, implementation and maintenance Lopez et al. (1999).

Building an ontology implies a complex activity given the difficulty to identify classes and the relationships between them. It can not be said that there is a general framework that can include several domains. The methodologies developed can create the premise of new conceptual methodologies if they go through certain steps. The first attempts to identify the steps for building an ontology are found in Gomez-Perez's papers. The disadvantages of this methodology refers to the applicability and reuse on a new domain, which is a hard process and will last until consistent results are achieved (Gomez-Perez, 1998).

At the same time, there are several approaches which refer to the creation of a new ontology. The pragmatic approach implies the construction of classes and relationships between them, the latter being the most common. The empirical approach is used for human knowledge (Smith and Mark, 1999) and the theoretical approach focuses on the conceptualization of existing researches. (Andone, 2005)

This research involves creating a generic conceptual model that provides an instrument for decision-makers from public administration to respond efficiently to the needs of the citizen, who knows exactly what he needs when using electronic services.

Since citizens can use different e-services through a portal such as e-romania, ghiseul.ro, e-government, there are still many things that need to be improved to reach a high level of management, and thus meet requirements comparable to other EU Member States.

2.CREATING A LIFE-EVENT ONTOLOGY (LE) ABOUT ISSUING AN ID CARD

We assume a scenario in which the citizen wants to issue the identity card, from the Directorate for Persons Record and Databases Management in Bucharest (DPRDM) and from the local authorities.

We will consider the life event (LE), we will build an LE ontology for a citizen and the LE subontologies for persons' record and civil status, which include classes and related relationships.
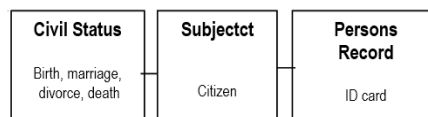

Figure 1. The relationship of a subject to civil status and persons record

It's very important to create an accurate conceptual model for the citizen, because this basic model will relate to other ontological systems. This ontological system can provide relevant data to the citizen, for example: civil status, information about vehicles registration, land or residence information, which can also be used by the business environment. So, the ontology of issuing an identity card is influenced by other ontologies, for example changing civil status following marriage, divorce or death, or changing physiognomy voluntarily or following an accident.

We will refer to a simple example, the sub-concept of issuing an identity card that relates to the person's record.

2.1.The current situation

The legal conditions for issuing of an identity card are described in Government Ordinance no.84 / 2001, approved by Law no. 372 / 2002 with subsequent modifications and additions. A citizen may request the release of an identity card at the age of 14,18, when the validity period of the identity card has expired, when he/or she has changed the civil status, in case of revocation of the document, change of sex or physiognomy, change of residence, street name or renumbering of the buildings, theft, destruction or deterioration and when he obtains Romanian citizenship.

To issue the identity card, the citizen must go to the DPRDM, file the application for the document and deposit the receipt of payment. The document is released within 30 days, at which time the citizen will have to go again to the same institution.

Next, we will use the UML diagrams to create the conceptual model. This UML diagrams are ways of representing the modeling components. Thus, using UML specific instructions, we have:

(Start)->Citizen->(Going to authority DPRDM)->(Submission of documents)->(Document check)->(Database access)->(Insert into database)->(Database check)->(Database update)->(ID card release)-> (Going to authority DPRDM)->(End)

The graphic representation of this conceptual model is presented in *Figure 2*, and refers to the current situation regarding the release of an ID card.
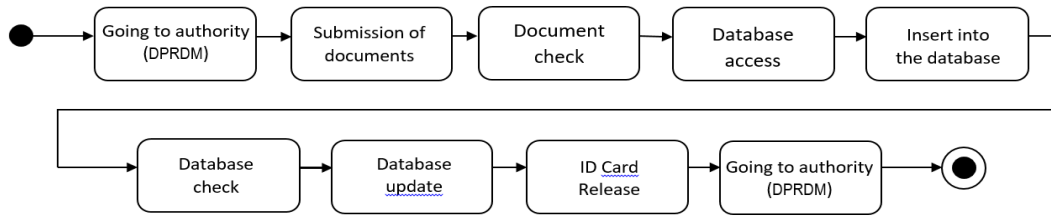
Figure 2. Activity diagram about the release of the ID card - current situation

2.2.Approaches

Improving this conceptual model implies optimizing these processes at the citizen level as well as at the level of the public authorities' management for the supply of public services. The solution proposed is to remove the instruction from UML diagram named *Going to authority DPRDM*. In this way, the citizen can access a portal, which allows the submission of documents online, so, the documents are delivered using a service provider to the citizen. If the authority requests a photo of the citizen, it can be used a software. This software will allow the image to be captured under certain security and formatting conditions, but at the same time will allow transmission to the public authority, following the model of some EU Member States such as Estonia or Sweden.

In this conceptual model, we have achieved process optimization in order to reduce the citizen's effort in terms of ravel expenses and the time spent to obtain this service. Thus, using UML specific instructions, we have:

(Start)->Citizen->(**Portal access**)->(Submission of documents)->(Document check)->(Database access)->(Insert into database)->(Database check)->(Database update)->(ID card release)-> (**Services Provider**)->(End)
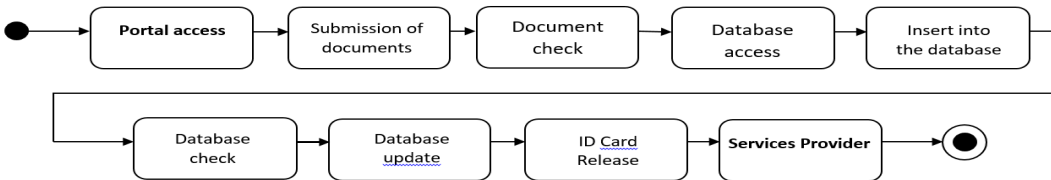

Figure 3. Activity diagram about the release of the ID card – Approach 1

Another approach, which can efficientize this conceptual model, is to take into account the fact that accessing a portal can be made from anywhere and whenever we want, from any mobile device. This would eliminate the need to move in order to access the portal from a computer and at the same access would not be conditioned by a location, where this e-service can be accessed.. The involvement of mobile ID technology allows electronic identification and mobile authentication. This idea has attracted the attention of political factors and the management of authorities from other EU Member States as a technology of the future that benefits the citizen. That's why implementation and operationalization has already begun in some EU Member States, such as Estonia, where mobile ID also allows digital signature of documents.Thus, the new conceptual model will change the UML instruction from the diagram *Portal access* with *Mobile ID*, and the *ID card release* will be replaced with a phone card customized with the data of each person. The solution optimizes intermediate processes to support the management of public authorities that prioritize the needs of the citizen. This conceptual model is described in the following UML-specific instructions:

(Start)->Citizen-> (**Mobile ID**)->(Submission of documents)->(Document check)->(Database access)-> (Insert into database)->(Database check)-> (Database update)->(End)
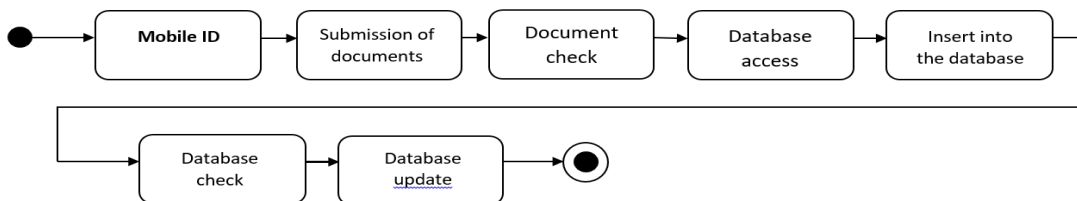

Figure 4. Activity diagram of the Mobile ID ontology- Approach 2

Switching from ID card to mobile ID (mID) is already implemented in some EU Member States, thus being a challenge for public authorities management and an opportunity for citizens and business environment. Whatever approach is used, an important role is the cooperation between political factors, public authorities, mobile provider, banks and citizens for the success of this switch. Stronger government involvement and efficient management of the authorities are a relevant factor for increasing the number of citizens using mobile ID.

With the introduction of the mID concept, digital governance is moving to another stage, as public authorities, through mobile identification and authentication, will gain more and more trust among citizens. The increased use of mID will make the transition faster towards mGov, where challenges and opportunities are valid for all stakeholders involved.

3. GRAPHIC REPRESENTATION
3..1.Representing the relationship between concepts

After we have identified the classes of the conceptual model, we will describe the relations between these concepts. The interpretations of these relations will be based on concepts directly involved in eAdministration: citizen, user profile, LE, person records, civil status, electronic services, legislation, public administration, rules, inputs, outputs and electronic documents.

Taking into consideration the fact that the *citizen* can request from the public administration more electronic services related to person records or civil status for a *LE*, we will outline the *profile* of these public services. The most accurate description of this profile contributes to optimizing the flow of information between the public administration and the citizen, where the inputs and outputs are created based on well-established rules. The request of more than one electronic service by the citizen, based on *inputs* that can be determined by a photo or an *electronic document*, must not allow duplication of processes or reduction of security measures on *outputs*, when an electronic document is released. The inputs and outputs are represented by electronic documents built using a set of restrictions established by rules. The rules are issued by public authorities and applied to electronic services.

In our example, the request for issuing an ID card is restricted by the legal provisions, by public authority management or by technical measures determined as a result of the database check for providing the electronic service. We have established a set of rules on the release of the ID card, according to the level:

a)   *Legislative,* when they can be released only under certain conditions, e.g. at the age of 14 or when the validity period of the identity card has expired, and so on*;*

b)   *Management* of the public authority by optimizing intermediate processes leading to the improvement of the decision process, such as the elimination of double processes, for example, to request more services, the citizen must use single sign on identification and authentication, and so on;

c)   *Technical*, caused by security measures such as authentication attempts up to three times, password complexity, or if we are talking about facial recognition for identification and authentication are required technical measures related to the phone's video camera, and so on.
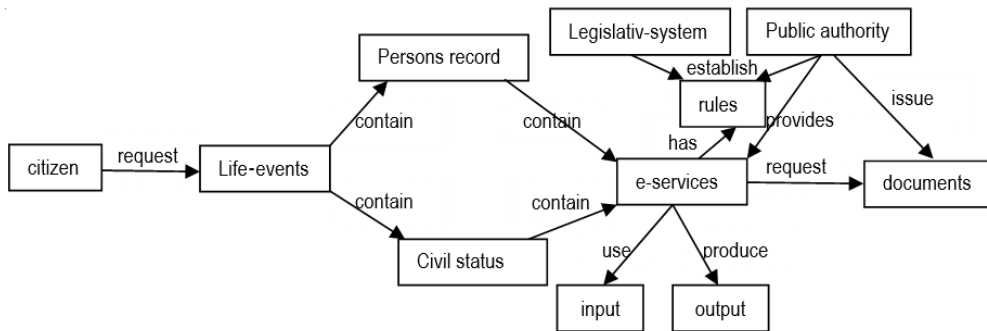

Figure 5. The relationships between concepts

3.2.Building ontologies using Protégé

The Protégé editor is an open source platform that allows the construction of conceptual models and applications using ontologies, and provides a set of tools for creating the models. The Protégé editor for ontology modeling has two ways of modeling ontologies, the Protégé frame and Protégé OWL. Protégé frame editor is based on building an ontology on frames and contains classes, slots for properties and instances. Protected OWL editor is for users who want to build using Semantic Web. This OWL editor uses classes, properties, instances and reasoning. For more details about Protégé editor and the two modules, you can learn on the free platform at https://protege.stanford.edu/.

The concepts described in the generic pattern refers to the activity of issuing an ID card. This includes, as we have specified, classes, relationships and rules. Using the Protégé editor, we can represent classes, properties, and instances to identify solutions to improve this conceptual model. The following figure presents the relationships between classes and subclasses and the graphical representation:
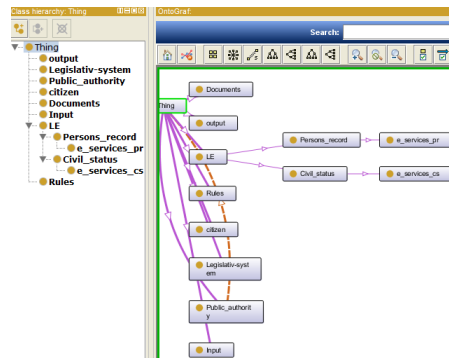

Figure 6. The relationships between classes and subclasses

To develop the conceptual model at the classes level, you can assign properties, rules, instances that can make more efficient information flow and optimize processes. With more conceptual details for these classes by identifying efficient properties and rules, we can create an improved conceptual model.

The Protégé OWL editor has enough tools to allow the construction of an improved conceptual model. This is the main objective of public authorities management.

CONCLUSION

Electronic governance is already a concept that has a well-established place in the modern economy. Although there are still EU Member States that have moved more slowly towards using it. In the meantime others are moving towards a new form of governance. mGov, which will open up opportunities and challenges for the stakeholders involved. Ontology stands up to this trend and sustains it with different types of models, the construction of conceptual models to improve the management of public authorities (Wimmer, 2007). The research was based on the instruments provided by these conceptual models and mobile ID technology that is used as pioneering in some Member States. The study of the conceptual model initially started from several concepts, some basic elements using different tools and representations and has enriched itself throughout the research. This is offering a better generic pattern. The resulting conceptual model is the starting point for the exploration and development of this domain, which has, as a priority, the citizen. However, the key factors for the efficiency and effectiveness of any generic pattern are the common interests of management together with those of public authorities.

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