INTEGRATING BUSINESS RULES INTO THE WEB DEVELOPMENT PROCESS

JEHAD NAJJAR
Dept. of Computer Science
K.U.Leuven
Celestijnenlaan 200A,
3001 Leuven, Belgium
jehad.najjar@cs.kuleuven.ac.be
Tel. +32-1- 6327 660
Fax: +32-1-6327 996

ABDALGHANI MUSHTAHA
WISE, Dept. of Computer Science,
Vrije Universiteit Brussel,
Pleinlaan 2,
1050 Brussel, Belgium
abdalghani.mushtaha@vub.ac.be
Tel. +32-2-629 3713
Fax: +32-2-629 3525

Olga De Troyer
WISE, Dept. of Computer Science,
Vrije Universiteit Brussel,
Pleinlaan 2,
1050 Brussel, Belgium
Olga.DeTroyer@vub.ac.be
Tel. +32-2-629 3504
Fax: +32-2-629 3525

ABSTRACT:

In this paper we propose an approach to integrate business rules into the web site development process. This approach is given as an extension of the Web Site Design Method (WSDM) [8, 9], developed previously in our group. In our approach the business rules are integrated throughout the phases of the web development process defined in WSDM methodology. In the first phase business rules are observed as business policies of the enterprise. In the second phase business rules are documented and mapped to the different audiences which are defined in the audience modeling phase of WSDM. In the third phase business rules are modeled conceptually using ORM (Object Role Modeling)[10]and RIDL (Reference and IDea Language[7]). The business rules are defined on top of the conceptual model of the web site.

KEYWORDS:

Web design, Web methodology, WSDM.

1. INTODUCTION AND MOTIVATION:

There has been a tremendous increase in the usage of the Internet to serve our daily needs and operations, e.g. accessing or submitting course material at the university, buying or renting a car, reserving a room in a hotel, booking a flight ticket, etc. These kinds of businesses require some rules and constraints. Therefore when a web designer develops a web application he has to take into consideration these rules and polices. Furthermore, a good web site or web application should satisfy the customer needs and the designer should also take into consideration the usability of the web site (e.g. the web site should be simple, understandable, all information should be reachable in an efficient way, etc). To achieve all of this the web developer needs to be skilled and experienced.

However experience and skills may differ considerably from one developer to another. A solid methodology for web development (also called Web Engineering) could overcome this. This methodology should also support the business polices and constraints relevant for the application.. We propose a strategy for web site design that on the one hand will result in a web site that satisfy the needs of the customers and on the other hand will cover and deal with all the business policies and operations. To achieve this, business rules must be discovered, documented and modeled and this as early as possible in the web site development process. Contrary to existing methodologies [2-4, 6], which all start and focus on data available in the organization or on the structure or data of the organization, WSDM is an audience-driven methodology. It is a powerful methodology; it starts from the requirements of the audience, documents, and models them and let them drive the structure of the web site. However, WSDM [8, 9] did not consider explicitly business rules and constraints while developing the web site. The method could be improved if the business rules were integrated through out the life cycle of the web development.

In this paper, we extended WSDM to take business rules and constraints into consideration during the development of a web site. In the first phase business rules are observed as business policies. Business policies are the general policies that the company has. Then they evolve into the second level as business rules. In this phase, business rules are documented and mapped to the audience (users) classes. At the third level business rules are modeled conceptually and intergraded in the web site conceptual model. Finally business rules are implemented using any data base application. By considering the business rules at the early stages of the web development process, traceability of the model during development is increased. This approach can cope with changes in the specifications during the development. Furthermore, it increases the maintainability and the effectiveness of the website. This will lead to successful web applications in general and e-business in particular

The overview of this paper will be as follows: In section 2, we will address the WSDM approach an life cycle. In section 3, our approach is explained in detail. In section 4 and example will be introduced to illustrate how business rules will be models and integrated into the web development process

2. WEB SITE DESIGN METHOD (WSDM):

The main characteristic of WSDM is the audience driven approach. So WSDM takes the requirements of the users of the web site as a starting point and uses this as basis for the structuring of data and the web site afterwards. WSDM gives consideration to the fact that web sites usually have different types of visitors that may have different needs.

WSDM conceptual design, which is free of any implementation details, is separated from the actual implementation design, like the presentation: the grouping in pages, use of menus, static and dynamic links etc.

From the fact that each intended audience(s) has his own requirements, and each web site has different 'kinds' of users, WSDM uses the concept of Audience Class. As an example, at the web site of Car rental Company we may distinguish the following users: Rental-Operator, Customers, and organizations-customer. Different users have different requirements, sometimes even different presentational needs, e.g. old people need special font size and color, while children may prefer a more use of pictures and animations.

WSDM classifies the users of a web site into audience classes: each audience class has its own requirements and characteristics. This may be reflected in the context (not all info for all users) and in the interface (language, jargon, look-and-feel, etc.).

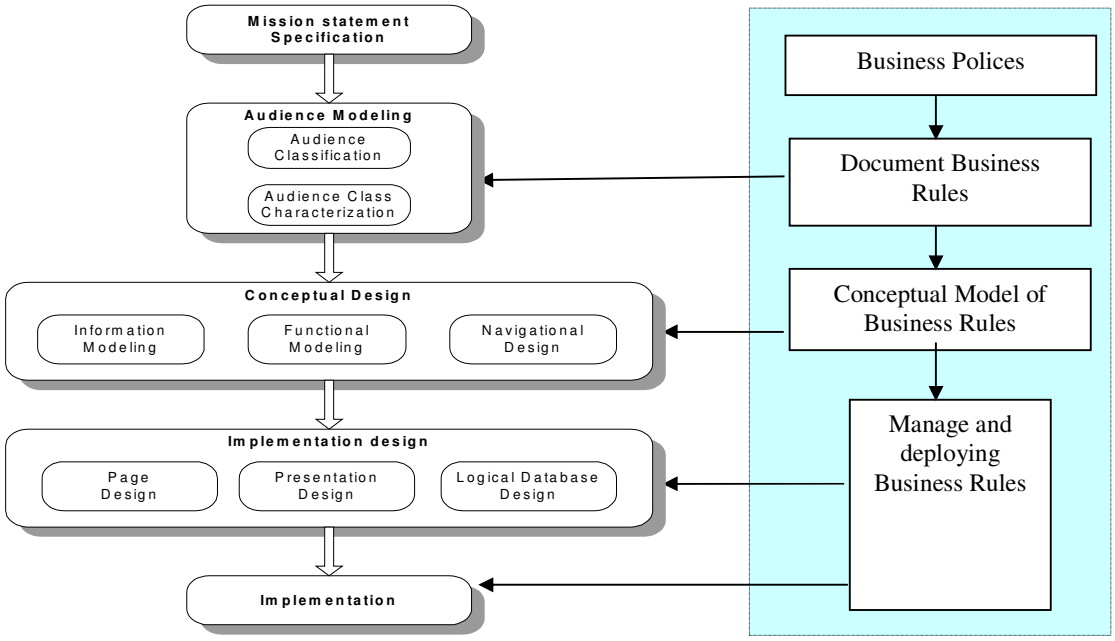

Figure 2.1: Approach overview

The division into audience classes has as the advantage that the site is more adapted to each user's needs, which will enhances the usability and the user satisfaction.

At left part of figure 2.1 above, an overview of the WSDM method is given. The first step is to define the Mission Statement. The Mission Statement should express the purpose and subject of the web site, and declares the target audience.

Based on the Mission Statement, the Audience Modeling is performed, in two steps: Audience Classification and audience class Characterization. During the Audience Classification phase, the different types of users are identified, while during Audience

class Characterization, characteristics of the different Audience Classes are given.

Next, Conceptual Design, in three steps: Information, Functional and Navigational Modeling. During Information Modeling we observe what kind of information is needed, while in the Functional Modeling phase we observe the functionality. The Navigation Design phase, we consider the global navigation through the information and the functionality.

The next phase, Implementation Design, performs Page, Presentation and Logical Database Design.. During these phases, grouping in pages, specifying the look and feel, and designing the database is included. The logical data base schema can be derived from the Business information model, which is made during the Conceptual Design.

The last phase, Implementation, is the actual realization of the website using the preferred implementation environment.

3. INTEGRATING BUSINESS RULES INTO –WSDM- APPROACH:

The main theme of our approach is to include business rules in parallel with the audience requirements to obtain a successful and efficient e-business. This development goes in parallel with the current development process proposed by WSDM. Therefore, it also has four phases, which will be defined as follows:

1) Mission statement and Business Policies: at this level the business policies are defined. Audience classes and Business Rules modeling: at this phase Business rules are written in natural language in parallel process then assigned to the different audience classes. Forming in input business rules to the Audience modeling phase.

2) Conceptual Modeling and Business Rules: at this phase business rules are integrated into the conceptual model.

3) Implementation: At this level the rules are implemented and managed using a rule engine.

3.1 Declaring Business Rules parallel to Mission Statement Specification:

In this step we define the enterprise business policies, which is a source of any business rule that might be found at any business. The first step of WSDM is to define a mission statement of the site. We suggest defining all business policies of the enterprise in parallel or independent with the Mission Statement phase.

A Business Policy could be defined as follows: "*Business Policy is a general statement, whose purpose is to guide the enterprise* " [1, 5]

For example a Business Policy for Car Rental business might be: Always attempt to give customers special offers. ¨The Mission statement of the Car rental enterprise site can be formulated as follows:

"To provide online rent where users can browse a list of cars for rent, get information about cars or company and rent cars. Company operators must be able to add or delete information about the cars."

In addition to that, Car Rental business policies can be formulated as follows:

1) "*We only rent cars in legal, roadworthy condition to our customers."*

2) *"Safety first"*

3) *"Always attempt to give customers special offers. ", Etc.*

Finally as mentioned above, each of these business policies that we defined in parallel or independent with the Mission Statement phase will form the bases of the enterprise Business Rules.

3.2 INTEGRATING BUSINESS RULES PARALLEL WITH AUDIENCE MODELING PHASE (BUSINESS RULES MODELING):

A Business Rule could be defined as bellow:

"A business Rule is directive, intended to influence or guide business behavior, in support of Business Policy. It is a single element of guidance that does not require additional interpretation. Often a Business Rule is derived from Business Policy "[1].

As already mentioned earlier, the aim of adding the Business Rules Model to the Audience Modeling phase of WSDM is to address and document business rules at the early stages of the web development; as a result the Business Rules Model now includes all of the enterprise business rules, which are declared according to the Business Rules Analyst decision. Let us consider the following example, at the Car Rental site, the requirements of both Customer and Rental Operator audience classes are defined, besides that, the Business Rules Model where each business rule is assigned to a related audience class, is defined.

Requirements of different Audience classes of the website:

Customer Audience Class	Rental Operator Audience Class
Functional Requirements: Fun_Req1: *Search by(car type, model, …) for cars* Fun_Req2: *Rent a car online*	**Functional Requirements:** Fun_Req1: *Add information about cars* Fun_Req2: *Delete information about a car*
Information Requirements: Info_Req1: *Information about cars* Info_Req2: *Information about Rental Company contacts*	**Information Requirements:** Info_Req1: *Information about cars* Info_Req2: *Information about customers* Info_Req3: *Add information about offers* Info_Req4: *Delete information about offers*

Business Rules Model:

Business Rules related to each of the audience classes could be formulated as shown below in the table.

Rule #	Business Rule	Audience
BR1	*"A car with a car motor more than 5000 CC must be of high rate cars group."*	Rental Operator, Customer
BR2	*"A customer must provide a valid driver's license in order to rent a Vehicle"*	Customer

3.3 MODELING OF BUSINESS RULES AT THE CONCEPTUAL MODEL:

This section shows how business rules can be modeled at the conceptual level. ORM notation [10] is used to represent static rules and the RIDL language [7] is used to model dynamic and procedural rules. ORM and RIDL rule systems complement each other, and they are powerful enough to enable representing the business policies of a domain.

Modeling Business Rules using ORM

Object Role Modeling (ORM) [10] is a conceptual modeling methodology, derived from NIAM (Natural-language Information Analysis Method), which is also one of the other known names for ORM.

The essential concepts of ORM are those of object, role and fact. Objects are the things being modeled (e.g., terms of an schema), while facts are the declarations that are made about objects (e.g., their relationships). A fact relates two or more objects; each of those objects playing a different role in the fact. Objects are put into group of what is called object types (denoted graphically by circles) and facts are put into group of what is called fact types each of these fact types are made of one or more role (denoted by rectangles with a line pointing to an object type).

One of the advantages of ORM as already discussed by [10] is that its wide and powerful graphical notation used to represent a business or domain in a declarative manner as a network of elementary facts and their constraints can be easily re-verbalized into statements in pseudo natural language in a structured and fixed syntax. Therefore business rule modelers could represent a business policy in one or both representation ways, graphically or textually, which will in general improve, simplify, help to validate, as a result of that modeling process is speeded up.

In order to facilitate the discussion of the next section, the most usually used notations for modeling any domain using ORM are provided:

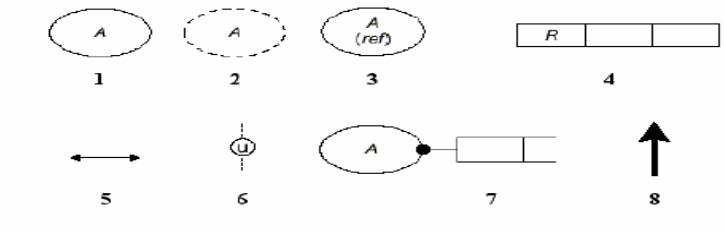

Figure3.1: Common ORM symbols

1. Entity type
2. Value type
3. Abbreviated reference scheme
4. Ternary predicate compromised of three roles
5. Internal uniqueness constraint
6. External uniqueness constraint
7. Mandatory role constraint
8. Sub typing

ORM has static and some dynamic constraint types and derivation rules that are expressive enough and can be used to represent many of the business rules rising during modeling of the enterprise. Those constraints and rules include classical types such as mandatory and uniqueness constraints, in addition to other types as value, subset, subtype, equality, ring, and derivation. Other types of rules that are not mentioned above will be formulated using RIDL, an expressive general-purpose language.

In order to model some of the business rules that could be expressed with ORM constraints, an ORM chunk is shown bellow.

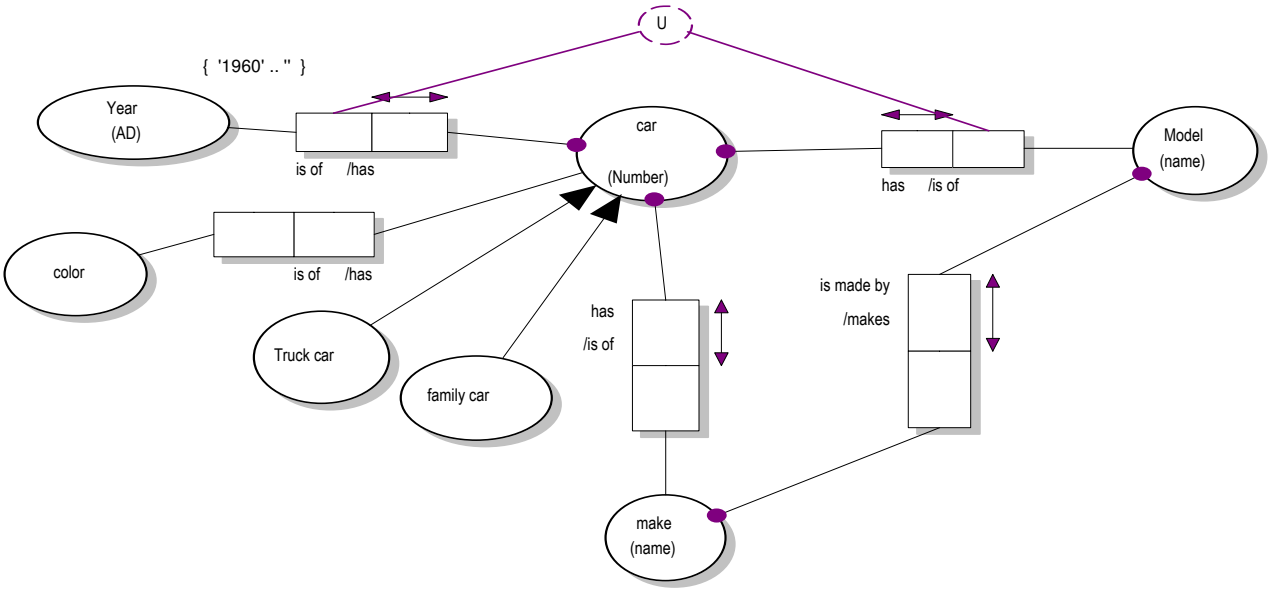

Figure 3.2: functional chunk: submit car information

Examples on modeling static business rules using ORM as illustrated at figure 3.2 above:

1) Mandatory constraint: used to indicate that all objects of a type must take part in a given role. Mandatory roles are indicated by a black filled circle at the line of the role. In the figure above the roles ¨has model¨, ¨ has make¨, ¨ has year¨ are mandatory roles, while the roles ¨ has color¨ is not mandatory.

Business rule example: *"it is not allowed to add cars to the list of cars for rent if its company of make is not provided"*

This type of constraint is modeled and verbalized as follows:

"Each car has at least one make"

2) Uniqueness: indicates whether entities of a type can participate more than one in a role. A uniqueness constraint is indicated by the double arrow over the role, e.g. on ¨has model¨, which means that each car has at most one car model.

Business rule example *"each car number at the company represents only one specific car"*

This type of constraints is verbalized as: *"Each car number is at most of one car"*.

3) External uniqueness: is used to indicate that the combination of roles is used to identify a specific entity. As shown in figure 3.2, the uniqueness constraint indicates that ¨ is year of¨ and ¨is model of ¨ as a combination identifies a specific car.

Business rule example *"each of our cars are identified at the company by both of its production year and model"*

4) Value constraint: enumerates in extension or through ranges, the values that a value type can take. In figure 3.2, a value constraint is placed over the type AD indicating that the company only deals with years greater than or equal to 1960.

Business rule example *"don't allow adding a new car if its production year before 1960"*

The above mentioned example about modeling specific types of business rules using ORM notations, illustrate how powerful ORM is as a tool to model business rules using ORM constraints, however other essential types of business rules still can not be captured using ORM alone. Therefore the RIDL Language, which will be the subject of the next section, is needed.

Modeling Business Rules using RIDL

RIDL (Reference and IDea Language [7] a powerful conceptual language defined on top of ORM. It is an integrated formal syntactic support of information and process analysis, query/update, semantic specification, as well as constraint definition language at the conceptual level, rather than the logical. RIDL is considered as a complementary of the conceptual modeling notation ORM.

"Any customer of three successful rents through any promotion and the number of his successful rents is greater than the number of his cancelled ones becomes a gold customer".

Example on modeling complex business rules using RIDL according to figure 3.3:

RIDL fragment:

```
add constraint become_gold_customer
  for each c customer aske_for rental through  a promotion
     Success: = successful rents (done_by c and through a promotion)
     Fail: = failed rents (done_by c and through a Promotion)
     If number of (success)<= cardinalitynumber of (fail) and
        Number of (success) is > 3
     Then
        add category of c equal to "gold"
     end if
  end for
```

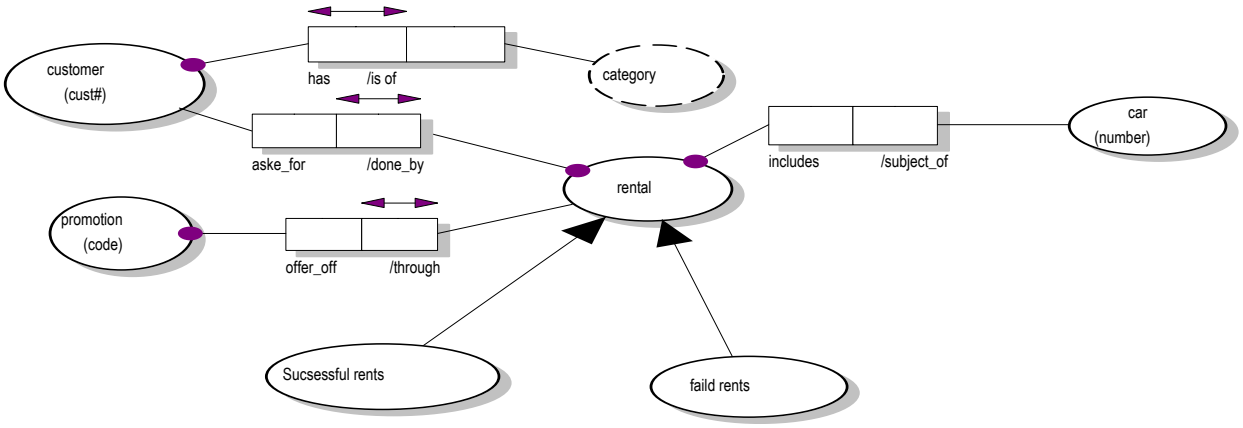

Figure 3.3 ORM chunk of promotion rental info

Representation of Business Rules at the Business Information Model:

In WSDM the Business Information Model includes the different information and functional chunks of the different audience classes. However this model does not consider the business rules defined by the enterprise.

In the following, we will present an approach to represent and integrate declarative business rules. Our approach is inspired from [12].

As different audiences can use different set of chunks, different chunks can also impose the same or different rules. Therefore we have to be careful in representing those rules to avoid redundancy and inconsistency in the business information model. The way to solve this is to start by the audience classes that use the same information and functional chunks as well as business rules, therefore we group the audiences in a table, the chunks used by them in an other table, and the rules imposed on those chunks in a third table. So, the business information model is represented by three

tables (Audience classes, chunks, and business rules). This is illustrated at the figure 3.4 below.

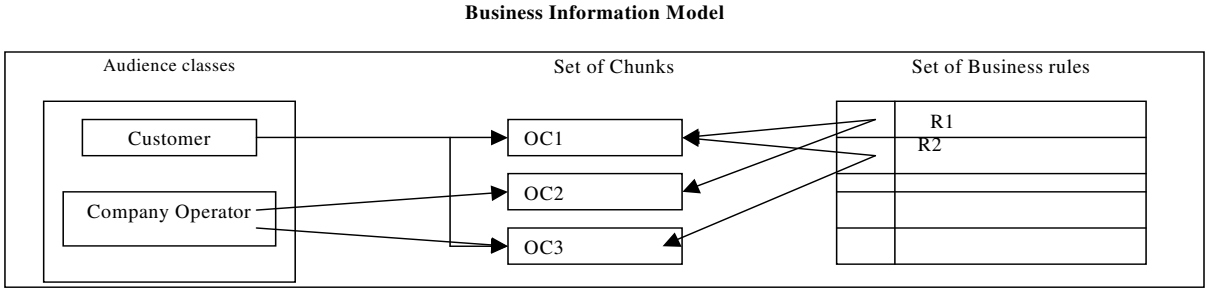

Figure3.4: business information model structure

CONCLUSTION:

In this paper we presented an approach for modeling business rules for web engineering, as a contribution to WSDM methodology. This approach integrates and model he busies rules throughout the web development process life cycle. This approach shows a flexible, reusable, and easy way of modeling web site that takes into consideration all the needs of the customer as well as all of the enterprise rules and policies. It also increases the maintainability and consistency of the enterprise web site. Furthermore this approach increases the tractability between the different phases of the website development life cycle.

As a future work, an executable code, -e.g. HTML forms with Java Script- can be generated automatically from business rules. Moreover, a consistency validation component can be implemented to validate ORM and RIDL constraints.

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