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Mapping an UML profile for XML schema to Object Relational Database

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***Abstract*— Much research has been done to transform a relational database in a (ORDB) object relational database, or transform an XML schema into ORDB, but little research on the transformation of mixing UML and XML schema, which is the UML profile for XML schema, in ORDB is the purpose of this paper, in fact we propose an approach to map an UML profile for XML schema in ORDB with an accentuation of inheritance relationships. We treat the UML profile for XML schema which represents the XML Schema data structures in the form of a UML profile, a UML profile and transformation rules are defined.**

Index terms - XML Schema, ORDB, Transformation, UML profiles.

I. INTRODUCTION

A. XML and Databases

The goal of XML was to define a generic language, but simple "XML has been designed for ease of implementation"[1], based on past years, this specification has fulfilled the objective it set itself, XML has been widely followed and promotes interoperability, and played an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere 2 . Databases and XML are functionally complementary the first stores data and the second makes easy data exchange, in recent years, almost all Internet applications use XML databases [Bray et al data. (2000)]. due to its ease of exchanging data over the network, it has become the inevitable norm. XML is able to run in the database, it provides solutions for the storage and manipulation of persistent data, therefore, XML needs to store data in databases, this implies the need to use methods to describe the schemas written in XML in the Object relational schema without disfigurement of semantics.

B. XML and UML profile

For software development based on UML is necessary to integrate the XML schemas in the process of development. Indeed production XML schema on UML models and integrating input XML schema given in the process of development are necessary.

The problem of automatic transformation of XML schemas in an object-oriented model is not yet addressed convincingly. In particular, we are always looking for a semantically equivalent of an XML schema in ORDB supporting a correspondence between the two representations, especially the transformation of constraints such as inheritance with mutual exclusion, that why we chose to use a UML profile as input and convert it into ORDB because it shows the relationships between XML Schema concepts such as 'element', 'complexType', 'simpleType' and 'XSD simpleTypes' . These XML Schema concepts are represented as stereotyped classes, allowing them to be used on logical level UML class diagrams to represent the corresponding XML Schema concept.

II. RELATED WORK

Starting from an existing XML schema, there are several approach related to mapping it into UML, N. Routledge [1] defines a mapping between the UML class diagrams and XML Schema using the traditional three level database design approach, in [2] all element and data types in XML Schema are mapped to classes annotated with stereotypes.

In this paper, we present a method to map an UML profile for XML schema, into Object Relational schema.

The UML Profile for XML describes a set of extensions to basic UML model elements to enable accurate modeling of XSD schemas [3]. Extension mechanisms allow refining standard semantics in strictly additive manner, preventing them from contradicting standard semantics [4], thus we introduce UML profile to specialize UML semantics of XML Schema; The mapping carried out using as a basis a UML profile defines specific concepts to XML Schema.

Since the concept of UML profiles is just begin to be developed, not much works have been done to transform an UML profile for XML Schema to an Object of Object Relational,

M.F. Golobisky [5], defines functions to transform elements of UML class diagram into object-relational schemas, In [6] describes a number of transformation steps from the XML schema to the ORDB, many works have been done to map an UML class diagram onto XML schema using UML profile see [7, 8] .

III. OBJECTIVES & OVERVIEW OF THE PROPOSED METHOD

[1] http://www.w3.org/TR/1998/REC-xml-19980210#sec-origin-goals
[2] http://www.w3.org/XML/

A. Objectives

The goal of this document is to describe number of rules to transform an UML profile for XML schema to ORDB focusing on a generalization relationship witch models inheritance of properties and behavior among classes. The subclass inherits from a superclass, the fact of using a UML profile is to try to maintain the maximum of the semantics of inheritance relationships, because in UML profile this relationships is visible that in schema written in XML.

B. Overview of the proposed Method

As we have said in the previous section, we propose a Method to transform a UML profile in ORDB, the transformation part of a schema in xml into uml profile is not considered in this article, we use this xml schema representation that we have transformed into UML profile based on studies already done in this direction [8]. Then map then map each component of the stereotypes profile on its equivalent in ORDB.

The following XML Schema Representation models "Type of vehicle".

We use this model in the examples presented along this paper. This profile includes stereotypes and properties that are required to support XML Schema definitions

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" attributeFormDefault="unqualified" elementFormDefault="qualified">
<xsd:element name="VehicleType" type="VehicleType"/>
<xsd:simpleType name="CarMakeType">
<xsd:restriction base="xsd:string">
<xsd:enumeration value="toyota"/>
<xsd:enumeration value="ford"/>
<xsd:enumeration value="holden"/>
<xsd:enumeration value="mazda"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="MotorbikeMakeType">
<xsd:restriction base="xsd:string">
<xsd:enumeration value="honda"/>
<xsd:enumeration value="suzuki"/>
<xsd:enumeration value="harley"/>
<xsd:enumeration value="kawasaki"/>
</xsd:restriction>
</xsd:simpleType>
<xsd:complexType name="CarType">
<xsd:complexContent>
<xsd:extension base="VehicleType">
<xsd:sequence>
<xsd:element name="make" type="CarMakeType"/>
</xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="MotorbikeType">
<xsd:complexContent>
<xsd:extension base="VehicleType">
<xsd:sequence>
<xsd:element name="make" type="MotorbikeMakeType"/>
</xsd:sequence>
</xsd:extension>
</xsd:complexContent>
</xsd:complexType>
<xsd:complexType name="VehicleType">
<xsd:sequence>
<xsd:element name="color" type="xsd:string"/>
</xsd:sequence>
<xsd:attribute name="Immatriculation" type="xsd:string" use="required"/>
</xsd:complexType>
</xsd:schema>
```

IV. FROM UML PROFILE FOR XML SCHEMA TO ORDB

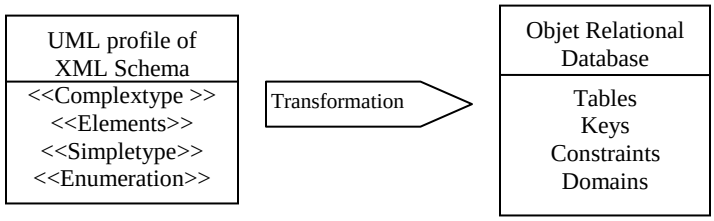

Figure 1. Mapping process of UML Profile for XML schema to objects relational database

After transformation of the XML Schema in UML profile as said before .The corresponding profile is as follow:

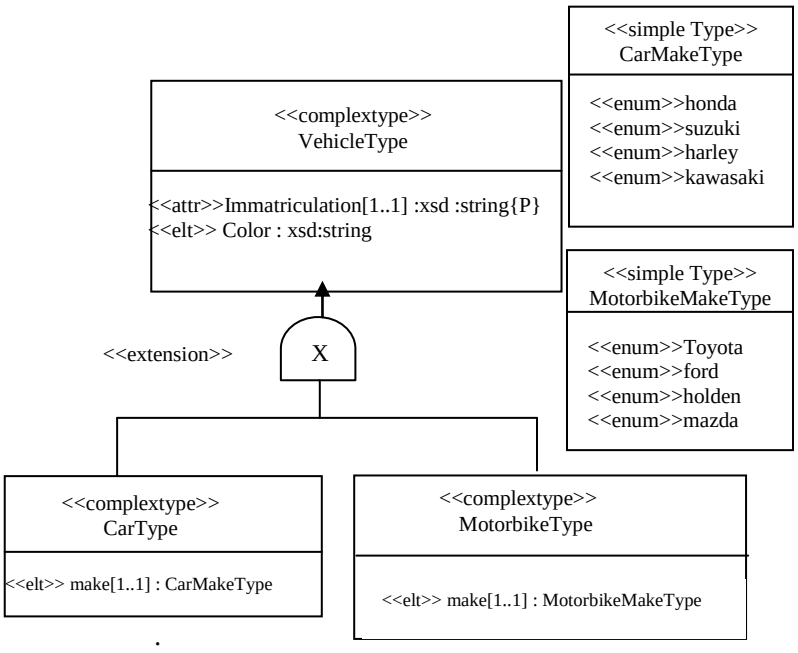

Figure 2. UML profile for XML schema at the logical level

In this model we have:

Complextype classes, attributes, elements, derivation by extension, simple types that include an enumeration constraint.

In this example we use single inheritance with mutual exclusion to ensure that there is only one heir in various tables. This example is called mutual exclusion because there is no Car who is also a Motorbike, and vice versa. We interested in a generic class vehicle and child classes by type of vehicle (Motorbike, Car)..., the subclasses in the generalization relationship are disjointed.

Inheritance above is mutually exclusive: this means that the vehicle is either a car or a Motorbike but never both at the same time. So we have, for each insertion in one of the child tables to ensure that the vehicle is not already used by other tables.

Mutual-exclusion inheritance declares that a group of subclasses in an inheritance relationship is pairwise disjointed. However, in this case there may be a Vehicle who is neither a Car nor a Motorbike[3].

Our goal is to present data in UML profile in a model OO in a way that preserves the maximum of information.

[3] Using Object-Oriented Features Johanna Wenny Rahayu, David Taniar ,Eric Pardede

V. MAPPING SPECIFICS

In this section, we describe a composition of exiting, and rules of transformation .

UML profile classes

A superclass with stereotype <<complextype>> named CT, whose sequence contains elements, is transformed in an object with the same name CT and its attributes will be the elements in the <<sequence>>including the constraints, (use= "required" to primary key….). And add an attribute CT_type with constraint not null4 , whose value must either be Cartype or Motorbiketype , to ensure the mutual exclusion inheritance.

Data types

Built in simple type (string, integer, double…) is mapped into a corresponding SQL (varchar, number, double..),

Attributes and elements

An attribute or elements, of the complextype class is transformed onto attributes with corresponding constraints.

Multiplicity

Multiplicity of UML profile that we have in this example are all [1..1],

Generalization

A <<complextype>> class CT2 having a super <<complextype>> class CT1 explains a generalization relationship implicitly with "extension" is mapped onto inheritance of UDTs in ORDB with key word (UNDER).

Simple type with enumeration

A simple type with enumeration is transformed onto a Domain in ORDB, with the same name; Domain creates a (restricted) column domain5,

In our sample example of domain, we have to manage information about vehicle. Vehicles are uniquely identified by an Immatriculation. We suppose that every vehicle has a color and a make. Furthermore, in our sample example, different makes are distinguished: 'Toyota', 'ford', 'holden', 'mazda'...,

```
CREATE DOMAIN CarMake_types  CHAR (10)
CHECK(VALUE IN ('Toyota', 'ford', 'holden', 'mazda'));
```

B. Mapping the example from UML profile to Object-relational in Oracle 11g

In this section, we describe the schema of the Type of Vehicle example, we use Oracle11g, Oracle Database 11g is the next generation of information management business, which can cope with the demands imposed by the rapid growth of data volumes, the ever-changing environment and the need to

[4] Inheritance Transformation of XML Schemas to Object – Relational Databases Nathalia Devina Widjaya, David Taniar, J. Wenny Rahayu

[5] Semantic Integrity Support in SQL-99 and Commercial (Object-)Relational Database Management Systems Can Türker and Michael Gertz

provide quality service maximum all reducing and controlling IT costs. Oracle 11g offers improved storage performance on files, for enhanced security features, significant performance enhancements to Oracle XML DB, and new functions for OLAP and data warehousing.[6]

The best way to handle mutual-exclusion inheritance without losing the semantics of the relationship is by adding to the superclass table an attribute that reflects the type of the subclasses or has the value null. In the table Vehicle, an attribute called Vehicle_type is added. Thus, Vehicle_type can take the values Car, Motorbike, or null. There are no Vehicles that can have two values for this attribute, such as a Car who is also a Motorbike simultaneously (mutual exclusion)[7].

This part shows the implementation details. Note that we use the "check" keyword for the purpose of checking the value of an attribute in a set of values.

To create the types we keep the same names those are in the UML profile.

The corresponding Object Database is as follow.

C. Implementation of mutual-exclusion inheritance

```
Create or replace type Vehicle_type as object
       ( immatriculation   varchar2(15),  color
       varchar2(10), Vehicle_type  varchar2(10))
       not final
Create Table Vehicle of  Vehicle_type
       (immatriculation   varchar2(15) primary
       key,  Vehicle_type   check (Vehicle_type
       in ('Motorbike_type', 'Car_type'))
Create  domain Carmake_Types  CHAR (10)
       Check (VALUE IN ('toyota', 'ford',
       'holden',' mazda'));
Create  Domain Motorbikemake_Types  CHAR (10)
       Check (VALUE IN ('honda', 'suzuki',
       'harley',' kawasaki'));
Create or replace type  Motorbike_type UNDER
Vehicle_type (make  Carmaketypes ) not final ;
Create or replace type  Car_type UNDER
Vehicle_type (make  Motorbikemaketypes ) not
final ;
Create table Car OF Car_type UNDER  Vehicle;
Create table   Motorbike OF Motorbike_type UNDER
Vehicle;
```

D. Comparaison and Perspectives

We have shown how to map an UML profile for XML schemas in ORDB, such that the transformation expresses the semantics of UML profile in terms of relationships as far as possible, and such that the representation is minimized in terms of oriented object constructs. The representation is based on a UML profile to convey the semantics of XML Schema's concepts going beyond UML.

VI. CONCLUSION AND FUTURE WORK

As mentioned before, this work describes the transformation of a UML profile for XML schema in ORDB using Oracle 11g, focused on the transformation of simple inheritance relationship with mutual exclusion, and simple type with enumeration, the advantage of this work is that the proposed transformation is simple to understand and it preserves the semantic of source.

Our future work, be on developing a better mapping taking into account the definition ODL (OBJECT DEFINITION LANGUAGE), allowing to establish correspondences between concepts that were not taken into account such as the notion of aggregation, composition besides the addition of these concepts allows to specifically identifies semantic links between elements and to provide information regarding the life cycle thereof..

REFERENCES

[1] N. Routledge, L. Bird, A. Goodschild: UML and XML Schema, Proc. 13th Australasian Database Conference (ADC2002), Melbourne, 2002.

[2] G. Booch, M. Christerson, M. Fuchs, and J. Koistinen: UML for XML Schema Mapping Specification. Rational White Paper, December 1999.

[3] David Carlson "Modeling XML Applications with UML" pp. 310.

[4] Si Alhir, S: *Guide to applying the UML*, page 350. Springer, 2002

[5] M.F. Golobisky, A. Vecchietti ,Proc. of Argentine Symposium on Software Engineering (2005) 65-79.

[6] N.D.Widjaya : Inheritance Transformation of XML Schemas to Object Relational Databases, IDEAL.2003, LNS 2690, pp, 1087-1091, 2003.

[7] L.A.Gunawan : mapping UML class and UML attribute onto XML schema using UML profile, Integral, vol 9 No.2 Juli 2004.

[8] M.Bernauer: Representing XML Schema in UML – An UML profile for XML Schema.

[6] Exploitation Oracle 11g , www.tellora.fr

[7] Using Object-Oriented Features Johanna Wenny Rahayu, David Taniar ,Eric Pardede

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