Networking among Product Ontologies: The Standard ISO 13584 – PLIB and related Developments

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Abstract: This paper gives an overview about PLIB (ISO 13584), a meta model for the building of product ontologies. Product ontologies provide a way to describe the meaning of product data in shared data bases or e-business exchange protocols. A number of product ontologies have been or are currently under development. Some activities are discussed which are meant to ensure their compatibility to allow the use of different product ontologies in applications.

1 Introduction

The exchange of product data in electronic form has become an important means for business communication and B2B processes. A fundamental prerequisite for data exchange is a common understanding of the meaning of the exchange message: Sender and receiver have to interpret the content of messages in same way.

Product ontologies (also called dictionaries or classifications) are used as a means for solving this problem. A product ontology comprises a hierarchy of product classes. Properties are associated with classes, and the meaning of property values is given by the property definitions. Due to their importance for the exchange process, many product ontologies have been developed over the last years by industry consortia and standardisation organisations. Some are domain-specific (vertical), others are domain spanning (horizontal). Often, product ontologies are both overlapping and unrelated.

The goal of this paper is twofold: First it gives an overview of the common ISO/IEC data model for product ontologies called PLIB (Parts LIBrary). Many product ontologies are based on this ontology model. Second, it illustrates some of the activities around PLIB with the goal to create more interoperability and less overlap among product ontologies.

2 Product Ontologies as defined by PLIB – ISO 13584

The ultimate goal of product ontologies is to allow the interpretation of values which are shared between different business partners, e.g. in exchange messages according to

business protocols or in commonly used databases. For this purpose, PLIB [Pi05] provides a meta model for product ontologies. Its formal basis is an EXPRESS data model shared among ISO and IEC [ISO13584-42, IEC61360-2]. The meta model defines the rules for the creation of product ontologies. It specifies the building of class hierarchies with associated properties. An essential concept of PLIB is the provision of worldwide unique identifiers for classes and properties. A product ontology is a model for catalog products (which may reside in databases or may be exchanged in business transactions). A product is related to a product class, and its characteristics are described by values of properties of the class. Catalog products are often identified by ordering numbers or part numbers.

The basic elements of the PLIB product ontology model are the following:

- Product groups or product categories are represented by classes. A class is defined by a number of attributes, including identifying attributes (ID, names, codes, etc.) and semantic attributes (definition, notes, etc.).

- Properties specify aspects by which a product can be described. Similar to classes, properties are defined by identifying and semantic attributes, but they contain additionally value related attributes defining data types, units, value lists, etc.

- Classes are related to other classes by the *is-a relationship*. This relationship specialises classes by adding properties and constraints, and the specialised class inherits all properties of its superclass. PLIB supports only tree-structured is-a hierarchies, i.e. each class has at most one direct superclass.

- Properties are related to classes by two different relationships:
  - *Is_defined*: associates a property with a class which defines its scope. The definition of the property can make use of the knowledge that it is only applied in the context of this class or its subclasses.
  - *Is_applicable*: associates those properties to a class which may be instantiated in an instance of that class (i.e. a product in a catalog). All applicable properties must be also *defined* for the class or one of its superclasses.
  - By distinguishing these two class–property relationships, the definition of a property can be done on a generic level, even if exceptions exist in subclasses, where this property does not apply. In addition, it is the basis for differentiating abstract ontologies for defining properties and their scopes and application ontologies for defining products as for instance done in [DIN 4002] and the DIN property server (www.dinsml.net).

- Classes may be related by the case-of relationship which is mainly used for referencing elements of different product ontologies: It relates a class to a "case-of superclass" with partial property inheritance: only those properties which are explicitly specified in the relationship are inherited by the subclass. This relationship is used mainly for linking product ontologies (e.g. of a company) to more general, commonly used product ontologies (e.g. a standard ontology). This mechanism can be used for the reuse of relevant property definitions from the

standard product ontology. In a variant of this relationship, existing properties of one class may be defined as equivalent to properties of another class, so that existing properties are related to properties of a class in the other product ontology.

- Products may be related by a component relationship: One product can be a component of another product. This is modelled by a property which references instances of another class. The component may be independent (i.e. it exists independently of the composite product) or it is embedded in the composite: it is deleted with the composite object.

More details about the PLIB standard and the model for product ontologies can be found in the standards itself [ISO 13584-42, IEC 61360-1, IEC 61360-2]. The model is formally defined by means of EXPRESS [ISO 10303-11], the information modelling language defined for STEP (ISO 10303). Tools for handling product ontologies according to PLIB can be downloaded from the PLIB website (www.plib.ensma.fr).

Currently, the second edition of PLIB is under development. New concepts will be included like the specialisation of properties, the definition of abstract properties to facilitate the maintenance of big sets of properties, or classification classes to capture pure classification structures as provided by UNSPSC and eCl@ss (no properties, just a categorisation of product groups). It is expected that the second edition will be finished and published as an IS in 2006.

Another major project is the development of an XML schema for data exchange. The XML schema will be generated from the EXPRESS model to allow a transformation of XML data into the EXPRESS file format (called STEP file format, ISO 10303-21). Then existing EXPRESS tools can be used to check the constraints which are defined in the EXPRESS model but which cannot be modelled by means of the XML schema. A major aspect in the development of this XML schema is its compliance to current developments in the area of business process protocols – and this brings us to the second part of this paper, developments around PLIB.

3 Networking of Product Ontologies

Currently, many projects in *standardisation organisations* are creating product ontologies on the basis of the PLIB data model. Examples are ISO 13584-Part 511 (fasteners), ISO 13584-Part 501 (laboratory and environmental measuring instruments), ISO 23584 (optical devices), ISO 13399 (cutting tools), IEC 61360-4 (electric and electronic components), or DIN 4002 and the DIN property server. Basically, these projects formalise the knowledge which already exists in the related standards in textual form. But also new developments are being captured in these product ontologies. The upcoming result is a new type of standard which is not distributed in form of paper but as a central database from which information can be obtained via the internet.

All these product ontologies are based on the PLIB model – but often they use PLIB concepts in different ways. This may become an obstacle for their use in a common

software environment. An example is the linkage of properties to classes (property "is defined for" class and property "is applicable for" class): Some product ontologies define all properties at the level of the root class – others associate a specific definition class to each property which gives the property its scope. There are other areas where differences exist, e.g. in the way how the product ontologies are maintained. Here general questions are currently not commonly answered: What are the procedures for maintaining product ontologies? Which organisations are necessary for organising the maintenance process? Should the maintenance process be standardised rather than the product ontology?

To address these kinds of questions, ISO and IEC have set up a joint working group (ISO/IEC JWG1) which is producing a guide that contains recommendations for building PLIB product ontologies. As a first step, it is planned to produce three documents:

- Part 1 will give an introduction to motivate product standardisation committees to use the mechanism of product ontologies for their work.
- Part 2 will give a comprehensive description of the concepts of the PLIB model without going down to the details of the EXPRESS model.
- Part 3 will give a number of experience reports from successful projects.

JWG1 only covers the product ontologies which are developed in formal standardisation organisations. But there exist a number *of de-facto standards* which are developed by different industry consortia. Examples are eClass, RosettaNet, ECALS (Japan), and others, which are used in some industry domains or specific regions quite successfully. But so far, none of them has been successfully on a global scale. For instance, there exist overlapping product ontologies in the domain of electronic components: IEC developed the IEC61360 standard including its product ontology (IEC 16360 Part 4) already in the late 90s. But due to an unclear copyright policy, other product ontologies were defined in the following years by JEITA in Japan (ECALS dictionary) and by RosettaNet (RosettaNet Technical Dictionary). This situation is a big problem for product providers if they have to use different product ontologies for different customers.

Therefore it is important to ensure that the product ontologies keep as compatible as possible. To ensure this compatibility, the OIDDI (Open Interoperable Domain Dictionary Initiative) was launched. The goals of this initiative are

1. to build a network of providers of product ontologies
2. to propagate the use of basic PLIB mechanisms like global identification of product ontology elements and references between elements of different product ontologies
3. to facilitate the building of a network of interlinked product ontologies to avoid overlap and to make the production of product ontologies less expensive
4. to encourage the harmonisation of different interlinked product ontologies.

OIDDI is supported by a number of industry consortia, and the goal is the foundation of an association in 2006 to promote the above mentioned goals. More information can be obtained at www.oiddi.org.

As said in the beginning of section 2, the ultimate goal of product ontologies is to allow the interpretation of values which are exchanged in business processes. Therefore it is necessary, to define the link from the value in the exchange message to the product ontology element which defines its meaning. Today, all existing or upcoming messaging systems for business transactions are based on XML. Thus, it is important to create an XML schema for PLIB which is compliant to these business process frameworks.

One example of a transaction framework is ebXML developed by UN/CEFACT and OASIS and which has now been taken over by ISO as ISO 15000. This standard defines a set of core components which are basically the objects which can be transferred in a business transaction. Therefore, the development of the PLIB XML schema (called OntoXML) is aims at making it core component compliant (i.e. to follow the rules for core component as set in ISO 15000-5). The goal is that each product ontology can be referenced in any business protocol.

4 Conclusions

PLIB (ISO 13584) provides a meta model for product ontologies which describe the meaning of values in shared databases or business exchange messages. The basic elements of this meta model have been briefly presented. Currently, a number of PLIB based product ontologies are being developed, both within standardisation organisations and within industry consortia. It is important to keep these developments compliant to ensure their interoperability and to allow the common use of different product ontologies in applications. For this purpose, ISO/IEC JWG1 and OIDDI have been lauched. Crucial for the success of product ontologies is their actual application in business process protocols. This requires to integrate into business process protocols both product ontologies and references from data values in messages to their descriptive element in a product ontology. The first step towards this goal is the provision of the PLIB XML schema in compliance with core components as defined by UN/CEFACT in ISO 15000.

References

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