Use profile management for standard conformant customisation

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Abstract. The adoption of public applicative standards could improve eBusiness adoption, especially among networks of SMEs. Nevertheless the adoption of such specifications encounters obstacles and hampering factors. This paper analyses some of such factors and the experience of promoting the adoption of standards for eBusiness in sectors dominated by SME's presence and outlines some of the actions that can be pursued through the adoption of use profiles. The paper also present an approach for the management of use profiles, that appear as a way to overcome some of the major problems arising from the nature of the standardised specifications and to reduce the efforts necessary to achieve true interoperability between systems.

Keywords: interoperability, UBL, standard, use profile, eBusiness, co-constraints, SMEs.

1. Introduction

In the scenario of data exchange for eBusiness interoperability, standards play a relevant role in creating a favourable environment: they are perceived as a guarantee for the investments when companies buy eBusiness solutions. This is especially true when the collaborating companies are small in size and not able to impose a data format to the community.

It cannot be ignored that standardisation initiatives and their results partially collided with the complexity and the variety of the business models and systems that regulate the real business scenarios: the number of critical issues increases dramatically when the context changes from an environment characterised by few large players to an environment with a widespread framework of networked organisations. Often in the past, the proposed solution to these problems was

increasing the complexity of the standard specifications in order to match a large share of needs.

This is especially true for large spectrum standards, where a high degree of generality leads to greater complexity of the specifications and, in turn, of the software solutions that manage such information.

The authors performed a deep analysis related to the complexity of UBL (Universal Business Language - an OASIS standard for business documents [1]) in order to highlight the difficulties that exist in the adoption of such kind of specifications in real business environment characterized by the presence of a large number of SMEs.

The focus of the analysis of this paper is the Textile/Clothing and Footwear sectors, but other experiences are known by the authors, like in the furniture industry (FunStep, www.funstep.org) or in the paper and wood industry (Papinet, www.papinet.org). Focusing the attention to Textile, Clothing and Footwear industry, we have recognised they are characterized by:

- Large presence of SMEs in the network;
- Long and segmented value chain;
- The existence of different standards which are valid only for parts of the value chain.

The resulting main drawbacks for standard specifications that emerge in this scenario are:

- The uncertainty in the semantics of the standardised models;
- The increased complexity and cost of the systems that implement the standard specifications.

The aim of this paper is to analyse, considering a specific use context, what is standard complexity and the criticalities for standard adoption, to present a different approach for eBusiness standard adoption in large SMEs networks by reusing already defined and well-established specifications and to define innovative solutions to customize general standards to particular SME's needs.

2. The problem and the status of art

Nowadays one of the challenge for the industry is to be able to adopt e-collaboration combined with other manufacturing and supply chain paradigms to strengthen or re-gain global competitiveness.

Some traditional retailers and manufacturers try to solve the conflict between long lead times and efficient consumer response with a vertical integration of the value chain, if possible. And if this is not possible, by e-linking and e-collaboration in the value chain to have the same fast answers to consumer demand.

But the central knot remains hard to solve: on one hand the real benefit of these solutions for the industries increases very quickly with the number of adopters while, on the other hand, this number remains small.

In the context of SME the problems are tackled from different points of view:

Industry. Initiatives were promoted but unable to achieve a critical mass of adopters: some communities where built around ASP providers of integration

services or company portals [2]. But these models appear less effective than in other sectors with lower predominance of SMEs, like automotive [3]. We can observe only few local islands of interoperability. In many cases the electronic flow of data, even when established, does not seem to result in a positive impact on the involved organisations. The key for a more wide connectivity seems to be the interoperability of systems based on commonly agreed open standards and in a strong role of the industry associations and other public actors.

Standardisation. A lot of efforts were done in the field of standardisation for Textile/Clothing and Footwear industry in these years (the first one in the 90s, EDITEX), that is the target scenario of our study. Euratex and CEC together with their national member federations, as well as the EU Commission, CEN/ISSS, GS1 and others have been involved in e-business standardisation initiatives for the fashion industry: B2B standard were developed within the framework of ESOs (European Standardisation Organisations): CEN/ISSS TexSpin [4] and TexWeave [5] for Textile/Clothing, CEN/ISSS FINEC[6] for Footwear.

Innovation prototypes. Various 'user centric' demonstration activities, collected requirements from the industry (mainly SMEs) and tried to adapt technology and, mainly, standards to the real needs: initiatives and projects like eTexML, Visit, Moda-ML [7], EFNET2/3, CecMadeShoe, ShoeNet [8], with a wide involvement of industry associations, prepared a background of analysis and specifications that was (almost) ready to be implemented by the industry.

Yet, a wide adoption and an overall harmonisation were lacking in the user community. There was a reluctance of many firms and technology providers to implement standards (and eBusiness technologies [9]); on one hand they feared an excessive 'normalisation' of the applications that would lead them to lose their assets towards the customers; on the other hand they preferred to wait and see the success of an initiative and to invest only when the risk is lowered to zero; meanwhile they invested on the products.

This situation was evidenced also by the eBusiness Watch reports for TCF sectors [1][10][11]: IT and eBusiness uptake was below the average of other sectors in the EU.

As a result, the landscape of existing B2B applications is extremely varied, spanning from P2P solutions to a variety of Internet based solutions, all characterised by difficulties in achieving a critical mass of participants and in connecting small companies.

Nevertheless data at European level [2] suggest the existence of an unsatisfied demand for a common standard architecture. To satisfy this demand, eBusiness standards where developed, depending upon the specific requirements and following different approaches, in order to find the best trade-off between completeness and rapid development. In fact, there exist many different standards and we can group the applicative level standards related to data models in two main categories: horizontal or vertical standards.

While a horizontal standard (like EDIFACT, UBL, GS1 XML…) is cross-sector and aims to cover a generality of processes (and data), a vertical standard (Papinet, OTA, HL7, TexWeave/Moda-ML) is closer to a specific domain.

This means that a horizontal standard has specifications that are only partially used in a concrete scenario while vertical standards (try to) provide data models

that are properly tailored to manage the information exchanged in a specific business domain.

But also vertical standards have to support a variety of data that are only partially in use: concrete implementations of vertical standards have similar problems, even if smaller in size, like horizontal ones. In fact in real supply chain networks, the enterprises need to define constraints that are stricter than the vertical standard specifications, to reflect the requirements arising from very specific and dynamic businesses.

The adoption of standardised technologies should encourage the early adopters but another issue arises from the nature of the standards themselves.

When a network of organisations wants to adopt a common standard, the balance between the resources necessary to map the local organisation/systems into the standard and its capacity to fit real business is critical. More in detail, two aspects are critical:

- The mapping between local (internal) processes and data models into the standardised models (and issues arising when they do not appear to fit each other);
- The reconciliation between different implementations of the same standardised specifications managed by different organisations.

Note that to tackle the first point, that is maintaining an adequate degree of generality, the standards must model many potential information, supporting a wider variety of data that are used only in certain scenarios; increasing the richness of the semantics leads to more complexity of the ICT systems that manage such information and to a plurality of different potential implementations.

As a general matter a vertical standard appears more focused and effective to support real eBusiness, but the problem is that certain industrial domains lack a sectorial standard to adopt for their eBusiness transactions. This case has been for example experienced in the eBIZ-TCF project, where no sectorial specification was available for the relationships between producers and retail organisations in the footwear and clothing sectors. In any case, both using a horizontal and a vertical standard, at different levels, one of the problems is to find a trade-off between generality and complexity of the specifications.

To solve the aforementioned criticalities, a possible approach is based on issuing profiles related to a specific use/domain. It is followed for example by UML, one of the most known modelling language, released by the OMG consortium: it provides rules for the definition of profiles intended as extensions of the modelling language in order to make it fitting specific application domains. Also in the world of EDI standard exists the possibility to define use profiles, called EDI subsets. These subsets are tailored for specific industrial sectors, but the specifications are released only in term of hard paper manuals, without a clear and simple machine readable format that could ease their adoption.

Another possible approach, based on the semantic reconciliation through a domain ontology without relying on a standardised specification, was not pursued by eBIZ-TCF because the largest part of the IT suppliers of the industry were not able to manage such kind of technologies while the more diffused XML based technologies are accepted and recognised as a mean to publish a common semantics.

3 A method to analyse XML data model specification

We relate the increase of "complexity" of the specifications to two parameters that can be observed in a business document template:

- **Redundancy**: the total number of possible distinct data containers in a document, necessary or unnecessary to support a specific business (for example, the possible XPaths that identify the leaves in a XML instance tree).
- **Uncertainty**: the number of distinct data containers that exist for a single specific type of information in a document (for example, the possible alternatives to specify the Order ID in an XML instance).

To adapt the specifications to the real business, the standard specifications need something that defines use restrictions (Use Profiles) for specific domains or processes in order to limit these two parameters.

Some samples, taken from our analysis of UBL documents, can clarify the problems.

Table 1 shows an example of uncertainty in the usage of the UBL 2.0 Order Response: the element SalesOrderID can appear in the document in different positions having the same meaning, thus the Order ID assigned by the Seller could be inserted indifferently in both the XPaths [13].

Table 1 different elements with the same semantics (Uncertainty)

	XPath of the element	**Description**	**Occ**.
1	OrderResponse/cbc:SalesOrderID	An identifier for the Order issued by the Seller.	0..1
2	OrderResponse/cac:OrderReference/ cbc:SalesOrderID	Identifies the referenced Order assigned by the Seller.	0..1

Table 2 reports a comparison between the number of potential different XPaths (calculated from the official UBL 2.0 XPath Information files [15]) identifying different containers of data allowed by different document specification.

In this table, the second column reports the number of information item a generic document should carry for data exchange, coming from our analysis in the eBIZ-TCF Textile clothing scenario. These numbers can be compared with the ones in the third and forth column, that represent the number of data containers ('leaves' in the 'tree' of the XML structure) made available by UBL 2.0 and the Moda-ML specification.

We assume that a high number of possible XPaths in a document schema is a warning sign of higher development cost and of potentially slow process in setting up data exchanges, together with ambiguities in subset of these XPath (table 1): the same information could be represented in different ways and the software should manage all of them. Speaking about hundred, or thousand, potential alternatives the cost becomes prohibitive.

The data reported in Table 2 show that such risk is lower in a vertical and domain specific scenario (like Moda-ML): in a vertical standardised specification

the number of possible XPaths is really lower. The benefit in order to reduce semantic uncertainty and redundancy is evident.

Table 2 Comparison between Horizontal Specifications, Vertical Specifications and Use Profiles in terms of potential XPaths (Redundancy).

Document template	***eBIZ-TCF Textile clothing scenario: data to be transferred***	**UBL 2.0 XML Schemas # of XPaths containing data**	**Moda-ML XML Schemas for a fabric purchase process # of XPaths containing data**	**UBL Use Profile for a retail-side purchase process from eBiz-TCF # of XPaths containing data**
catalogue	55	38.630	99	60
order	22	2.893.732	163	36
order response	28	2.895.909	163	39
despatch advice	27	915.815	136	40
receipt advice	29	913.812	69	41
invoice	37	61.162	148	66

4. The approach for business document customisation

According to this analysis, in business document modelling we envisage an approach not only to support the reduction from a general horizontal specification (UBL 2.0) to a sectorial scenario without loosing the conformance with the standard, but also to simplify the process of implementation and to limit the complexity of UBL documents for the final users; this approach leads to the definition of a use profiles (Figure 1). The fifth columes in table 2 can give an idea of the dimension of the UBL eBIZ-TCF Use Profile we have defined. The reduction of the document complexity for the final users is evident and the comprehension and adoption of the specification is symplified.

Depending on the characteristics of the business sector it is possible to point out a second aspect: the tension that exists between standardised models and the need for customisation at company level [14]. On one hand, there is the need to have, for the collaborating enterprises, a common and shared "language" (the standard specifications) between heterogeneous partners; on the other hand each enterprise, with its informative systems, needs a mechanism that can reflect and solve its specific requirements. At first glance, these two visions seem to be incompatible. Thus the defined approach aims also to support a second type of customisation:

from the sectorial specification to the specific applications running between two or more systems.

Finally, in order to support the reconciliation phase between 'standard based' different applications of different companies, it is necessary to have a clear documentation of the customisations implemented in this second step.

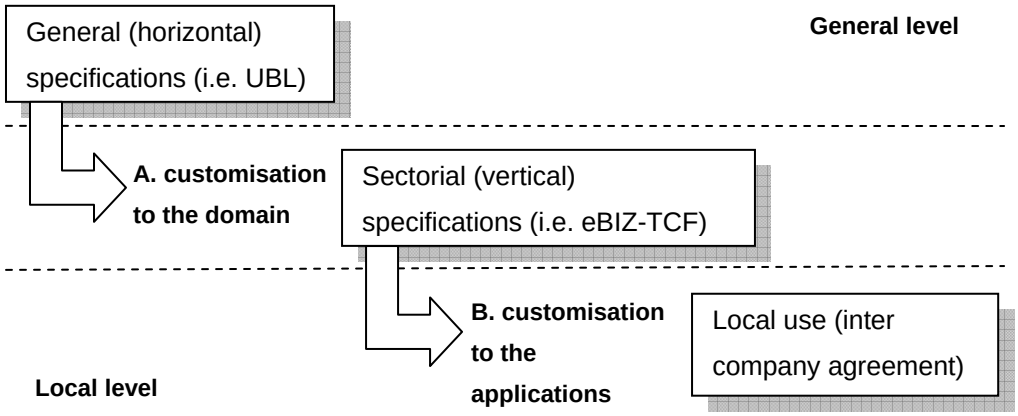

Fig. 1. Use profile definition

Applying this approach in the eBIZ-TCF project, we observed that in the Textile/Clothing and Shoes sectors different specifications were in place for inter-manufacturer relationships (Moda-ML and Shoenet) but on the relationships between manufacturers and retailers no sectorial specifications were available: there relationships could be covered using already defined standards, like UBL.

To overcome this issue we assumed as starting point an abstract data model provided by the sectorial experts and compared it with the UBL standardised documents. The result of such type of comparison was a set of use profiles.

The obtained use profiles reduce a general standard (UBL) to a size comparable with the corresponding data structures of an enterprise informative system (Table 2). Still, although in this way it is possible to limit and specify the set of abstract information to manage, different data models could exist and still slow down the process of implementation.

5. Profile customisation and validation

During the analysis, together with the activities related with the profile definition, a further need emerged: a more powerful customisation mechanism that, exploiting co-constraint definition, can definitively guarantee a complete specification of all the data format constraints that reflect the enterprise informative system needs.

Usually, XML Schema is the XML technology adopted for document template definition. Nevertheless, in the context we are considering, and after our analysis

on the eBIZ-TCF scenarios, XML Schema is not enough to support profile customisation and validation.

Customisation issues are also strictly related with the structure of the reference standard, in this case UBL 2.0. UBL 2.0 defines a component library that is shared by the set of the main documents (Order, Invoice, etc.). Moreover, both the XML elements and the XML types are declared globally, following the Garden-of-Eden design style. In this way, it is impossible to redefine an element (maintaining the full compatibility with the UBL standard), since all the components are global. In this situation, we needed two levels of restrictions on UBL 2.0 components:

1. A global restriction for the eBIZ-TCF component library, respect to the UBL component library. This restriction is performed at sectorial level.
2. Ad hoc restrictions for specific component in the eBIZ-TCF profiles respect to the general eBIZ-TCF component library.

The basis of this work has been an analysis done by sectorial expert about the needs (in terms of data model to adopt) shared by all the actors

Performing this kind of restrictions is extremely important to maintain only one library that remains common for all the profiles, for maintenance requirements. It is not feasible to produce each profile with its own different library that specifies its ad hoc restriction.

Using a single shared component library, XML Schema is not proper to model every possible use of the different components. Moreover, XML Schema does not allow specifying co-constraints, as emerged from the analysis of the eBIZ-TCF Textile clothing scenario.

In order to overcome these issues, we have introduced a three steps mechanism for eBIZ-TCF library and profile definition:

1. Reduction of the XML Schema element in the library, in order to delete the unused components in the set of profiles and to refine the cardinalities of the elements.
2. Definition in the library, using Schematron code, of co-constraints that are common for every eBIZ-TCF document.
3. Definition in the main documents, using Schematron code, of co-constraints that are specific for eBiZ-TCF document.

This set of restrictions is defined for the whole industrial sector that is target of the eBIZ-TCF project. For example, the UBL 2.0 "Item" element is composed of 28 child elements (10 elements have simple type, 18 elements have complex type), whereas in the eBIZ-TCF catalogue profile the "Item" element is restricted to 13 child elements and in other eBIZ-TCF documents the "Item" element has only one child element. In this way, optional elements for UBL, that are not useful in the eBIZ-TCF use context, are not present and the documents are easier to manage.

Concerning the step two, the following code, included in the definition of the component library, describes the mechanism adopted to invoke a validation pattern defined for a specific component (in this case, the cac:ReceiptLine/cac:Item component). We do not report the abstract definition of the pattern.

```
<sch:pattern id="RecpLineItem" is-a="item">
    <sch:param name="mypath" value="cac:ReceiptLine/cac:Item"/>
</sch:pattern>
```

Concerning the step three, the following code represents a definition for a validation pattern that is defined only for a specific document (the eBizORD:Order document). These rules are included in the definition of the main document.

```
<sch:rule context="/eBizORD:Order/cac:Delivery">
    <sch:report test="cbc:ActualDeliveryDate">In this path, the 'cac:Delivery' element requires the 'cbc:ActualDeliveryDate' child.</sch:report>
    <sch:assert test="cac:DeliveryLocation">In this path, the 'cac:Delivery' element requires the 'cac:DeliveryLocation' child.</sch:assert>
</sch:rule>
```

Following this procedure, within the eBIZ-TCF 17 Use Profiles have been designed, starting from 8 official UBL 2.0 documents; 13 of these profiles are full conformant with the UBL documents, while 4 of them, since are completely new documents not existent in the UBL 2.0 document set (built following the UBL customisation rules and exploiting when possible the UBL library), are only compatible. These documents can be used as common data models for data exchange between the enterprises of the sector. According to the last column of table 2, such documents have a very low '# of XPaths' that make them much more similar to the documents belonging to a vertical standard and thus are expected to have less redundancy and uncertainty when the implementers design their applications.

6. Conclusions

The problem of achieving a critical mass of adopters in sectors characterised by the large presence of SMEs is challenging both for policy makers and for IT research.

Sector specific initiatives based on public open standards appear to be one of the leverages to tackle the problem, but standards traditionally are perceived as costly and resource consuming elements of possible technological solutions.

The analysis of different approaches to standardization has pointed out that some of the problems arise from the intrinsic nature of standardised specifications: the first idea at the basis of this work has been to characterize the intrinsic properties of standardised specification, firstly by identifying some metrics.

Secondly this paper has shown that some of the disadvantages of using horizontal rather than vertical or sector related specifications could be overcome by using use profiles but they need to be automatically processable (expressed through XML Schema and Schematron).

Thirdly we expect also that in some cases the same approach could prevent an excessive proliferation of specialized data model structures even in vertical specifications.

Future developments are in the field of:

- improvement of metrics related to standard specifications' properties
- exploitation of co-constraint languages to enforce business rules at a smaller granularity (inter-company level instead of sector level).
- automatic management of the alignment between different customisation descriptions to speed-up the implementation processes.

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