eProduct Catalogues Using Web Services

Robert Amor & Wolfgang Kloep

Abstract
Online product catalogues for construction have tended to mimic traditional paper-based catalogues. This approach adds little value to the electronic format and does not integrate well with the object-based design world which is starting to become accepted within CAD systems. The development, and mass deployment, of new Internet-based technologies such as XML, SOAP, UDDI, WSDL, etc support new approaches to online product catalogues. The potential benefits provided by these technologies include: identification of products via actual parameters; a single data transport mechanism; dynamic identification of available products as required; the ability to handle multiple information formats from manufacturers; support for product differentiation by manufacturers; and manufacturer control of their information base. These potential benefits have been tested in example projects which show that difficulties still remain in creating an open framework for product brokering. The lessons learned from these projects and paths for future work are presented here.

Keywords: web services; manufactured product; online catalogue

1 Introduction

Paper catalogues are still the main method of collating a large number of manufactured product information sheets into a single document. A paper catalogue will usually impose a particular classification over the range of products encompassed in the work, and often will have a standard format for basic business information about the manufacturers and suppliers of the product. However, they have a number of drawbacks, including:

- Lack of coverage. Most countries have several catalogues which compete in a national market. Where the business model is to charge the manufacturer or supplier to be included in the catalogue, there is a limit to the number of catalogues that a manufacturer or supplier can afford to place themselves in. With thousands of firms in any one country, new or smaller manufacturers and suppliers are also likely to be missed by the catalogue producers.
- Currency of the data. Frequently, a paper catalogue is out-of-date the day it is published, with products being added, dropped, or modified on a regular basis, as well as changes occurring in the businesses involved. This also has an impact on the accuracy of the parameters used to describe a product which may change with changes in production.
- Transposition errors in use. Data extracted from a paper-based catalogue, or details redrawn from a diagram, must be copied manually. This provides a conduit for transposition errors into project documents.
- Single pathway to products. As the classification system is the only access mechanism to the products, the user must manually determine which of the set of products under a particular classification satisfy the remaining constraints for their use within the building. As CAD systems are becoming more object-based and therefore contain the majority of parameters for selection of a required product, this process is increasingly inefficient.
- Control of the information published. Manufacturers and suppliers are often not happy with how much information gets published for their products which is under the control of the catalogue editors.

Online catalogues are now firmly established in the market (e.g., Sweets, AEC Info, Barbour Index) and, apart from some very limited systems (e.g., providing scanned images of the original paper catalogue), they address some of the problems listed above. Online catalogues can ensure the data is more up-to-date, as long as they are informed of changes by the manufacturers and suppliers - though there is no guarantee this will happen. They can also reduce transposition errors by allowing cut and paste of the text from the manufacturers' and suppliers' information sheets, and by having links through to CAD drawings, etc for details. However, the basic model of operation is little changed from the paper world, and the majority of the issues with paper catalogues still remain in these electronic counterparts.

1.1 Previous research work

Several research projects have looked at the requirements of (Jain & Augenbroe 2000), and frameworks for (Ofluoglu et al 2000; Amor & Newnham 1999; Radeke et al 1997), a full online manufactured product

catalogue which can address the issues stated for paper catalogues (for a fuller list of projects see Hannus 2002). For example, in the ARROW project (Amor & Newnham 1999), the prototype developed allowed for structured information to be provided by manufacturers and suppliers alongside standard textual information from websites and related documents. Products could be identified by any of the provided parameters and the results of such a search was linked directly to the application (e.g., a CAD program) which requested a particular type of product information (e.g., a CAD file, or compliance certificate).

However, despite the impressive ability of these prototypes to find products well suited to requirements, they were still cumbersome in some areas, including:

- Provision of information. The cost to manufacturers and suppliers working with the online system was considerably higher than for paper-based catalogues. Information had to be either: laboriously transformed by hand from the company's internal format to the rigidly specified format of the online supplier; or a program had to be written to enact this conversion. While the manufacturer, or supplier, had full control of the information which would be published (including their own differentiating attributes), they had to run this publishing process for each catalogue every time there was a change in their product line.
- Collation of manufacturers and suppliers. As with the paper catalogues, it was still necessary to sign up individual manufacturers and suppliers to the online system. Hence the coverage had similar problems.

As there are many thousands of manufacturers and suppliers in any one country, expecting a sea-change to a more laborious process for the unproven business benefits of an electronic catalogue is not realistic.
Standards have been developed to support descriptions of product libraries, for example ISO-PLIB (Pierra et al 1998) and PDML (Burkett 1999), however they do not address the barriers identified above and are not currently widely used.

2 Further requirements of an online product brokering system

In looking at how to take forward the research work in online catalogue systems it seems clear that manufacturers and suppliers have further requirements on top of the ability to utilise product parameters as well as classifications of the collated products. These, more business-oriented requirements, would seem to include:

- Tie-in with standard business environment. The ability of any online catalogue producer to interoperate with manufacturers and suppliers is going to be greatly increased if they can work with the standard packages used in business. The data extraction problem for passing information through to a catalogue is then greatly reduced, and bespoke coding to map information to the catalogue's format is not needed by manufacturers and suppliers.
- Common transfer format for input to any catalogue. If a common data transfer format were available then the work required to send and access data would be minimised for both the catalogue developers and the manufacturers and suppliers. For example, the ARROW project (Amor & Newnham 1999) allowed the ISO standard 10303 SPF (STEP physical file) as a transfer format, although almost no business tool supported the generation of this file format for data transfer.
- Reduced need to sign up with all product catalogues. It would be helpful for catalogue developers if they had a simpler mechanism to identify suitable manufacturers and suppliers for their catalogues. Manufacturers and suppliers would also be helped if there were a way for catalogue producers, not necessarily just from one nation, to identify products as suitable for their catalogues. If the contacting and inclusion could be done on an as-needed and automatic basis then both sides would be reducing their workload substantially.

3 Web services support technologies

A range of new technologies have come through from the computing domain which seem to be of benefit to the development of online catalogues. These technologies support web services by provision of layers of support as shown in Figure 1. These services are surveyed below, and their utility is examined through the exemplar projects described in the next section.

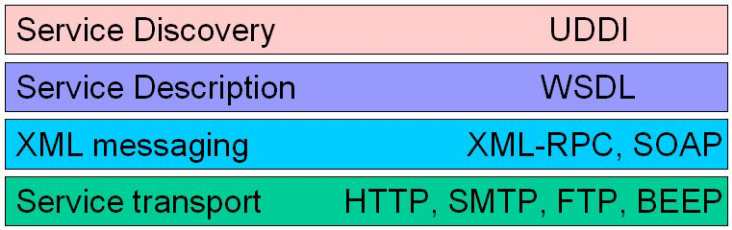

Figure 1. Web services protocol stack

3.1 XML

The eXtensible Markup Language (XML) allows for the transfer of structured data between two applications (XML 2000). The format of a XML file is very simple and allows for data in any number of structures to be encoded. Data in a XML file can be published according to a known data structure, or to any extension of a data structure decided by the creator of the file. While this is hardly a new ability for data transfer, XML has been taken up by the vast majority of applications currently in use today. Database systems read and write XML formats, and most software developers (including Microsoft) are providing for the manipulation of XML files in their products. The extensibility of the data which can be handled in XML, and its availability through the most common of business tools, provides a simple way for data to be accessed and transferred between users and applications.

3.2 WSDL

The Web Service Description Language (WSDL) is a XML grammar for describing the public interface of a web service (WSDL 2002). As it is based on XML, WSDL is a platform- and language-independent system. A WSDL file contains important information about interfaces, messages, data types, transport protocol and location of a specific web service. Thus, a WSDL description provides all the information needed to understand what a service can offer and the manner in which it should be invoked. In terms of catalogues, this seems to provide a way for manufacturers and suppliers to specify how to find their products (e.g., what type of parameter-based searches are available) and describes the structure that the resultant data will be delivered in.

3.3 UDDI

The Universal Description, Discovery, and Integration Specification (UDDI) is focused on the discovery of web services (UDDI 2003). UDDI is a platform-independent and open framework for describing services, discovering businesses and integrating business services. It provides a standardised method for announcing, and also finding, services. This should allow manufacturers and suppliers to describe their business and the types of service they offer in a neutral and openly accessible location.

4 Exemplar projects

Two projects have been run to test the utility of these web service technologies. The first examined what UDDI offers for a brokering environment. The follow-up project layered in WSDL to attempt to rectify failings identified in the UDDI approach.

4.1 UDDI brokering

The initial project (Cope & Amor 2002) worked on the premise that a manufacturer or supplier could publish all of their business information to a public UDDI registry. As UDDI assumes a cloud of public registries talking to each other to enable service discovery it was thought this would allow a manufacturer or supplier to publish and maintain their business information in one place for all to use. Searching a UDDI registry for a product would then draw upon all registered manufacturers and suppliers anywhere in the world. Figure 2 shows the information accepted by a UDDI registry. UDDI is modelled after the phonebook world, with basic business information in white pages, service classifications in yellow pages, and specific product information in green pages.

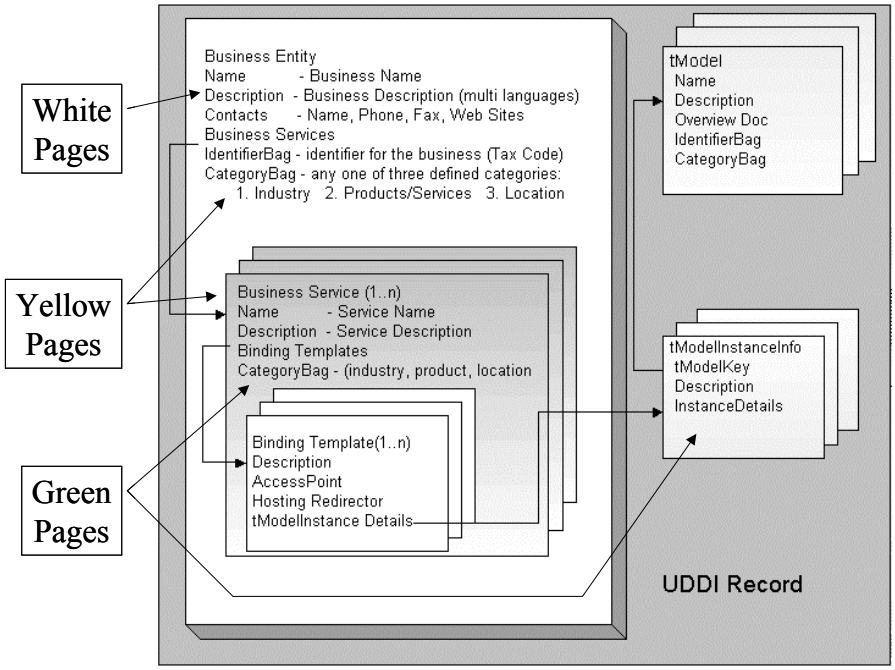

Figure 2. UDDI core data structures (Siddiqui 2001)

This project successfully demonstrated the open identification of manufacturers and suppliers based on their business information. However, it also showed that UDDI only allows for business level information to be recorded along with classification of service types. UDDI does not allow for the parameters of a service to be published in an easily accessible form. So while UDDI may allow a user to discover who manufactures a particular object, the user is unable to determine any of the object's properties. UDDI is also constructed with a set of generic classification systems (e.g., UNSPSC, NAICS, ISO 3166), which are not well suited for construction needs. While a UDDI registry can set up its own classification system (e.g., CSI or UNICLASS) this is not shared with other UDDI registries around the world. To register construction specific classifications for manufacturers and suppliers there would have to be a construction specific UDDI registry which linked to the general business information in the global UDDI registries but maintained the construction-specific codes locally.

4.2 WSDL and UDDI brokering

The second project built upon the results of the UDDI broker described above. In this project we assumed basic business information about manufacturers and suppliers was locatable within a UDDI registry and that a construction specific UDDI registry existed with classifications for manufacturers and suppliers operating in the construction world. This project looked at how the UDDI registry could point to WSDL information, held by manufacturers and suppliers on their web sites, describing how to find details of the products they have available. In this project we assumed that each manufacturer and supplier web site had a WSDL interface built over the top of their enterprise applications (see Figure 3).

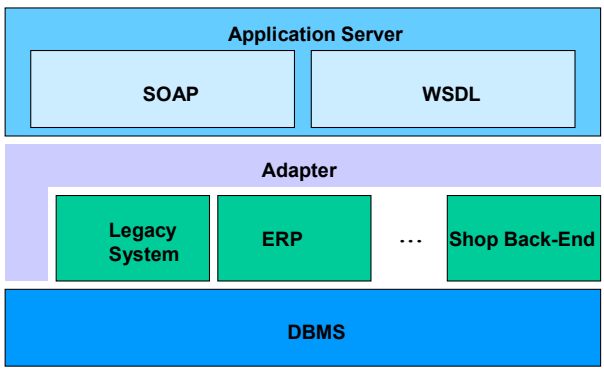

Figure 3. Use of WSDL to access product parameters

This project showed that this setup enabled parameters of products to be determined from each individual manufacturer and supplier of a category of product. WSDL was used to identify what information was available from each of these manufacturers and suppliers and then pass the appropriate query through to see if they had a product which matched the requirements of the product specifier. This gives the openness being sought by manufacturers and suppliers and allows them to publish and maintain their data in one place. It allows the user to find parameterised products from everyone online. However, it still leaves the problem of how to map between all the different data formats manufacturers and suppliers may use. In this scenario this problem is passed through to the catalogue producer. This scenario also assumes that all manufacturers and suppliers will have a WSDL interface to their system, which is currently unlikely. And, as with many online brokering systems, this style of manufactured product service only provides answers from those web sites which are online at the time the question is asked.

5 Conclusions and future work

The projects described in this paper show that it is possible to build a more open framework for the development of manufactured product catalogues than previous research and commercial efforts have achieved. In this framework the manufacturers and suppliers need only publish their business information in one open UDDI registry of their choice and provide construction specific classifications in a construction specific registry of their choice. If they then provide a WSDL description of their web site's search capability a catalogue system can identify appropriate products based on business information, construction categorisation and the product's parameters. However, this framework requires an IT capability which is currently beyond the majority of manufacturers and suppliers and requires catalogue producers to tackle the issue of mapping product information between the varying formats held by manufacturers and suppliers.

This work will be extended to examine how WSDL wrappers could be automatically generated for a business' web site and to what extent mappings can be automatically generated for differing data formats at the catalogue producer's end.

Bibliography

Amor, R. & Newnham, L. (1999). CAD Interfaces to the ARROW Manufactured Product Server, *Proceedings of the Eighth International Conference on Computer Aided Architectural Design Futures*, Atlanta, USA, Kluwer Academic Publishers, pp. 1-11.

Burkett, W.C. (1999). PDML: Product Data Markup Language, A New Paradigm for Product Data Exchange and Integration, White paper, 24 April 1999, last accessed March 2003, http://www.pdit.com/pdml/pubs.html.

Cope, G. & Amor, R. (2002). UDDI for a Manufactured Product Brokering Service. *Proceedings of the EC-PPM Conference on eWork and eBusiness in AEC*, Portoroz, Slovenia, 9-11 September, pp. 603-608.

Hannus, M. (2002). Building Product Libraries links, last accessed March 2002 at http://cic.vtt.fi/links/prodlib.html.

Jain, S. & Augenbroe, G. (2000). The Role of Electronic Product Data Catalogs in Design Management, *Proceedings of the CIB W96 Conference on Architectural Management*, May, pp. 271-288.

Ofluoglu, S., Coyne, R. & Lee, J. (2000). Managing Building Product Information on the Web. *Proceedings of INCITE 2000,* Hong Kong, 17-19 January, pp. 856-868.

Pierra, G., Sardet, E., Potier, J.C., Battier, G., Derouet, J.C., Willmann, N. & Mahir, A. (1998). Exchange of Component Data: The PLIB (ISO 13584) Model, Standard and Tools, *Proceedings of the CALS EUROPE'98 Conference*, 16-18 September, Paris, France, pp. 160-176.

Radeke, E., Leonard, C.D., Kesteloot, P. & Ritvas, J. (1997). Intelligent Access to Engineering Information by GENIAL, *Proceedings of the conference on Integration in Manufacturing (IiM '97)*, Dresden, Germany, 24-26 September.

Siddiqui, B. (2001). Using UDDI as a Search Engine: smart web crawlers for all, last accessed May 2002, http://www.webservicesarchitect.com/content/articles/siddiqui01.asp.

UDDI. (2003). Universal Description, Discovery, and Integration Specification 2.0, last accessed March 2003, http://www.uddi.org/specification.html.

WSDL. (2002). Web Services Description Language Version 1.2. W3C Working Draft, 9 July 2002, last accessed March 2003, http://www.w3.org/TR/2002/WD-wsdl12-20020709/.

XML. (2000). Extensible Markup Language 1.0 (Second Edition) Specification. W3C Recommendation. 6 October 2000, last accessed March 2003, http://www.w3.org/TR/REC-xml.