A Framework for Design Centric Content Management

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Abstract

Electronic catalogs are a central component of the eProcurement processes in electronic commerce. Integrated multi-catalog frameworks allowing buyers to search and compare across multiple have received significant attention recently. Topics investigated include search and information retrieval mechanisms, architectures of multi-catalog systems, information presentation and user interfaces; and taxonomies and standards for representing non-traditional and service-related content. In this paper we argue that the scope of e-Catalog definition should be extended in the context of enabling eBusiness applications. We focus on environments where a personalized total solution is sought by a customer (business, consumer or government). We use a particular class of applications, referred to as *design-centric*. These applications are in the context of ad-hoc design processes, where ad-hoc denotes one-time projects, rather than mass-production oriented design. Most of the results however are applicable to the latter type of designs and other business applications.

1. Introduction

Content management can be described as activities of aggregating, leveraging, managing, and distributing content in a collaborative and efficient fashion. In this paper we use the term 'content' to refer to a larger set of acquisition related data than the conventional definition of e-catalog. In order to put it in the right context, it is important to understand what e-catalogs are. There is no standard definition for e-catalogs and the concept has been evolving constantly. An analogy is the definition of an electronic document that evolved from merely an electronic image of the printed document to a very complex object in today's web environment.

Traditionally, product catalogs contain an item code, a description of the item and graphical images or photographs [1]. According to [2], there are two types of catalogs: consumer and business-to-business. Consumer catalogs may be further classified into unaffiliated, retail, manufacturer-supported, incentive, non-profit, co-op, syndicated and international. Many other definitions of s of electronic catalogs exist. For example, [3] defined electronic catalog as "any web page that contains information about the products and services a commercial entity offer. A typical electronic catalog contains detailed pricing information which potential customers can use to help make purchasing decisions. Moreover, it may also support online shopping, ordering, and payment capabilities…" In [4] a broader definition is given: "electronic representations of

information about the products and/or services of an organization."

A narrower definition is provided by [5]: "… allow customers to browse through multimedia product representations and to get relevant information concerning the product…" In [6] they are define "as the reference for product selection and which can assist with source selection and description of terms and conditions." Current research in the structural design of electronic catalog design has focused on both the front-end and the back-end [4,7-12]. Front-end design typically focuses on the information organization and media presentation [13], while back-end design focuses on the system functionally. In front end design, for example, [12] introduced an Internet-based Electronic Product Catalog (IEPC) that reduced online customers' difficulties in navigating the catalog while searching products. Personalization strategies were incorporated into product searching mechanisms in Participatory Electronic Product Catalog (PEP) and Intelligent Catalog Search System (ICSS) [14,15]. Research in back-end design focused on support for user functions and features such as search engine [6,12], shopping cart [16], personalization of information and interface layout [6,10,14], as well as system administrator functions such as product information retrieval and storage, communication and collaboration with organizational parties and customers [4,14], and mediation with other databases and electronic catalogs [6,17,18]. Although much work has been done in designing individual front-end and back-end components, a comprehensive structural design for an electronic catalog is still lacking

Research was done in the area of designing e-catalogs, most from the consumer shopping perspective. In studying the impact on consumers, [19] compared individual's perceptions of Internet catalog shopping and print catalog shopping. They also compared individual's attitudes and intentions to shop using print and Internet catalogs [20-21]. The papers by [9-11,22-30] studied the effectiveness of using different media in the product presentation, such as text, image, photo-realistic virtual reality object, 3D virtual object, animation and video. From a management perspective, [35] showed that the impact of Internet and related technologies changes the role of purchasing department from a transaction- oriented one to a more managerial one that focuses on establishing and maintaining relationships with related parties. The above impact studies provided piecemeal evidence on the effectiveness of electronic catalog features and hence piecemeal advice on catalog design.

In our framework we include features that are crucial for both designers of e-Catalogs, intermediaries (e.g., marketplaces) and buyers. The context for the work is a personalized total solution sought by a buyer (business, government or consumer). We first describe that environment followed by a proposal for content management.

2. Enabling Next Generation eBusiness Applications

Next generation (NG) eBusiness Applications is of strategic importance to economic growth. The consensus among experts is that the enablement gap among the three levels of communication & computing infrastructure, business applications, and business use of those has been a primary factor in the technology sector decline and the resulting economic downturn. Enabling NG eBusiness must be based on process-oriented technologies and applications. Our research deals with the following interdisciplinary problem: "What are the best business and technology models to support the end-to-end NGI eBusiness processes associated with various applications?" Dealing with e-catalogs and content management in general must be done within this content. The Fisher Center for Information Technology & Marketplace Transformation (http://haas.berkeley.edu/citm), has been pursuing various projects on enabling eBusiness transformation. Results of that work indicate that NG eBusiness processes and technology must focus on the support for personalized solution oriented business models. To achieve that, the following major problems were identified:

- Flexible Process interleaving models. How to enable intra- and inter-organizational processes to come together in new collaborative interleaved ways in providing a personalized total solution.
- Systems and applications models to support those new process models. Key problems to be addressed here are interoperability and context transfer. Issues related to usability and user interfaces, security and privacy, and scalability are crucial in addressing these key problems.
- Communication and computing Infrastructure support Interoperability mechanisms to provide secure, broadband support

3. Business & Technology Requirements for Design-Centric Process Interleaving

In order to illustrate the concepts, we use a an example from office design. Figure 1 shows the players involved and their interaction. Figure 2 provide a visual view of the important concept of process interleaving. The numbers in the diagram refer to the specific task descriptions which are omitted here.

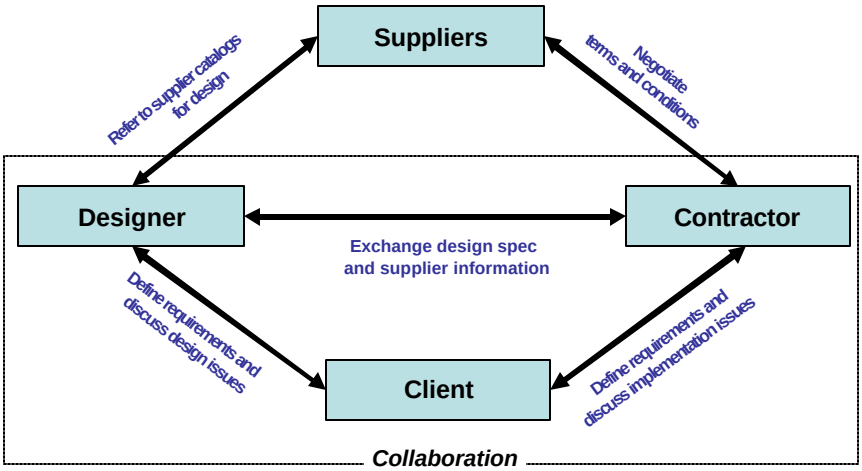


Figure 1: Model of Buyer-Seller interaction

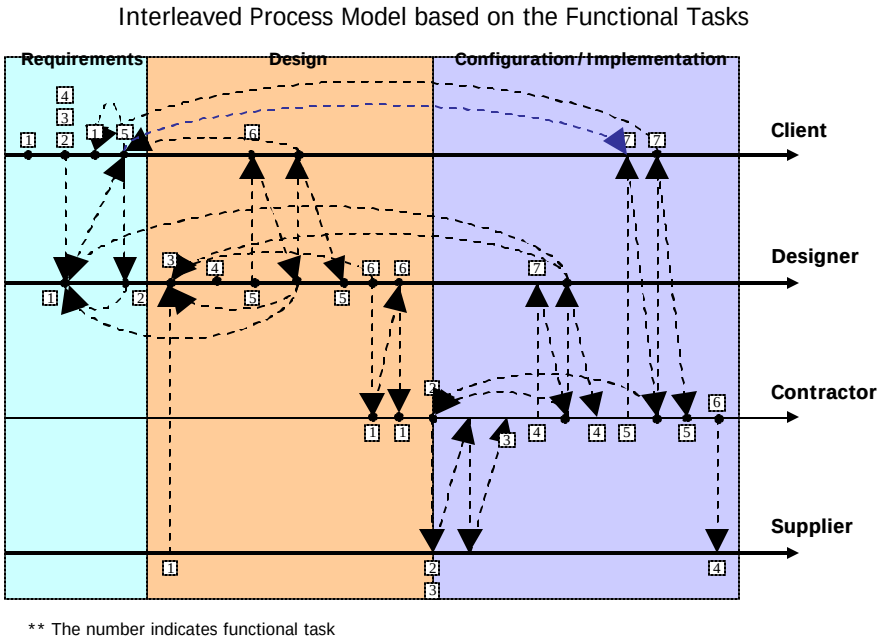
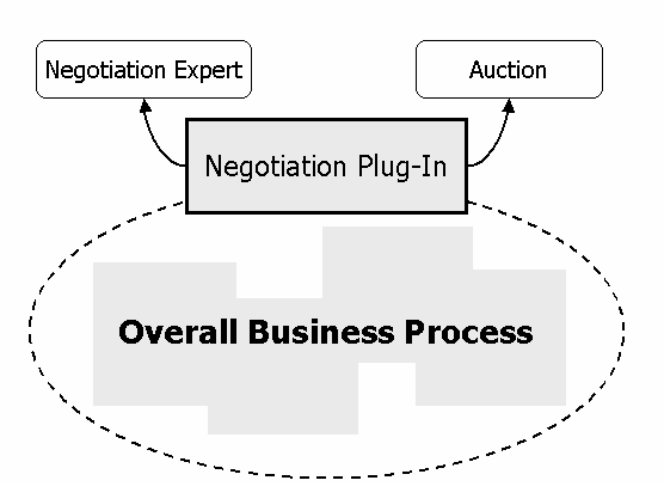


Figure 2: Example of the Interleaved Process Model

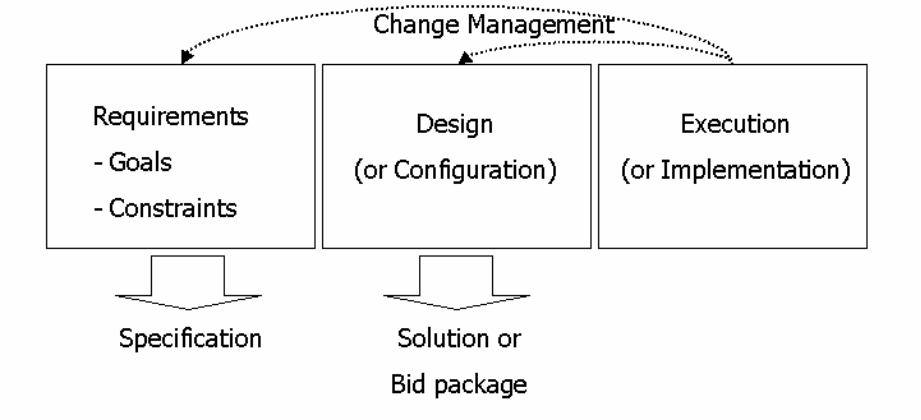
There are various processes that should be considered in scenarios such as the one discussed above. An important process that is tightly interrelated to e-catalogs and content management is negotiations.

4. A Framework of Negotiation

We use a generic model that is applicable to different domains and situations. A negotiation module can be designed to support auction mechanisms, negotiation process support, etc. as part of the overall business process.



In the case of the office design model, the following model will be used to incorporate a negotiation component.



Finally, a challenging task is to identify the best way to Integrate the major blocks as shown in Figure 3.. That requires to identify the relationships among requirements,

utility, supplies, and design; and model the interactions; and integrate the blocks and interactions to have a systematic view of negotiation in the process design.

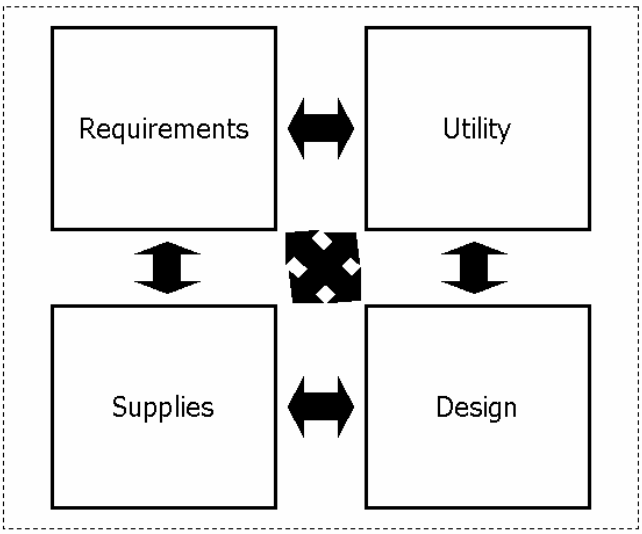


Figure 3: Integrating the various blocks

5. A Framework for Content Management

The integrated catalog containing design and procurement information as well as other related data plays a key role in this environment. However, there are many issues that must be resolved in order to enable the NGI business processes. For example, the context must be included in the catalog. Context is very important because a design process will fail without information on compatibility, optimal environment, etc. We propose an integrated catalog that incorporates new functionality to enable the next generation processes as explained below. There are several content related problems and business scenarios that will impact the design; they are discussed next.

Problems in content management

Typically content management solutions try to solve two kinds of problems: problems in publication of the content and problems in using the content. Problems in content publication include various problems in creation, maintenance, and distribution of the content. Problems in using the content include data intelligence issue. The following are more detailed problems that are considered in content management solutions in today's market. The proposed framework addresses these problems.

Content aggregation

Content aggregation is to aggregate and combine content components from different sources. The content components must be re-usable and compatible to create content by aggregation.

Content collaboration

Content collaboration is to compose and publish content in collaborative way. For content collaboration, content must be componentized and concurrent control must be considered.

Content management

Content management is to update and maintain content components and documents. The content components must be easy to update. Also they must be reliably stored and retrieval.

Content distribution

Content distribution is to control content. Syndication is a common way of controlling distribution of content. Content distribution considers reuse based on terms and conditions governing reuse, schedules, redistribution rights, etc.

Content intelligence

Content intelligence is to provide semantics of data in consistent way. Meta data is a common way to provide intelligent content. Meta data is data about the data. It provides intelligence through information on subject, ownership, data links, similarity among contents.

Content Management for Customer Oriented Business Model

Customers are not equal. Each customer has different needs and the needs change over time. Customer oriented business model tries to satisfy the different and dynamic needs as if it is one-to-one relationship – i.e. in a customized way. e-Business enables businesses to provide a 'real' customized solution in such dynamic environment. We name such a business process as agile sense-and-response business process. The aggregated and coordinated products and services to satisfy a customer's need is named as total solution. The process of providing a customized solution is an ad-hoc process and in many cases it is unlikely that one vendor or one market will be able to provide the total solution. Therefore, to provide a total solution, content integration and coordination of companies are required. Content integration issue includes how to combine catalog contents to provide them as a whole to a customer. Coordination issue arises because to fulfill a total solution it is very common that more than one companies join the process. An example of the coordination issue is business partnership vs. ad hoc cooperation.

We focus on marketplace-oriented total solution. In this case, a customer comes to the market place to purchase a total solution and marketplace aggregates and formats the content from different sources (i.e. sellers and manufacturers). 4 shows a scenario of marketplace-oriented total solution. A customer's needs are composed of component 1,2, and 3. The customer comes to marketplace A to satisfy the needs. In marketplace A, there are suppliers for 1 and 2 but there is no supplier for supplier for 3. Marketplace A asks marketplace B if there is a supplier for 3 who are compatible with the suppliers in marketplace A. The marketplace B returns such suppliers to marketplace A, and marketplace A returns suppliers for 1,2, and 3 to the customer as if all of suppliers are in marketplace A.

As seen in the example scenario, in customer oriented business process, there are several more content management problems beside the problems stated in the previous section (i.e. content aggregation, collaboration, management, distribution, and intelligence).

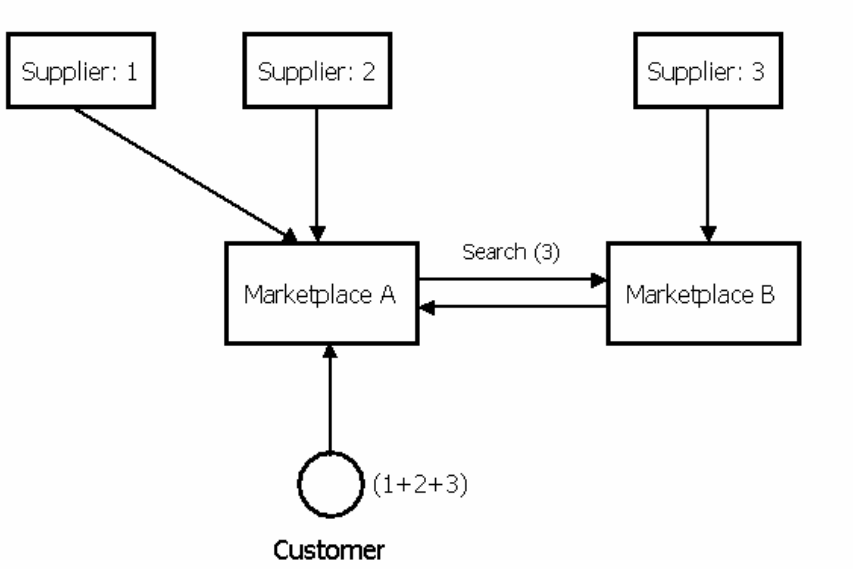


Figure 4. Example of Marketplace Oriented Total Solution

First, interoperability among content components must be considered. As stated earlier, in many cases it is unlikely that one vendor or one market will be able to provide the total solution. Therefore, typical business processes for total solution are inter-organizational processes. To provide a solution as a whole to a customer, the content components in different organization must be interoperable. Second, content on the interoperability must be considered. The content components in a total solution must be interoperable to present the components as a whole to a customer. However, it does not mean that the content of the content (i.e. product or service) is interoperable with each other. For example, two catalogs may be interoperable but the product described in the catalog may not be interoperable. Therefore, to make actually deliverable solutions from the contents, interoperability information must be included. Interoperability information includes product information such as compatibility as well as dynamic and real time procurement information such as cost dependency, availability, delivery date, etc.

Third, context of the content must be considered. For example, when an item in a catalog is intended to be under a certain environment such an environment must be also presented in the catalog. It can be interpreted as the recommended complements or constraints of an item.

Based on the considerations on the content management issue in total solution business model, we propose an integrated catalog. The integrated catalog for customer oriented business model includes the following components:

- Supplier-related information:
- Contact information, category of business, services and product provided, method of technical interactions, supplier rating, etc.
- Item-related information:
- Features of the product and services
- Procurement information:
- Price, delivery date, terms and conditions, etc.
- Interoperability information:
- Compatibility with other items, constraints, required complements, etc.
- Context: Requirements, recommended complementary parts, constraints, etc.

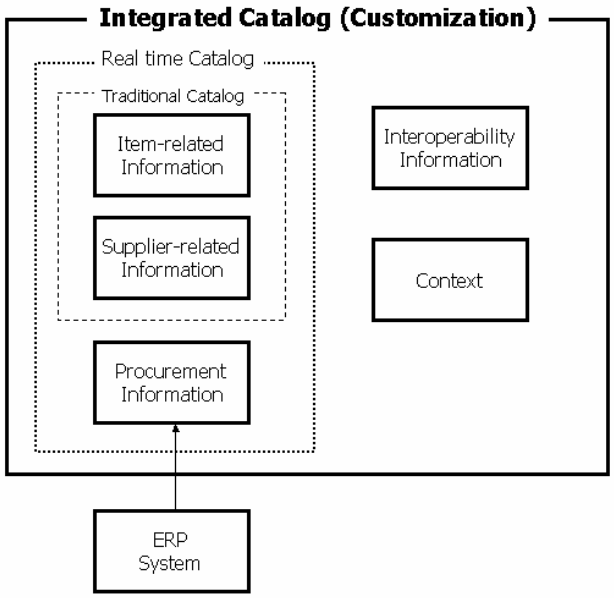


Figure 5. Integrated Catalog for Customer Oriented eBusiness Process (Customization)

Content Management for Design-centric Business

Design-centric business is a set of businesses that are initiated in the context of a design project. A characteristic of such environment is the need for process interleaving in order to achieve a total solution explained in the previous section.

Primary processes that need to be interleaved in a design centric business process include design, negotiations, procurement, project management, and various other marketplace and supply chain activities. Design can be more implementable and cost efficient, and procurement can reflect the design decisions better in interleaved design centric business process. Eventually, it brings a better outcome. The integrated catalog containing both design and procurement information plays a key role in such interleaved processes .Figure 6 shows content management system (i.e. catalog server) can be regarded as a part of overall design infrastructure from the interleaved design-centric business point of view.

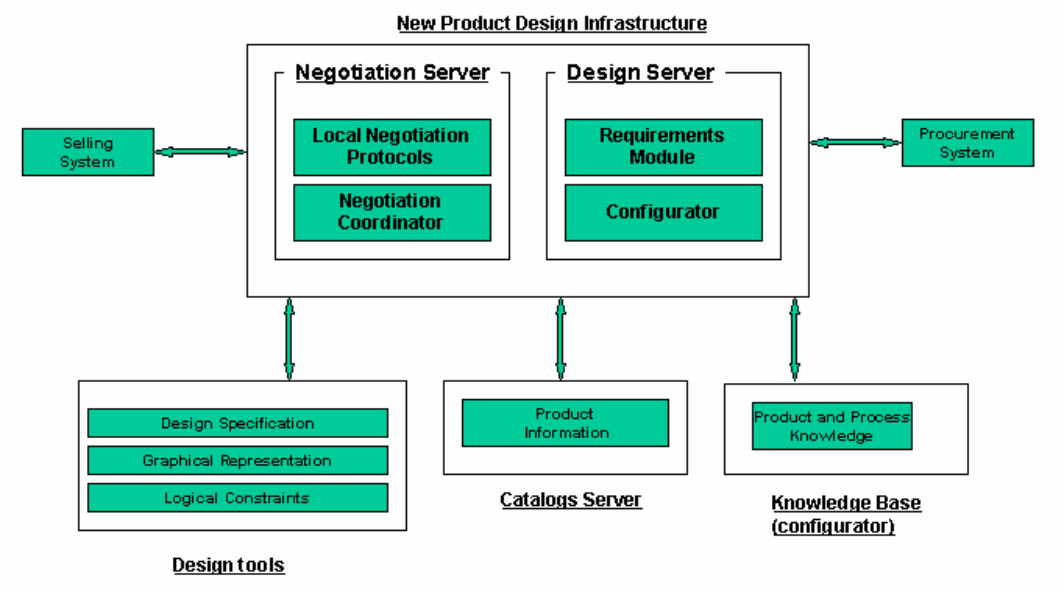


Figure 6. A new product design infrastructure

For the content management in the context of the design infrastructure, we find that there are issues and problems beside the traditional problems in content management. First, we find that separation of design information from other information such as procurement is required. In the design process, it is beneficial to consider information beside the design part only. However, it is also required to have only design related data to focus only on the design when necessary – for example, when searching the right items for the design before considering procurement constraints.

Second, design content component must be included in the catalog. This is ignored in most of the catalog system mainly because it is ignored that an item can be used in a

design. By providing design content component, design process can be streamlined because then design process becomes a plug-and-play type of process.
Third, context must be included in the catalog. Context is very important because design process will go wrong without information on compatibility, optimal environment, required complements, etc.

Based on the considerations on the content management issue in design-centric business model, we propose an integrated catalog. The integrated catalog includes the following components (we show only a subset in this simplified example, see Figure 6 below):

- Design-related information: Size, shape, material, etc.
- Supplier-related information: Contact information, category of business, technical information, supplier rating, etc.
- Procurement information: Price, delivery date, service terms, etc.
- Design content component: Software component for design such as CAD objects describing the item
- Context: Constraints, complementary parts, optimal environment, etc.

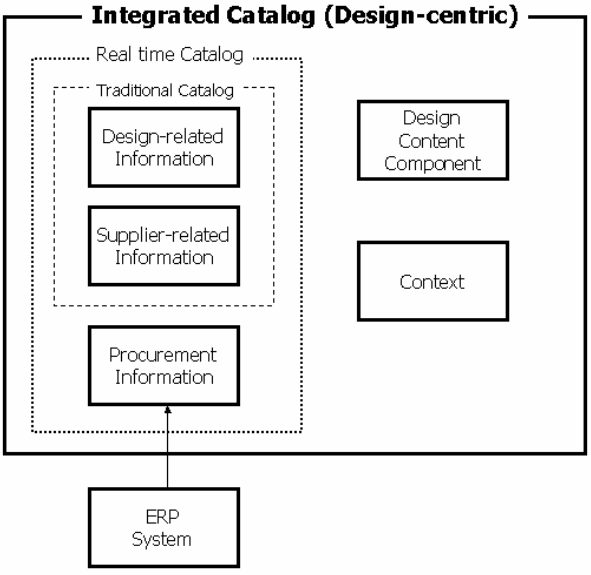


Figure 6: The Design-Centric Integrated Catalog

As an example, consider a simple case of office design where different types of furniture need to be purchased and other items such as carpet and plants are also

required. Figure 7 shows an example of an integrated catalog for a desk. The integrated catalog contains design and procurement information as well as context and design content component. The following is explanation of each part of the integrated catalog example.

- Downloadable CAD object for a desk (i.e. design content component)
- A recommended environment setting or selected setting for the desk. (i.e. context type information)
- Supplier information and product features (supplier-related and item related information)
- Real time data for the price and delivery time (procurement information)

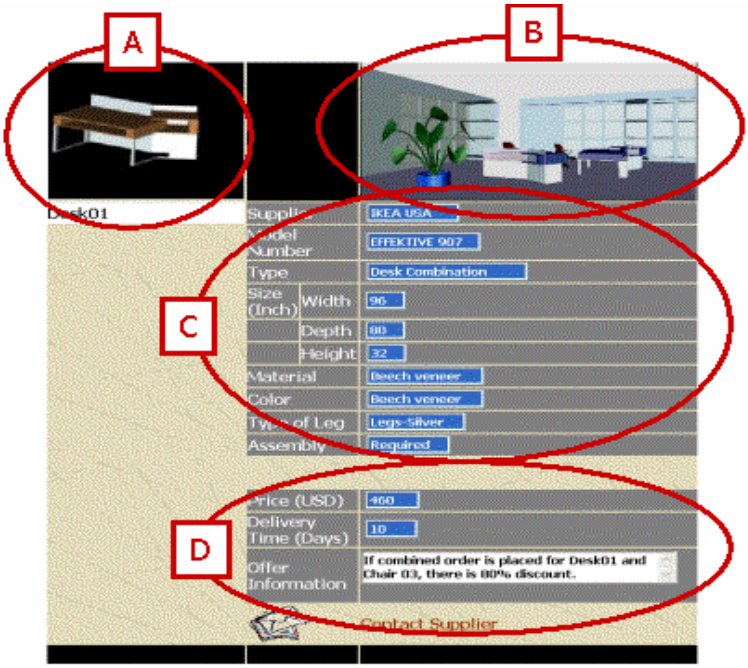


Figure 7: Example of Design-Centric Integrated Catalog

6. Summary

This paper proposed a framework for content management for design-centric environments. The framework is based on an extension of existing definitions and models of e-catalogs, to include additional data in a way that is aligned with the

process interleaving needed to support next generation models of eBusiness processes. The key contributions of this research

- Identifying the business and technology problems involved in such applications and proposing new process models to solve them.
- Developing a novel interleaving model that prescribes optimal integration of key processes such as requirements and constraint satisfaction, 3D design, content search, collaboration, negotiation and the product data. Integrating product sourcing, negotiations and commitments during the design are therefore infeasible or extremely inefficient or are feasible in a "hard-wired" proprietary way for a specific application.
- Developing and prototyping systems & applications to support these models in the selected application areas. This will be done in the context of collaboration with industry and analyzing the eBusiness transformation issues in deploying such solutions in the particular domains. There numerous business, organizational, and technology related obstacles to marketplace adoption of new models.

References

[1] Bond, W.J. (1993). *Home-based Catalog Marketing*, McGraw-Hill, Inc.

[2] Muldoon, K. (1995). *How to Profit through Catalog Marketing*, NTC Business Books.

[3] Segev, A., Wan, D. and Beam, C. (1995). Designing electronic catalogs for business value: results of the CommerceNet pilot, *CITM Working Paper CITM-WP-1005*, October 1995.

[4] Baron, P., Shaw, M.J. and Bailey, A.D. (2000). Web-based e-catalog systems in B2B procurement, *Communications of the ACM*, **43**(5), pp. 93-100.

[5] Timm, U. and Rosewitz, M. (1998). Electronic sales assistance for product configuration, *Proceedings of the 11th International Bled Electronic Commerce Conference*, Bled, Slovenia.

[6] Keller, A.M. (1997). Smart catalogues and virtual catalogues, in R. Kalakota and A.B. Whinston (eds.), *Reading in Electronic Commerce*, Addison-Wesley, pp. 259-271.

[7] Gosalvez, M.G. (1997). Electronic product catalogues: what is missing? *International Journal of Electronic Markets*, **7**(3), pp. 3-5.

[8] Palmer, J.W. (1997). Retailing on the WWW: the use of electronic product catalogs, *International Journal of Electronic Markets*, **7**(3), pp. 6-9.

[9] Koch, N. and Mandel, L. (1997). State of the art and classification of electronic product catalogues on CD-ROM, *International Journal of Electronic Markets*, **7**(3), pp. 16-21.

[10] Luedi, A.F. (1997). Personalize or perish, *International Journal of Electronic Markets*, **7**(3), pp. 22-25.

[11] Spiller, P. and Lohse, G.L. (1998). A classification of Internet retail stores, *International Journal of Electronic Commerce*, **2**(2), pp. 29-56.

[12] Stanoevska-Slabeva, K. and Schmid, B. (2000). Internet electronic product catalogs: an approach beyond simple keywords and multimedia, *Computer Networks*, **32**, pp. 701-715.

[13] Hoffman, D.L., Novak, T.P. and Chatterjee, P. (1996). Commercial scenarios for the Web: opportunities and challenges, *Journal of Computer-Mediated Communication*, **1**(3).

[14] Schubert, P. (2000). The participatory electronic product catalog: supporting customer collaboration in e-commerce applications, *International Journal of Electronic Markets*, **10**(4), pp. 229-236.

[15] Glezer, C. and Yadav, S. (2001). A conceptual model of an intelligent catalog search system, *Journal of Organizational Computing and Electronic Commerce*, **11**(1), pp. 31-46.

[16] Lim, G.G. and Lee, J.K. (2000). Buyer-carts for B2B EC: the b-Cart approach, *Proceedings of the International Conference on Electronic Commerce 2000*, Seoul, Korea, pp. 54-63.

[17] Lincke, D.M. and Schmid, B. (1998). Mediating electronic product catalogues, *Communications of the ACM*, **41**(7), pp. 86-88.

[18] Ginsburg, M., Gebauer, J. and Segev, A. (1999). Multi-vendor electronic catalogs to support procurement: current practices and future directions, *Proceedings of the 12th International Bled Electronic Commerce Conference*, Bled, Slovenia

[19] Jones, J.M. and Vijayasarathy, L.R. (1998). Internet consumer catalog shopping: findigns from an exploratory study and directions for future research, *Internet Research*, **8**(4), pp. 322-330.

[20] Vijayasarathy, L.R. and Jones, J.M. (2000). Print and Internet catalog shopping: assessing attitudes and intentions, *Internet Research*, **10**(3), pp. 191-202.

[21] Vijayasarathy, L.R. and Jones, J.M. (2000). Intentions to shop using Internet catalogues: exploring the effects of product types, shopping orientations, and attitudes towards computer, *International Journal of Electronic Markets*, **10**(1), pp. 29-38.

[22] Marcus, A. (1997). History lesson: the Web discovers user interface design, *Proceedings of the 7th International Conference on Human-Computer Interaction*

[23] Nielsen, J. (1996). Top ten mistakes in Web design, *Alertbox*, http://www.useit.com/alertbox/9605.html.

[24] Richtel, M. (1998). Making Web sites more 'usable' is former Sun engineer's goal, *The New York Times*, http://www.nytimes.com/library/tech/98/07/cyber/articles/13usability.html

[25] Gehrke, D. and Turban, E. (1999). Determinants of successful Website design: relative importance and recommendations for effectiveness, *Proceedings of the 32nd Hawaii International Conference on System Sciences*, Hawaii.

[26] Zhang, P., Small, R.V., von Dran, G.M. and Barcellos, S. (1999). Websites that satisfy users: a theoretical framework for Web user interface design and evaluation, *Proceedings of the 32nd Hawaii International Conference on System Sciences*, Hawaii.

[27] Fink, D. and Laupase, R. (2000). Perceptions of Web site design characteristics: a

Malaysian/Australian comparison, *Internet Research*, **10**(1), pp. 44-55.

[28] Lohse, G.L. and Wu, D.J. (2001). Eye movement patterns on Chinese yellow pages advertising, *International Journal of Electronic Markets*, **11**(2), pp. 87-96.

[29] Liu, C., Arnett, K.P. and Litecky, C. (2000). Design quality of Websites for electronic commerce: Fortune 1000 webmasters' evaluations, *International Journal of Electronic Markets*, **10**(2), pp. 120-129.

[30] Miles, G.E., Howes, A. and Davies A. (2000). A framework for understanding human factors in Web-based electronic commerce, *International Journal of Human-Computer Studies*, **52**, pp. 131-163.

[31] Chau, P.Y.K., Au, G. and Tam, K.Y. (2000). Impact of information presentation modes on online shopping: an empirical evaluation of a broadband interactive shopping service, *Journal of Organizational Computing and Electronic Commerce*, **10**(1), pp. 1-22.

[32] Westland, J.C. and Au, G. (1998). A comparison of shopping experience across three competing digital retailing interfaces, *International Journal of Electronic Commerce*, **2**(2), pp. 57-69.

[33] Goff, L. (1999). The Sharper Image, *Catalog Age*, pp. S15-S16.

[34] Johnson, C. (1998). On the problems of validating DesktopVR, in H. Johnson, L. Nigay and C. Roast (eds.), *People and Computers XIII: Proceedings of HCI'98*, Springer-Verlag, pp. 327-338.

[35] Gebauer, J., Beam, C. and Segev, A. (1998). Impact of the Internet on procurement, *Acquisition*

Review Quarterly, **5**(2), pp. 167-184.

[36] Yen, B.P.-C. and Ng, K.Y.M. (2000). Web-based virtual reality catalog in electronic commerce, *Proceedings of the 33th Hawaii International Conference on System Sciences*, Hawaii.