The Concept of a Mediating Electronic Product Catalog

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Introduction

The emergence of the Information Highway – in its current form Internet – opened up a vast potential for new electronic forms of commerce. Especially, the ability to quickly, inexpensively, and easily disseminate information regarding products and services has motivated many companies to offer their products using this medium. Electronic Product Catalogs (EPC) are basic means to achieve this. By offering a multimedial representation of product information as well as retrieval, classification, and ordering services EPC are the supplier's interactive interface to potential customers.

The above mentioned developments provide hitherto unknown opportunities for buyers as well. They have the possibility to search for products all over the world and to pick the most favorable offer. Yet in many cases this potential remains unharnessed. The world wide search for products is impeded by the heterogeneity of the product descriptions and different search strategies required by the suppliers. This particularly affects the matching of the customer query, i.e. his EPC, with the one of the supplier. Thus, even though product information is offered in electronical form, its processing and comparison is still a cumbersome manual process.

In order to utilize the potential of the information highways to establish global marketplaces, intermediaries are needed, capable of matching the supplier's EPC to the customers (Schmid 1997). In the following, we will present a concept for a Mediating Electronic Product Catalog (MEPC), an enabling technology for intermediation in electronic commerce. First, the requirements on such intermediaries are described, then the concept of the Mediating Electronic Product Catalog will be presented in detail. The paper finishes with a short overview of the current status of implementation and future work.

The requirements for intermediation

An intermediary can only be successful if he provides solutions, which at the same time add value to both the supplier and the customer. In order to determine the requirements for the functionality and architecture of an intermediary, first the problems and aims of the two players in current electronic commerce will be analyzed.

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The requirements for intermediation from a buyers' point of view:

The available search possibilities for product information on the Internet will be discussed by way of example (see also (Keller 1997)). If a buyer wants to procure a Chinese version of a word-processing application, he can either use an existing search engine such as AltaVista or visit the site of each relevant supplier directly. In the first case, appropriate search words have to be generated as inputs to the search engine. The result is a list of all pages which contain one of the search words. The search is performed on a syntactical level because the search engine does neither understand the meaning of the search words nor the purpose of the search. Thus, the result includes a lot of irrelevant information (e.g. pages which describe experiences of using a Chinese version of some special word-processing application). The buyer first has to filter out the information which matches his query. Subsequently, he has to translate the different product descriptions in his own language, in order to be able to compare them.

Following the alternative strategy of visiting individual Web-sites, the customer can retrieve relevant information from the beginning. A necessary prerequisite however is the knowledge of all suppliers, that offer the required product. Thus, in this case, the search for product information starts with a search for suppliers. Thereafter, the buyer has to navigate through their different search procedures. At the end, as described above, he has to transform the information found in his own language and to compare them manually.

The difficulties of the buyer increase if he wants to combine complementary products. The same procedure has to be repeated for each component of the complex product.

Based on the described example the following requirements for an intermediary can be identified from the buyers point of view:

- The intermediary should provide a language for an easy definition of buyers' needs, i.e. the definition of a buyers EPC. The language should support the search for single as well as complex products.
- It should support a transparent cross search over different suppliers' EPC. These catalogs should be presented to the customer in the chosen framework, i.e. the buyers EPC format.
- It should be able to store and track the access path of possible suppliers as well as the origin of the retrieved information.
- It should offer support for the evaluation and comparison of the retrieved product information.
- It should also provide additional services as electronic payment or contracting.

The Requirements for intermediation from the suppliers' point of view:

A basic aim of presenting products on Internet is to differentiate oneself against competitors. In order to achieve this, companies are defining their EPC uniquely in terms of product representation, description, and search. There is also no particular interest to allow easy comparison with competitors. Thus an intermediary, which imposes a rigid standardized structure upon existing suppliers EPC would probably have serious problems to acquire participants on the suppliers side. From the suppliers point of view, an intermediary will only be accepted if he provides integration but at the same time secures the autonomy of the supplier. In addition, special services, as for example electronic payment, electronic contracting, or generation of statistics, which allow a comparison with competitors could also increase the attractiveness of an intermediary for suppliers.

Summarizing the above requirements from both points of view the needed functionality of an intermediary can be classified as follows (Lincke 1996):

References

Genesereth, M.R. "Agent Communication Language" URL = http://java.stanford.edu/concur/language/, July, 1997.

Geyer,G.; Höhener, T. and Stanoevska-Slabeva, K. "Acquisition and Processing of Quantitative Information Within a Distributed Heterogeneous Environment", in: Proceedings of the Eleventh IASTED International Conference. Annecy, France, May 19-21, 1993. p.p. 143-146.

Geyer, G., Kuhn C. and Schmid, B. "An Electronic Product Catalog for Distributed Environments", in: Information and Communication Technologies in Tourism. Proceedings of the International Conference ENTER 96, Innsbruck, Austria. (URL= http://www-iwi.unisg.ch/iwi4/km/papers/enter96.html, July1997).

Handschuh, S. "Konzeption und prototypische Implementierung eines verteilten und adaptierbaren Elektronischen Produktkatalogs", Diplomarbeit der Universität Konstanz, 1997.

Keller, A.M. "Smart Catalogs and Virtual Catalogs", in Readings in Electronic Commerce, Ravi Kalakota and Andrew Whinston (eds.), Addison-Wesley, 1997.

- *Translation services* supporting the matching between buyers and sellers EPC. In other words, the intermediary should offer a mediating EPC combined with translation services for existing EPC.
- *Integration services* providing on the one hand an integrated view on heterogeneous suppliers EPC and on additional general services on the other hand.
- *Differentiation services* allowing the definition of specific views on the integrated platform.
- *Value adding services* as electronic contracting, payment as well as the generation of market research statistics.

In the next chapter the focus will be on the translation services and a solution for a MEPC based on the Q-Technology will be presented.

The Concept of MEPC

Considering the above described requirement for MEPC and based on the existing formal language Q-Calculus for the description and classification of products (Schmid, et al. 1996) as well as on previous experiences for the integration of heterogeneous databases (Geyer, et al. 1993), a concept for Mediating Electronic Catalogs was developed at the University of St. Gallen (Geyer, et al. 1996). The concept applies the paradigm of Federated Information Systems (Stanoevska-Slabeva 1997) and was influenced by the approach of Sheth and Larson (Sheth, et al. 1990) for developing federated data models.

The architecture of the MEPC

The MEPC is a federated system of autonomous EPC (Fig. 1).

The federation consists of a mediator i.e. an integrating Electronic Product Catalog, and of individual EPC from different suppliers. The glue, which mergers the components into one entity is a common product description frame, the Q-Calculus.

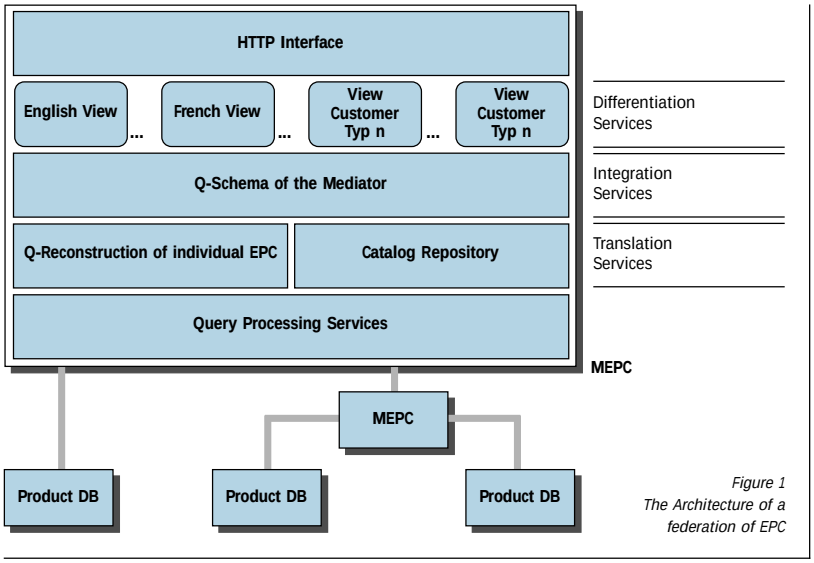

Figure 1
The Architecture of a federation of EPC

The Q-Calculus is a formal language for the description and classification of sets of objects, which was developed by Schmid (Schmid 1996). The basic language constructs offered are (Schmid, et al. 1996):

- *sorts*, which delimit sets of objects or products by naming them. For example sorts describing software products could be the following: *WordProcessingApplications*, *SpreadsheetApplications*
- *scales*, which contain the possible values of classification criteria. For example: *OperatingSystems* *={Windows, UNIX, Macintosh}*. *RequiredMemoryInMB* *= {0-2, 2-4, 4-6, 6-8, etc.}*.
- *attributes*, which combine sorts with scales. The scale of an attribute defines partitions on the sort. With other words it defines a classification structure upon the set of objects denoted by the sort. For example: If the scale "OperatingSystems" is applied on the sort "WordProcessingApplications" by a defined Attribute "RunsOnOperatingSystems", than the set of Word Processing objects is divided in subsets of objects running on only one of the specified operating Systems given in the scale.

RunsOnOperatingSystems *= Sort: WordProcessingApplication ->Scale: OperatingSystems.* *InstallationMemory* *= Sort: WordProcessingApplication ->Scale: RequiredMemoryInMB*

One sort can be the definitorial domain of several attributes. A sort with its attributes defines the maximal search space delimited by a sort.

Based on the above described basic language constructs more complex i.e. derived terms can be defined in two ways:

- By using logical operators upon scale elements to define and name subsorts of objects. For example: *WindowsWordProcessingApplications* *= Sort:WordProcessingApplications, Attribut: RunsOnOperatingSystems* *= Windows*.
- By applying multiplication on sorts to construct complex object sets. One example is the combination of word processing and spreadsheet applications (word processing X spreadsheet), to a new set of objects - integrated Wordprocessing and Spreadsheet Packages - which inherits the classification criteria of the definitorial sorts. *WordProcessingApplications X SpreadsheetApplications*

Basic and derived terms are the foundation for recursive definition of further derived terms. The set of logically related terms referring to a special domain (i.e. the reconstruction of a particular suppliers EPC) forms one Q-Vocabulary.

The Q-Calculus serves as the common data structure within the federation. It has a theoretically founded interface to the relational database theory (Schmid, et al.1996). This feature is used to reconstruct individual product catalogs, which rely on relational databases. The Q-Calculus reconstruction of such catalogs is then its interface to the federation. In addition, each catalog can keep its autonomous user interface. This solution provides on the one hand, the autonomy of the supplier. On the other hand, it enables its EPC to communicate with other EPC in the federation via the mediator.

To some extent the functionality offered by the Q-Calculus, as a common product description framework, can be compared to the one offered by Ontologies, which are a component of the Agent Communication Language (ACL) (Genesereth 1997). ACL was developed at the Stanford University and was also used for intermediating EPC in the concept known under the name Smart Catalogs and Virtual Catalogs (Keller 1997). Compared to the simple language structures of Q-Calculus ACL provides the whole repertoire of semantic nets for representing information as well as standardized protocols for their communication. But it also requires Basic and Domain Ontologies, i.e. controlled and standardized terminologies for description of products, which have to be available and accepted by suppliers. The Q-Calculus imposes only a common information structure. The terminologies can be chosen by the intermediary and the individual EPC. This is the reason for a greater flexibility and of its acceptance potentials from both buyers and suppliers (Handschuh 1997).

The most important component of the mediator is its integrating terminology expressed in the Q-Calculus. Each indi-

vidual catalog or relevant parts of it can be embedded in the mediators terminology (Stanoevska-Slabeva 97). In addition, he comprises mappings between his terminology and the ones of the individual EPCs. Another component of the mediator is the EPC repository. It contains the access addresses of the participating suppliers EPC. With this functionality the MEPC can mediate between individual catalogs and provides a summarized view on their data.

A MEPC can participate in another federation of EPC or MEPC, which results in a flexible and recursive structure of easily scaleable intermediates.

The information flow within a federate system of EPC

In the federation, the mediator offers an integrated interface for buyers to the participating suppliers. The buyer defines his query in the language of the intermediary. The mediator first determines which of the participating EPC is relevant for the buyers query by consulting the EPC repository. Then the query is translated into the terminologies of the suppliers and the individual queries are routed to the corresponding EPC. The incoming replies are translated back into the language of the intermediary and are consolidated into an integrated answer. Based on the answer further evaluations, i.e. comparison according to given criteria as well as classification, can be performed automatically.

Lincke, D.M. Der Einsatz neuer Tools für Internet-Informationssysteme zur Entwicklung elektronischer Produktkataloge. Final work at the Universität of St.Gallen, 1996

Schmid, B., Geyer, G., Wolff, W., Schmid, R., Stanoevska-Slabeva, K. "Representation and automatic evaluation of empirical, especially quantitative knowledge", Final Report of the SNF (Swiss National Fond) Project No. 5003-034372, March 1996.

Schmid, B. "Requirements for Electronic Markets Architecture", in: EM Newsletter (7:1), March1997, p.p. 3-6.

Sheth, M.P. and Larson J.A. "Federated Database Systems for Managing Distributed, Heterogeneous, and Autonomous Databases", in: ACM Computing Surveys (22:3), 1990, p.p. 184-264.

Stanoevska-Slabeva, K. "Neugestaltung der Unternehmensplanung mit Hilfe eines prozessorientierten Planungsinformationsystems", Dissertation, University of St.Gallen 1997.

Current Status of Implementation and Future Work

In order to evaluate and ground the described concept empirically, it is currently implemented in the programming language Java (Handschuh 1997). The implementation is embedded in two projects, which provide special test cases. The first one is the Virtual Software House project (VSH). The aim of this project is to establish a virtual software engineering enterprise. It should be a market place where those requesting software or programming services and those supplying and producing them can meet. The MEPC will be used as a core component of the VSH to match the different terminologies of suppliers and buyers. The second project is EPICA. Here the domain of discourse are new concepts for intermediation in the tourist branch. The MEPC is considered as an enabling technology for intermediates in this branch.

The implementation and evaluation will be performed in three phases: In the first phase, which will be finished in October 1997 the basic functionality of the mediator - the reconstruction of relational EPC - will be provided. As an interim result of the first phase concrete examples for the above mentioned projects have been constructed (Handschuh 1997). In the next phase the aspects of differentiation and integration will be included. In the last phase, concepts for interfacing payment and contracting applications will be developed and implemented.