Integrating Manufacturer and Customer: the funSTEP way

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Abstract

This paper focuses on the problems underlying the integration (information wise) of manufacturers, retailers, interior decorators, and customers in the market of furniture and interior design. The problems and solutions presented account for the work being undertaken by UNINOVA under the scope of the European Commission's (EC) ESPRIT IV project 22056 - funSTEP - "Development of a Data Model Based on STEP for the Manufacturers - Customers Integration in the Furniture Industry".

In the CAD2 environments (CAD for Interior Design) the current scenario is that of a multitude of manufacturers (each producing a set of product lines), supplying product catalogues to a set of retailers who, in collaboration with the interior decorators, use the information contained on the catalogues to help the customer plan, design and acquire the furniture needed for its decoration project.

The subject of this paper is not only the exchange of information among several CAD2 systems, but also the problem of maintaining the information on the multi-manufacturer, multi-retailer, multi-decoration studio and multi-customer scenario.

Keywords

Modelling, Integration, Heterogeneous Systems, Standards, STEP

1 INTRODUCTION

Furniture manufacturers, interior designers and retailers need to exchange graphic and non/graphic product information, regardless of the CAD2 systems used (Figure 1) (funSTEP, 1997).

The original version of this chapter was revised: The copyright line was incorrect. This has been corrected. The Erratum to this chapter is available at DOI: 10.1007/978-0-387-35390-6_58

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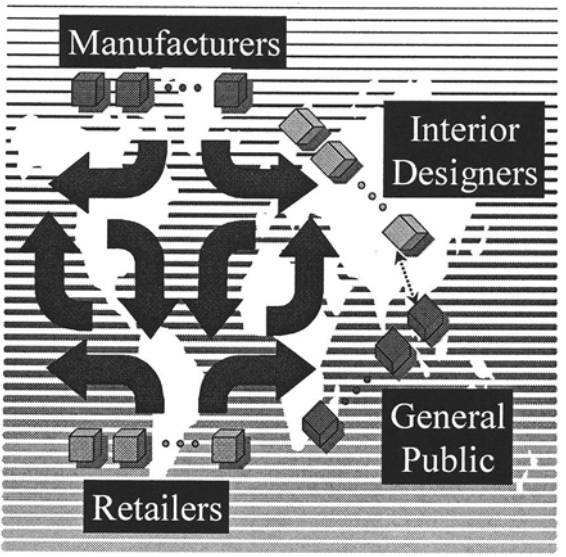

Figure 1: Manufacturer - Retailer - Interior Designer Relationships.

A wide offer of CAD2 systems is available on the market, but information cannot be exchange as desired. Moreover, there is no complete EDI - Electronic Data Interchange - based solution for the furniture industry.

Most manufacturers, interior decorators and retailers consider this CAD2 information exchange difficulty as the main obstacle towards making their investment (in equipment, training and product libraries) profitable. For that reason they decide to delay the decision of improving information management and related customer services, and wait for the market situation to become clearer.

In addition, the compatibility between the product libraries of the different systems needs to be assessed in order to avoid the problems of information exchange in the day-by-day process.

The ESPRIT IV project funSTEP aims at:

- the development of an ISO10303 (STEP) (ISO1, 1992) standardised model for the furniture industry -- the funSTEP model --;
- the implementation of tools to assist CAD2 system vendors to develop the required interfaces that enable information exchange using the model;
- the development and implementation of certification methods and procedures for commercial CAD2 systems, to assess its conformance with the funSTEP model;
- the demonstration of the project architecture in a particular industrial case, using commercial CAD2 systems.

The main focus of funSTEP is on the creation of the infrastructure that allows the information to flow among manufacturers, retailers, decoration studios and customers.

Once the problem of the compatibility among the CAD2 systems involved is solved, through the implementation of the funSTEP model and the creation of CAD2 interfaces, the possibility of exchanging information becomes a reality.

It will then be possible, for the manufacturers to transfer, by electronic means, product catalogue information to the retailers, and for these to return to the manufacturers information representing the decoration projects produced. This is the problem that this paper addresses.

It is assumed that one given decoration project only uses a line of furniture from a given manufacturer; i.e. a decoration project refers to only one catalogue. One of the major problems that subside is how often, when and how is this information flow concerning catalogue transfer activated.

2 THE FUNSTEP PROJECT ARCHITECTURE

The funSTEP project architecture is based on a set of three basic environments (Jardim-Gonçalves, 1997):

- the **modelling environment**, where the project and product data models are being defined;
- the **development environment**, that supports the creation of tools to facilitate the manipulation of the product libraries and project models from the existing CAD2 systems;
- the **conformance environment** for the certification of CAD2 systems, regarding their conformity to the use of the funSTEP model.

Orthogonal to these environments is the funSTEP's testing bed, which is depicted in Figure 2. It is in the real testing bed that the information flow and maintainability problems that have been raised find their home.

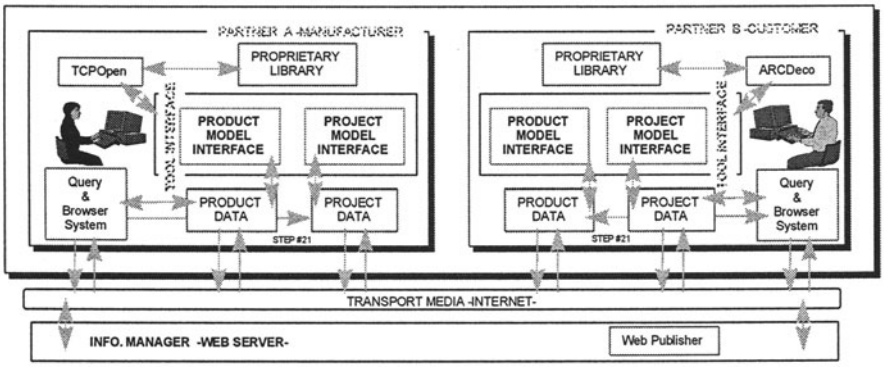

Figure 2 - funSTEP's testing bed.

It is funSTEP's objective that once the manufacturers produce the catalogue information, it will be made available to the retailers, decoration studios and customers that want to use it.

This means not only the entities possessing CAD2 systems, but also those that do not have those systems.

For this later case, the funSTEP consortium intends to make available to retailers, decoration studios and to the general public a form of catalogue that, based on the STEP version produced by the manufacturer will be able to be browsed using a WWW[1] client with VRML[2] plug-in, or with HTML[3] and Java[4]. To this purpose the software ST-WebPublisher from STEP Tools has been acquired and is being tested with a version of the funSTEP model, in order to assess its viability.

It must be understood, however, that the use of the WEB[1] based interface only allows for catalogue browsing (with product information) and will not allow the use of project information neither will it allow for project information to be prepared by the retailer in order to be sent to the manufacturers.

3 THE INFORMATION FLOWS

This chapter is devoted to the assessment of the information flows that must be taken into account, under the scope of funSTEP.

The entities that we are considering (producers and consumers of information) are manufacturers, retailers, interior designers and general public.

The models being considering (that flow among the entities) are product models (product catalogues) and project models.

Bearing this in mind, the possible relations among entities are the ones depicted in Figure 3 (and for increased readability, presented in Table 1), which bring a deeper perspective to the information exchanges presented in (funSTEP, 1997).

The relations between the given entities may be either bi-directional (e.g. Manufacturer-Retailer), where different information models flow in each direction, or uni-directional (e.g. Manufacturer-General Public).

Also relevant is the fact that some relations are based on EDI[5], while those involving the General Public, in the production of a project model, are essentially Non-EDI. This is based on the assumption that a decoration project development requires a specialised and expensive CAD2 tool that is only found on some Interior Designer Studios and on some Retailers.

Table 1 depicts the full set of relations considered under the scope of funSTEP. Some considerations regarding the contents of this table are in order.

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[1] World Wide Web (or "WEB" for short)

[2] Virtual Reality Modelling Language

[3] Hypertext Markup Language

[4] "A simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, multithreaded, dynamic, buzzword-compliant, general-purpose programming language developed by Sun Microsystems in 1995(?). Java supports programming for the Internet in the form of platform-independent Java "applets"", in "The Free On-line Dictionary of Computing"

[5] Electronic Data Interchange

In this table a relation is represented by a tuple with four elements:

1. The Source Entity for the Information Flow;
2. The Destination Entity of the Flow;
3. The Model used in the Flow;
4. The Probable Means (which is the most likely way for transferring the information).

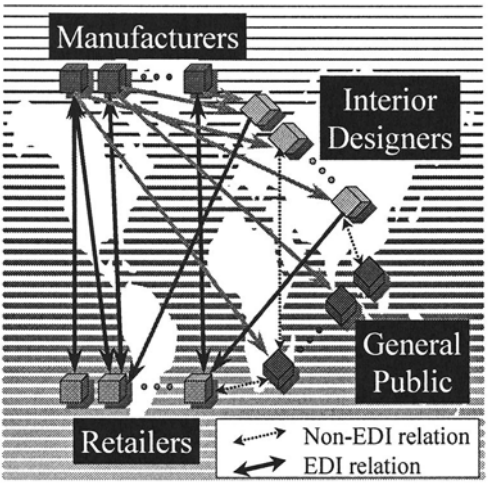

Figure 3 - Entity relationships in funSTEP.

Table 1 - Entity-Model relations.

Flow	Source Entity	Destination Entity	Model	Probable Means
1	Manufacturer	Interior Designer	Product	STEP-CAD2
2	Manufacturer	Retailer	Product	STEP-CAD2
3	Manufacturer	General Public	Product	STEP-WWW
4	Retailer	Manufacturer	Project	STEP-CAD2
5	Retailer	General Public	-	Non-EDI
6	Interior Designer	Retailer	Project	STEP-STEP
7	Interior Designer	General Public	-	Non-EDI
8	General Public	Retailer	-	Non-EDI
9	General Public	Interior Designer	-	Non-EDI

One may also notice that in the cases where the General Public is involved in the creation of a Project, no Model has been specified, since all the information transfer is done in Non-EDI means.

Regarding the "probable means" for EDI of information, it is assumed that the source is always able to produce a STEP version of the model. It is also assumed

that the destination is either a CAD2 system or a WWW browser, in which case, the STEP to WWW converter (ST-WebPublisher) will have to be applied.

For the five identified EDI information flows (1, 2, 3, 4 and 6), one should now assess the need for reuse and maintainability in order to define the appropriate Information Update Techniques.

It is understandable that defining project information flows as "one-time-transfer", may constrain the system when it comes to the need of updating a project, but the fact that in a project information transaction only two entities are involved (one manufacturer and one retailer or Designer Studio), makes this option an acceptable cost.

In this scenario the main problem is on the one-to-many information flows, that are the basis for product information dissemination, and on the costs involved in updating product information.

4 INFORMATION UPDATE TECHNIQUES

Based on the results of the previous chapter, the focus of this one will be on the transfer and maintenance of catalogues (product data).

On the following sub-chapters, some strategies for dealing with the problem of distributed information systems are presented and analysed under the focus of our problem.

4.1 Client-server architecture

The problem to deal with is a variation on the standard problem of distributed systems with client-server architecture (where one has a set of servers supplying information and a set of clients consuming the information - Figure 4 -).

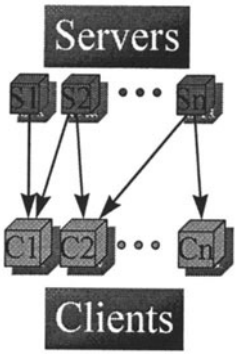

Figure 4 - Client-Server system.

One of the main concepts behind client-server architecture is the ability to reduce the amount of information to be transferred among server and client. This means that most of the queries to the server will result in short amounts of data to be transferred to the client, decreasing the frequency of large quantities of information's transfer.

The difficulties of the direct application of this approach to our concrete problem are created by the following facts:

- A product catalogue is represented by a large amount of information;
- The frequency of accesses to a given catalogue can not be easily determined, neither can the frequency of updates to catalogue information, for they depends on a multitude of variables, that in the end are based on psychological (of customers and employees) and conjuncture profiles.

This results on the ineffectiveness of the usual client-server approach.

4.2 The WWW approach

One step ahead on the effort of maintaining large volumes of information updated, with the purpose of reducing the need for repeating transfers of large amounts of information, is the caching mechanisms introduced by WWW client applications.

In fact, several mechanisms were introduced with this purpose on the WWW, but the bottom line is always the same: the information is downloaded from the client once and, every time that is needed on the client, a check for validity is performed with the server to determine the need for downloading.

Since the WWW was originally based on the concept of files, where each piece of information was represented by a file, the basic form of validity is to cross-check each file used in terms of modification date.

This can relate with the STEP models to be downloaded from the manufacturers, that might correspond, in fact, to information flows using the Neutral File Format (STEP-Part 21) (ISO21, 1992), which in turn could be stored in files.

The WWW also produces some insight to the case where the information is not stored in a file, but instead, produced automatically for the client. In these cases, since the results are not file based, the above mentioned validity check can not be performed. This relates to the WWW use of CGI[6].

To this end new mechanisms were introduced via the HTML "META" element (Graham, 1995). This extension to the HTML language allows the server to send back to the client information that about the information being sent:

```
<META HTTP-EQUIV="Expires" CONTENT="25-Dec-1995 12:00:00 GMT">
```

The above line of HTML code defines the expiration date on a document that is sent to the client.

Some producers of WWW client applications (e.g. Netscape, Microsoft, etc.) have understood the potential of this extension and have included in their applications code to cope with this extension.

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[6] Common Gateway Interface.

More significant is the redirecting possibility introduced by Netscape, where upon a specified time-out the client redirected to another source of information:

```
<META HTTP-EQUIV="Refresh" CONTENT="12; URL=http://foo.bar/blatz.html">
```

The problem with this approach is that although the system recognises changes on the information stored in the information system (WWW server), a change leads to the download of the full information (file) to the client application, regardless of the amount of information changed in the file.

Also the capability of having a STEP model referring to entities in other models might be the solution for this drawback of the WWW solution.

4.3 Multicast approach

It is possible for the manufacturer, when producing a new catalogue, to determine the differences between the new and the old catalogue. Thus a change log file could be produced stating all the changes to be performed by addition and removal of information to an existing model, which could be produced with a tool similar to the UNIX SCCS[7].

Assuming that a client possesses a copy of the model and a tool that allows it to process the change log file, only these log files would need to be passed to the clients. Moreover, the control of when to pass the information to the potential customers would be left on the hands of the manufacturers, which is quite similar to the way most manufacturers and producers of consumer goods work nowadays.

Nevertheless, the transfer of electronic catalogues from the manufacturers to the clients can only be understandable if the client has a possibility and willingness of using that information; i.e. there is no point on passing a catalogue to a client that does not possess a funSTEP model certified CAD2 system. In short, the use of broadcast is out of the question.

So, one can only conclude that the correct approach for the catalogue information dissemination must be based on having the clients state that they wish to access a given model.

This can then be used to implement a *multicast* policy, where a given information is disseminated among a well defined group of clients, by opposition to broadcast techniques where a given piece of information is "broadcasted" and who ever wishes can access it.

Note, however that broadcast and multicast techniques rely on the availability of the receiver to receive the information and on the fact that the sender does not, usually, get any feedback on the set of receivers that got the information.

An implementation based on the use of mailboxes may allow the system to achieve a higher degree of reliability, since the model change logs are sent to the client's mailboxes, from which is up to the client application to access the mailbox in order to fetch them.

The implementation of the system may then be based on a mailing list maintenance application, such as "majordomo".

[7] Source Code Control System - a tool that helps application developers to keep track of versions in source code files.

This mailing system that greatly simplifies the communication processes, also allows the client application to request for a "fresh" version of a catalogue, which is done by unsubscribing the mailing list and then subscribing it again, since it is expected that the answer to a subscription of a given catalogue will imply that the manufacturer sends out to the client the latest version of the catalogue.

5 CONCLUSIONS

The problem of the integration, information wise, between manufacturers, retailers, designer shops and customers was presented under the scope of the ESPRIT IV funSTEP project.

The information flows regarding product data (catalogues) and project data (integral part of orders to be placed to the manufacturer) were identified and characterised with respect to: the type of interaction (EDI or Non-EDI), the source and destination entities, the STEP models used, and the type of processing expected on the information (to CAD2 system or to WWW).

For the identified EDI STEP to CAD2 flows, regarding product information (catalogues), the problem of maintaining the information updated was raised and three techniques/technologies were analysed:

- Client-server,
- WWW,
- Multicast.

By now it seems that the two last approaches are the most adequate for solving the updating problem. In fact, we will now be evaluating in more detail the pros and cons of both approaches, in order to make a decision based on the effective use of both solutions (using real case information).

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7 BIOGRAPHY

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