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EXCHANGE OF COMPONENT DATA: THE PLIB (ISO 13584) MODEL, STANDARD AND TOOLS

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Abstract

The newly available PLib Standard (officially the ISO 13584 Standard series "Parts Library") has defined a model and an exchange format for digital libraries of technical components. The major benefits of this approach include : productivity increase (the components are not modeled several times), quality increase (the data models are guaranteed by the supplier of the library) and product data storage / exchange efficiency (in product data a component is only represented by a reference). Developed in the same ISO committee as STEP, PLib is fully inter-operable with STEP. In PLib libraries, component representations may be defined as STEP data. In STEP product data, PLib components may be represented by simple references.

This presentation gives an overview of the PLib information model and outlines the document structure of ISO 13584. It discusses the use of PLib for the design and the use of on-line electronic catalogues. Then, some of the tools developed in several ESPRIT projects to generate, on the supplier site (catalogue generators), and to use, on the customer site (Library Management System-LMS), PLib conforming libraries are presented.

KEYWORDS: Parts Library, data dictionary, electronic catalogues, industrial data, logistics, CAD-CAM.

INTRODUCTION

When modeling product data, and design knowledge, two very different pieces of information, data and knowledge, appear (see Figure 1):

– the information which refers to the enterprise' products;

– the information which refers to the autonomous components which are used to build the enterprise' products.

If some problems are common (e.g., how to model technical information), several ones are different.

– The *origin of the information*. Enterprise' product information are issued from the enterprise. Component data and knowledge originate from suppliers. Supporting full electronic information exchange between component suppliers and users would drastically increase the quality and reduce the cost of all the partners in the virtual enterprise.

– The *structure of the information.* Each particular kind of enterprise' product is explicitly represented in the enterprise product data management system as an autonomous and stand-alone instance. To avoid data blow up, and to facilitate component retrieval and selection, components are gathered into

families of similar objects where each instance is only implicitly defined using, e. g., tables, expressions and formulas.

– The *access to the information.* When looking for an enterprise product, the user generally knows which product he or she is looking for. When choosing a component intended to be used in some product, what the user generally knows is the engineering problem to be solved. The component library should support the user selection process to solve this engineering problem. It should also contain the supplier knowledge about the components behavior and selection criteria.

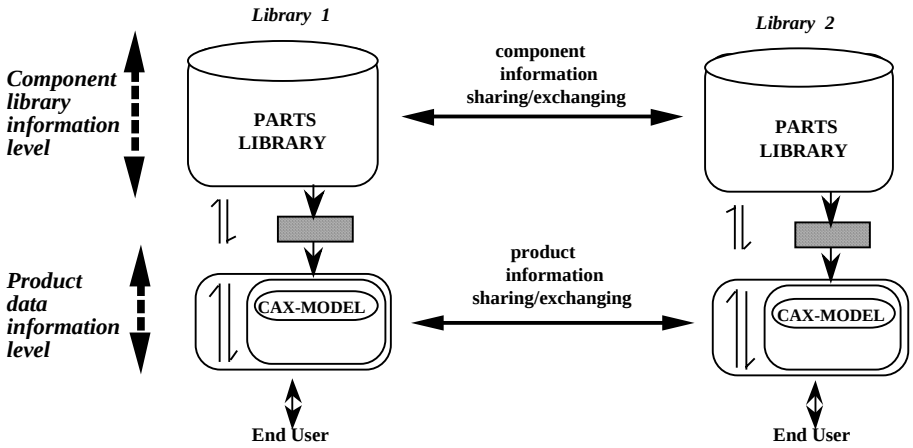

Figure 1 – Product and Component Library Information

Developing an information infrastructure for the open enterprise needs the capability to model, to store and to exchange both kinds of information. It also needs to model the relationships between these.

The product data information level is dealt within the STEP Standard: Standard for the Exchange of Product model data, officially the ISO 10303 Standard series.

The goal of this paper is to present how the component library information level is addressed in the newly available ISO 13584 Standard, "Parts Library", known as PLib, with a special focus on its use for electronic commerce and on the design and use of on-line electronic catalogues.

The content of this paper is the following. In the first section, we present the status of the PLib standardization effort. We outline the role of the different parts of this multi-part Standard. The relationship with STEP is discussed in the next section. In the third section, we discuss the relationships between parts libraries and electronic catalogues and their use over the Internet. We show how PLib integrates the data base oriented perspective (“Parts Library”) and the document-oriented perspective (“Electronic Catalogues ”). In the last section we present some of the tools we developed around PLib. These tools enable full electronic business between component suppliers and users.

1. PLIB STATUS

The Parts Library standardization initiative was launched at the ISO level in 1990. Its goal is to develop a computer-interpretable representation of part library data to enable a full digital information exchange between component suppliers and users.

1.1 PLib requirements

The exchangeable information should include the following pieces:

– all the technical data about components;

– criteria and knowledge about components selection (e.g., how to select a cotter pin? which screw should be used for a particular assembly?)

-behavior of components (e.g., what should be the life time of a particular needle bearing in some environment);

– component representations, including their geometric representations when needed.

The following constraints were also defined. The mechanism for transferring parts library data was requested to be independent of any:

– particular storage technology (e.g., relational database, object oriented database,...);

– particular architecture (e.g., centralized, distributed, client-server, ...);

– granularity (e.g., ordering a part, transferring a parts family, exchanging a complete catalogue).

1.2 PLib contents

Figure 2 shows the contents of the first release of the PLib Standard. It also presents the current status of the PLib standardization effort as in July 1998 from a document oriented point of view. "IS" means that the development of this part is achieved. It has been published as an ISO standard. "DIS" and "FDIS" means that the document is stable and that an international consensus is actually reached on its content. It requires only additional editorial work. "CD" means that consensus was reached among the PLib developers and that the document is under international review and ballot.

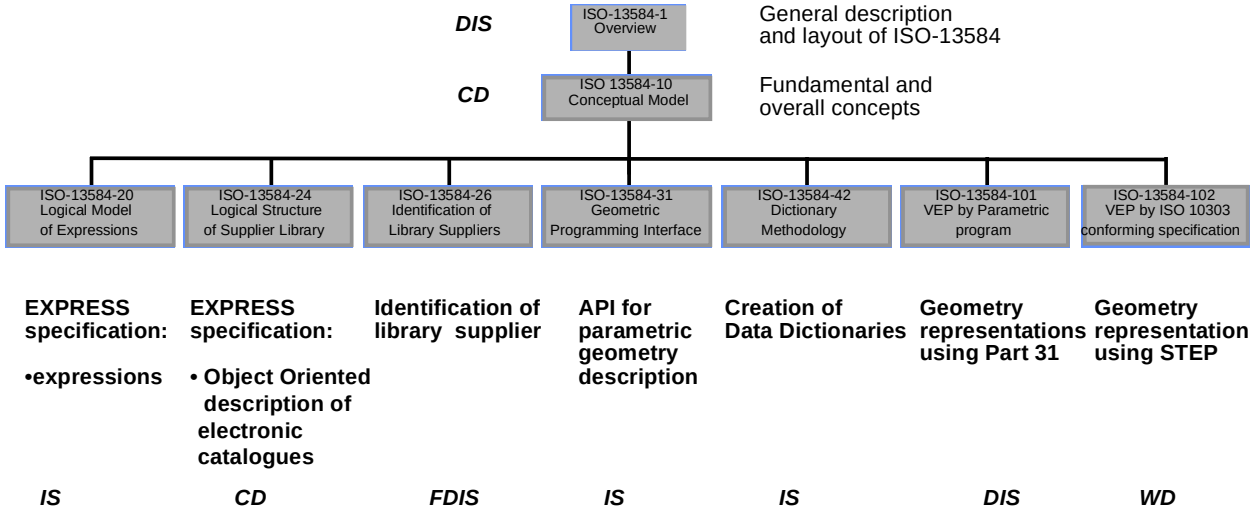

Figure 2 – Current status of ISO 13584

1.3 PLib documents structure

ISO 13584-10, entitled "Conceptual model of parts library", was the first part that was developed [Pie 94] and that was agreed as the basis of the future work. It defined the main points of the PLib approach:

– an object oriented approach as the more efficient way for capturing knowledge about components;

– an information model formally specified in EXPRESS to ensure the portability on different platforms and software systems (both data management systems and CAx systems);

– a data dictionary to support the integration of multi-supplier libraries and the progressive standardization of the data element types that describes the various technical properties of components (e. g., the *threaded_diameter* of a screw, the *maximum_working_temperature* of a pump, the *capacity* of an electric capacitor);

– separation of component definitions (general model classes) and component representations (functional model classes) to support multi-representation (e.g., geometry, schematics, simulation

models) of the various components.

This part was frozen as a Committee Draft (CD) until the end of the standardization process. Together with ISO 13584-1, they describe globally the PLib approach and document structure.

1.3.1 PLib logical resources: The 20's series of PLib contains the EXPRESS [ISO 13584-11] information models that provide for exchanging not only the data about components, but also their behavior and selection rules. As shown in [Pie 97], these information models are able to capture all the supplier knowledge about its components. Then, all this (dynamic) knowledge may be exchanged using the STEP static physical file structure [ISO 10303-21], thanks to a meta-programming technique [APS 97]. For those implementers who want to have a global overview of the data model, a simple documented example of physical file is presented in [SAP 97].

1.3.2 PLib description methodology: An electronic catalogue is not only intended to be exchanged between computers that process data, it is also intended to be accessed by human catalogue-users. In paper catalogues, a supplier normally defines in the very first pages the categories of components, and, for the various categories, the properties that are meaningful to describe some aspect of these components. These definitions are often pretty long, they involve various kinds of descriptions (e.g., text, technical drawing, images), and they consist of several information elements (e.g. for a property, its definition, its acceptable domain of values, its measurement unit possibly, its symbolic representation in a formula). Each of these definitions are intended to define a concept, and to associate it with a symbol that consists of a word, or a group of words. Such a symbol may thereafter be used throughout the catalogue to represent instances of the concept where ever the concept applies.

When shifting from paper catalogues to electronic ones, a double requirement appears. First, each concept shall be defined as precisely (hopefully, more precisely) as in a paper document both in a human readable and in a computer sensible ways. Second, each concept shall be associated with a computer-sensible symbol that will stand for the concept where ever it is intended to be used.

The capability to build such computerized concept dictionaries, or ontologies, has a much broader field of application than the parts library domain. For instance, it is required both to build computerized counter parts of the so-called terminology standards, and to design a data dictionary for all the technical properties of the various products of any enterprise.

This capability was provided by means of an EXPRESS information model and of a methodology both developed as a joint effort with the electronic community. This commonality ensures the consistency of component description across all the different industry sectors. The common EXPRESS information model has been published twice. Once as [IEC 61630-2] standard. Once as [ISO 13584-42] standard. An important point is that the electronic community has already built a content according to this structure and currently uses it. [IEC 61630-4] defines and enables reference, to most of the technical properties and families of components existing in the electrotechnical area.

The basic idea of this common approach is that a technical property cannot be defined without defining in the mean time its field of application by means of families of components, and that an (abstract) family of components cannot be defined without defining, in the mean time, the technical properties that characterize this family.

Therefore, a data dictionary conforming to ISO 13584-42/IEC 61630-2 consists of two parts

– a classification tree where component families and technical properties are identified and connected (see figure 3)

– a set of templates that describes successively each component family and each technical property (see figure 4).

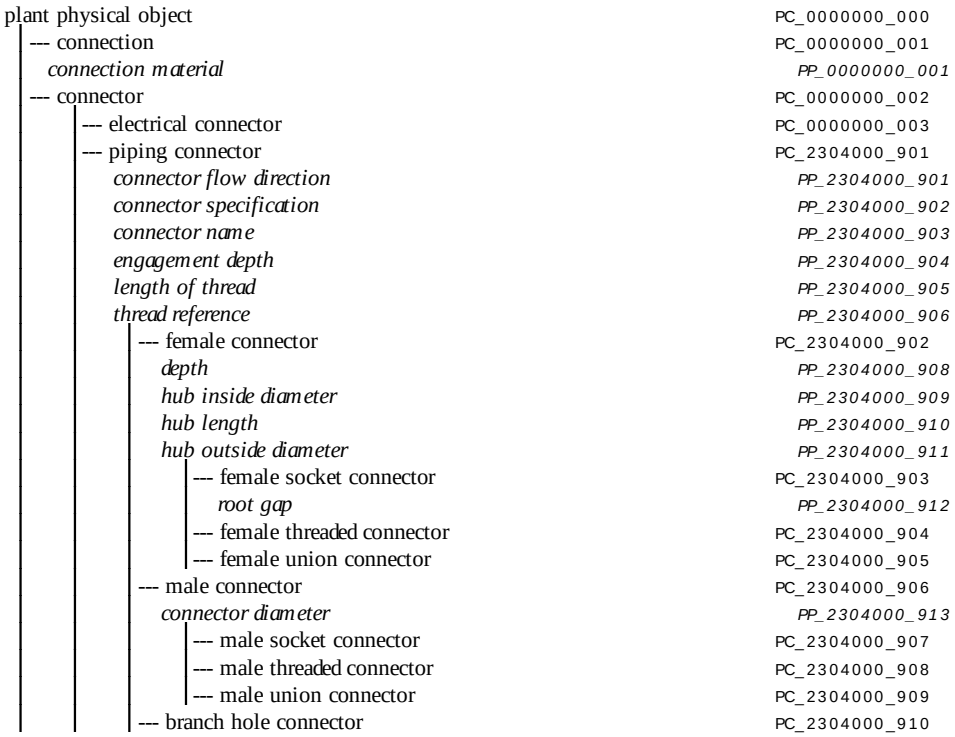

Figure 3 – Dictionary proposed for AP221: classes of physical objets and their properties [Lan 96]

AAF307-005 **01** **NR3 S..3.3ES2**
for: CCD124-002 **E25**
K-1**

(en: temp factor of permeability
fr: facteur temporaire de perméabilité) **$a_F**

(**en**: temp factor of reluctivity
(**fr**: facteur temporaire de réluctivité) $r_F

Definition: (en: The value as specified by level (minTypMax) of the negative of the change in the permeability due to a change in temperature, divided by that change in temperature (in K**-1) of a soft magnetic material at specified frequency.
fr: Valeur indiquée par le niveau ... à une fréquence spécifiée)

AAE029-005=frequency

ref: IEC50(221.02.49) (1990)

Figure 4 – Dictionary definition of a property [IEC 61360-4]

1.3.3 View exchange protocols: The 100's series of PLib, called view exchange protocol series, is devoted to component representations. Normally, PLib does not define "new" kinds of representations. It just enables to associate a representation defined by any other Standard (or private agreement between the sender and the receiver) with a PLib Library. For each particular kind of representation, a particular view exchange protocol needs to be developed. It is a small document (10 to 20 pages) that specifies, e.g., how to relate an VHDL file with a PLib library. It is anticipated that several view exchange protocols should be developed in the future. In the first PLib release, only two view exchange protocols have been developed. VEP 102 specifies how to exchange explicit representations of each library component as a STEP AP conforming representation, while VEP 101 specifies how to exchange parametric geometry by means of parametric programs based on a standard API.

1.3.4 Implementation resources: Geometric programming interface. Finally ISO 13584-31 has only been developed because no standard for exchanging parametric geometry was available. This part of PLib specifies a set of parametric geometry functions, and a binding in a programming language to trigger these function. The binding defined in ISO 13584-31 is in FORTRAN and a new binding in Java is currently under development. This approach provides a sound short-term solution for exchanging parametric geometry within the context of component libraries / catalogues exchange. In the mean time, the functions from ISO 13584-31 should be used within the development process of history-based parametric data model for STEP.

2. COOPERATION BETWEEN PLIB AND STEP

ISO 10303 "Product data representation and exchange" (STEP), and ISO 13584"Parts library" (PLib) are developed in the same ISO subcommittee (ISOTC184/SC4 "Industrial data"), and they share a common technology basis in the use of the EXPRESS data specification language [ISO 10303-11], the STEP Physical File Format [ISO 10303-21] and Standard Data Access Interface [ISO 10303-22].

These commonalties facilitate the joint deployment of:

– STEP as a standard for representation and exchange of product data;

– PLib as a standard for representation and exchange of libraries of parts.

Cooperation between PLib and STEP involves two aspects. First, the STEP capabilities should be usable for providing representations of the parts defined in a PLib library. Second, the PLib capabilities should be referencable from STEP product data to avoid duplication of information.

The first aspect, is addressed in the view exchange protocol 13584-102. It specifies how various representations of the parts defined in a PLib-compliant library may be represented, and exchanged, as STEP AP conforming files. It also specifies how such STEP files may be referenced from the PLib library file. Thus, each part of a family of parts defined in a PLib library may be associated with explicit representations defined by any STEP Application Protocol.

The PLib capabilities that prove useful from STEP product data were analyzed in Günter Staub's paper : "Interpretation of PLIB services: A proposal for interpretation of the “services" provided by PLIB using the STEP Integrated Resources" [Sta 98].

Four capabilities, termed "services", were identified:

– Service 1 provides the capability to express that a classification of a piece of product data that is a part (or a material, or a feature) is a component family defined in a PLib-compliant dictionary;

– Service 2 provides the capability to express that the definition of a property of a piece of product data that is a part (or a material, or a feature) is provided in a PLib-compliant dictionary;

– Service 3 provides the capability to express that a piece of product data that is a part (or a material, or a feature) is itself defined in a PLIB-compliant library, i.e., as a PLIB-catalogue-defined part;

– Service 4 provides the capability to express that a representation (of a piece of product data that is a part, a material, a feature etc.) is defined (e.g., parametrically) in a PLIB-compliant library.

Günter Staub also developed information models for using any of these services from any STEP Application Protocol (AP). The two first services are already implemented in a number of STEP APs, including AP210, AP212, AP214, AP 221, etc... They permit, in particular, to reference the PLib-compliant dictionary defined in IEC 61630-4. Several APs, including AP221, are considered to develop PLib-compliant dictionaries to define the standard objects and properties that shall be recognized by any implementation claiming conformance to the AP. As an example, [Lan 96] contains a PLib-compliant dictionary developed in the European PIPPIN project as a contribution to AP 221 (see Figure 3).

The role of the two last services, is to avoid the duplication of component descriptions (service 3) or of component representations (service 4) when these information elements may be retrieved (or re-generated) from a PLib-compliant implementation. The STEP product data just needs to include those

pieces of information that would be required for retrieval purpose, and, in case of service 4, for positioning purpose.

The underlying idea of these services is to avoid to have separate libraries for the different enterprise applications (e.g., functional designs, CAD, CAM, ...). A PLib-compliant implementation, called a "component repository" (or a Library Management System), contains for each part, one definition and as many representations as required for the different enterprise disciplines. This component repository is referenced, using service 3 and service 4, from the product model repository. It may also be accessed by any application to browse its content, and to request the suitable representation (see Figure 5).

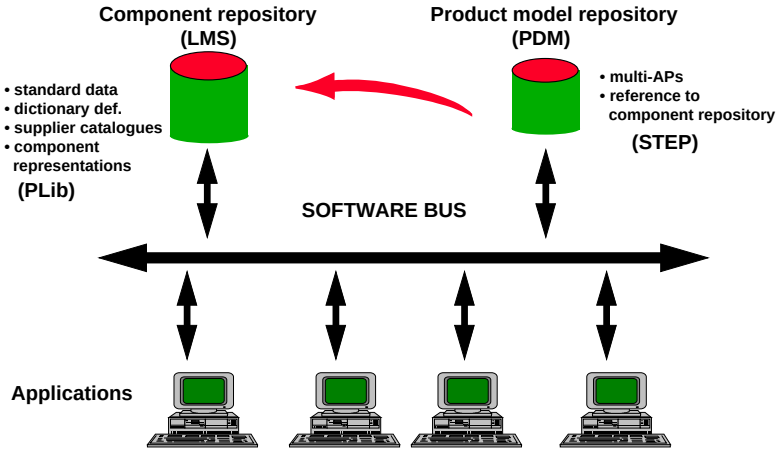

Figure 5 – PLib and STEP cooperation in the enterprise IT architecture

All these referencing capabilities between STEP and PLib ensure that the two standards contribute to an integrated data management capability within organization and between organization and customers, collaborators, sub-contractors and/or suppliers.

3. PLIB AND THE WEB

The first focus of the PLib standardization effort was to build an EXPRESS model able to capture in an unambiguous way all the information about component definition, component selection rules, component behavior and component representation. Instance data conforming to the PLib EXPRESS model were intended exchanged through a physical file compliant with the physical file structure defined in [ISO 10303-21]. This file is called the library delivery file.

However, it was also recognized that documents should be associated with this description to facilitate user understanding and selection process. Thus, a mechanism was defined to refer from the library delivery file to other files. These files are called library external files. Such files contain, in particular, documents, represented according to some document format.

Therefore, a PLib "library", called a library exchange context, consists of:

– a library delivery file, and

– zero, one or several library external files referenced either from the library delivery file or from other library external files.

The document formats selected by PLib for library external files are the Internet-supported document formats, and particularly HTML. Moreover, a mechanism has been defined [Pie 97] to enable the user to switch back and forth from document-oriented navigation to database-oriented navigation.

The next step was to use active document as an interface to a PLib library.

3.1 Using a document as a library user interface ("electronic catalogues")

Here, the goal is to enable the access to, and the selection in, a PLib library using a simple Internet browser.

Two approaches may be followed:

– either the active document (a questionnaire) is generated on the fly by a PLib data base library Management System; the search engine is an a LMS and cannot be moved from one place to another;

– or the active document embedded in its own search logic as Java applets and a Java application. The search engine is in the document (or in browser plug-in) and it may move with the document.

Both approaches have their own domains of application and should be usable from a PLib description. Section 4 shows how these two approaches have been successfully followed.

3.2 Using a document as a library supplier interface

The goal is to capture PLib data just by tagging a digital catalogue using some XML/SGML Document Type Definition. Such an approach is also presented in section 4. The corresponding DTD is not a Standard, but it shows that it is also possible to exchange PLib library as an XML document instance. It is anticipated that an XML DTD of the PLib model might become a Standard in the future.

3.3 Using PLib over the Internet

There are a number of scenarii that may prove useful in various contexts for exchanging a parts libraries/electronic catalogues over the Internet. Each scenario may be run at various level of granularity: selecting a part on a supplier site, up-loading one family from a supplier server, fetching a complete catalogue. Figure 6 shows those scenarii that were proved to be feasible. It shows the flexibility of the PLib model and Standard for information exchange between component suppliers and component users.

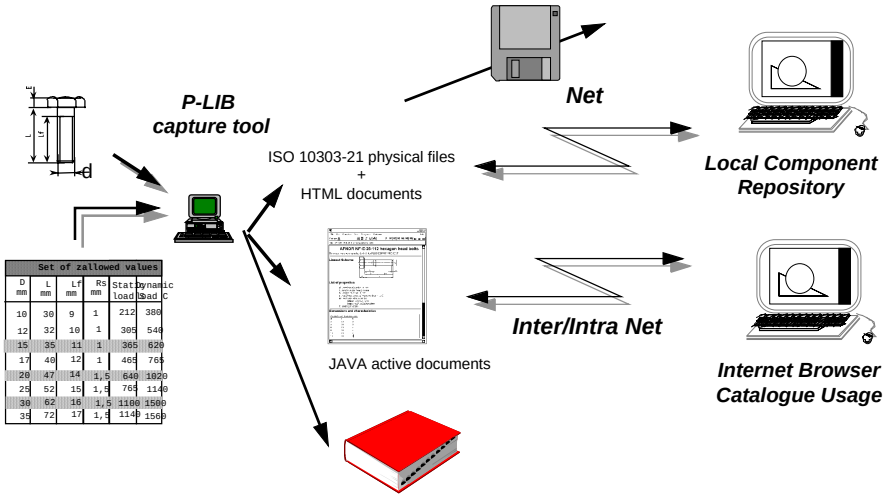

Figure 6 –Different scenario for using PLib over the net

4. PLIB TOOLS

We present in this clause three tools that address the different phases of information interchange between components suppliers and users with a special focus on document orientation.

4.1 A document-oriented PLib capture tool (LISI, CRCFAO)

The idea of the document oriented PLib capture tool, jointly developed by LISI/ENSMA and CRCFAO, and based on a previous SPRING/SGAO 's work [PGP+97], results from two facts. Firstly, capturing PLib libraries using a pure database approach (i.e., display forms) is hard to put into practice, because of the

complexity of the underlying data model. Secondly, most of the data about parts are already existing in parts manufacturers catalogues, that exist, in general, in digital form. Thus, the role of the tool is to instanciate a PLib compliant database just by picking up data from a digital catalogue.

The advantages of this approach include the following:

– a very friendly environment may be proposed where PLib data just need to be selected and not to be entered again;

– the digital catalogue presentation does not need to be changed while adding PLib semantics, this presentation being already familiar to the catalog owner;

– various representations such as databases exchange formats may be generated.

4.1.1 PLib capture tool approach: The PLib capture tool is based on an SGML approach, more precisely on its XML restriction. Indeed, it is assumed that, nowadays, paper catalogues are developed using authoring systems. All the information about manufacturer parts is available in these documents. SGML will enable to manipulate this information directly inside the document. The starting point would be an HTML representation of the catalogue. There exists converters from most of the authoring formats into HTML. Moreover, HTML is defined by a particular SGML Document Type Definition (DTD). This HTML DTD deals with document generic structures only, but this DTD may be extended by additional structures ("tags") able to represent the concepts defined in the PLib data model. This extension defines a new DTD (named HTML/PLib DTD) gathering both HTML for presentation purposes and PLib for capturing domain specific semantics (see Figure 7).

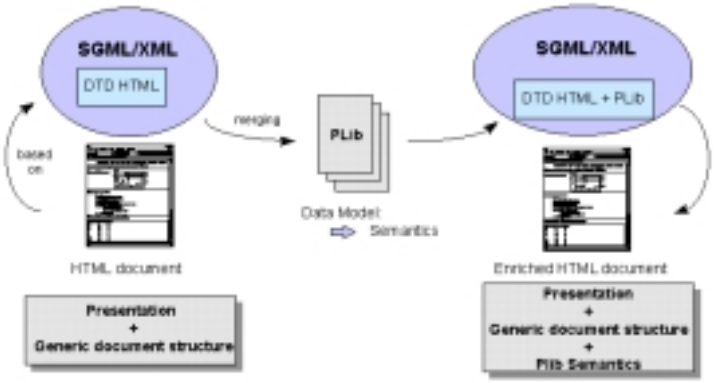

Figure 7 – PLib Integration approach

Nevertheless, SGML is a language that addresses document structure only: it does not provide for expressing constraints as it would be required for information modeling [Sch 95]. On the other hand, the EXPRESS language precisely deals with this problem. To achieve a completely consistent tagging process, the idea is to gather the capabilities of both worlds. In our tool, tagging requests expressed by the user in an SGML editor are sent to an EXPRESS-based database management system built on the top of a PLib data model. Thereafter tagged value is then checked, and if allowed, stored in the database. Finally, a request result is sent back to the SGML editor either as an error message if inconsistencies have been detected or as a tag addition into the document (see Figure 8).

Figure 8 – PLib capture tool architecture

4.1.2 PLib capture tool interface: The PLib capture tool is a SGML/XML editor designed to be able to read HTML documents based on the HTML/PLib DTD (see Figure 9). The PLib capture tool supports a two phases process.

Firstly, an inference process is launched when the document is loaded in the SGML/XML editor. The goal is to identify and to characterize (i.e., to tag) as more as possible data from the document with the minimum of user interactions. For instance, several properties characterizing the part can be extracted from tables of values and automatically tagged inside the document. The result is a pre-tagged document viewed in the SGML/XML editor under the form of an HTML document.

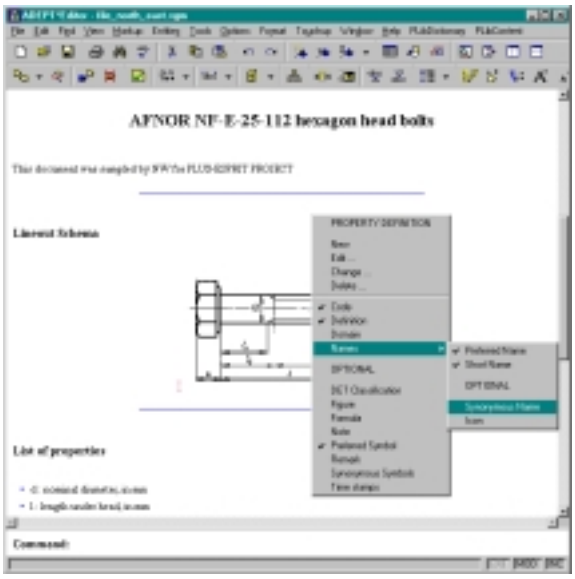

Figure 9 – PLib capture tool user interface

Secondly, the interactive part of the tagging process occurs. Figure 9 presents an example of tagging. Using a contextual menu, the user just needs to select the particular text area of the document where this synonymous name appears. A tagging request is sent to the instance checker to ensure data consistency according to the PLib data model. The request result is returned, and if authorized, the tagging of the selected text area is done: the SGML/XML document instance contains now a new semantic piece of information. Notice that some pieces of information, mandatory according to the PLib information model, may not appear in the document. In such cases, keyboard entries need to be done by the user.

The PLib capture tool interface is built on the document itself. The complexity of the PLib data model is completely hidden by the proposed menus.

This process gives two outputs:

– an ISO 10303-21 physical file, generated by the instance checker, and

– a document instance conforming to the HTML/PLib DTD, generated by the SGML/XML editor.

The document instance contains all the PLib data clearly identified by tags. Moreover, the followed approach ensures that these data meet all the constraints specified in the PLib data model. Therefore, this document structure provides an equivalent exchange format for a PLib library. It might be processed again to extract the PLib semantics. A particular usage is discussed in the next clause.

4.2 A PLib based active document generator (ITEMATIC)

The idea of the e-SMART product is to automatically generate a format of a PLib Library that may be processed by any Internet browser and that supports a user selection process.

This format consists of HTML documents, including Java applets for supporting user interactions, and a downloadable application that constitutes the search engine. Such an active catalogue is generated without any programming activity, just by capturing the PLib description of the catalogue.

4.2.1 General product description

- ITEMATIC e-SMART is an HTML/Java application. It works on any browser in an Internet/Intranet network.
- e-SMART is shown as an instance browser included inside HTML pages. These pages describe family of components, typically PLib component classes from supplier catalogues. Thus, e-SMART preserves the original presentation of " paper " catalogues and datasheets, which are easily handled by end-users, in combination with an object database query tools.
- e-SMART works at any level in a PLib family hierarchy. Requests may be stated at a generic level (like ball /needle /cylindrical roller bearings). Requests will be redirected to all these families.
- e-SMART includes a search engine. Constraints can be defined explicitly (list of values, inequality, ...) in the search engine or by " clicking " directly in a cell on a data table.
- The selected components can be exported automatically on, e.g., an order form.
- The user can also ask for the different representations (CAD drawing, datasheet) of the selected components, via CGI programs installed on a WEB server. Alternatively, with the same mechanism, he can export the characteristics to fill a corporate database (legacy system).

4.2.2 Technical features: e-SMART is fully compatible with ISO 13584 (conformance class 3). It may be seen as a Java binding of the PLib data model. Some of these characteristics are listed below.

- Complete dictionary descriptions have been implemented: classes, context parameters, properties (context dependent or not).
- Data schema can handle families defined in intention, with any number of tables, expressions and conditions (guarded tables, predicates, ranges).
- Management of user defined variables is allowed (context parameters like temperature, pressure, loading, quantity, but also user defined properties like actual length of a pipe).
- Management of "level type" properties is possible (minimal, nominal, maximal, typical values).
- Association of different units within the same property may be performed. A nominal diameter can be defined in 'mm' and 'feet'.
- Generic search process is handled: search can be defined at an abstract class level. All simple sub-classes will be then requested.

4.2.3 Capturing data: There exist two ways for capturing data. The first way uses an e-SMART specific tool. The process involves three steps:

1. Dictionary level : declaration of classes and properties.
2. Family schema level : declaration of tables, expressions and conditions.
3. Presentation level : displaying information attached to combinations of tables (in horizontal, vertical or matrix form, ...), localization (label translations, ...).

The second way is to extract all the information from another PLib representation that may be either an existing PLib database, or SGML/HTML files such that the ones provided by the tool defined in *section 4.1*. Notice that in the second case, the presentation and layout of the existing document is preserved. Only the tables become "active". In any case, no programming at all is required. The active document is generated from declarative data.

4.2.4 Interacting with the dialog: For each family, simple or generic, a query interface that includes all the properties applicable at this level of the PLib hierarchy is generated. It supports query by example requests (see Figure 10).

Figure 10 – Query by example interface generated in an HTML pages

Then, when the document includes tables, matrix or formulas, the elements become "active":

– they may be picked up by the user;

– they are used by the search engine to echo the current state of the search (see Figure 11).

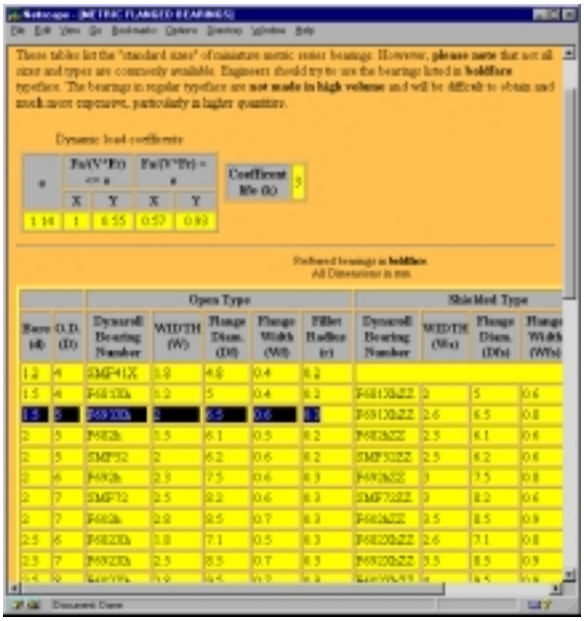

Figure 11 – Interacting with an e-SMART document

4.3 A RDB-based PLib Library Management System (SPRING TECHNOLOGIES)

In several corporates, components used for the design of products are chosen from a preferred list. The list is approved by the company's experts and includes the components of a number of manufacturers, chosen on the basis of both technical and economic criteria.

Component users need the data handled by the system to be:

- reliable,
- up-to-date,
- usable by design tools (CAD, Simulation, Geometry, Thermal),

- easy to select.

The Library Management System developed by SPRING Technologies, called MASTERCAT V2.0, allows the end user to download information from an information broker's or component manufacturer's database and to integrate it into the corporate design database.

The SPRING LMS distinguishes between two kinds of users:

- **the librarian** responsible for downloading component information for relevant components into the design database;
- **the designer** using the component information in the corporate design database. The designer is only allowed to use components which are parts of the design database and are therefore approved by the company, e.g. due to favorable conditions negotiated with the respective manufacturer.

4.3.1 Structure of the MASTERCAT V2.0 product

MASTERCAT V2.0 product consists of three tools:

- The Import tool imports the ISO 13584 family information from the Supplier system, e.g., using the Internet, extracts the information from the ISO 13584 STEP physical file and transfers it into the LMS family data base.
- The Customizing tool allows the definition of a mapping between the data model of the end user's database and the model of the downloaded family (which is described by its class). Then the information about the relevant single components is extracted from the family, and these components are imported into the design database.
- The Explore tool controls the design database and allows the designer to retrieve component information from the database and to use them in CAD tools and CAD processes.

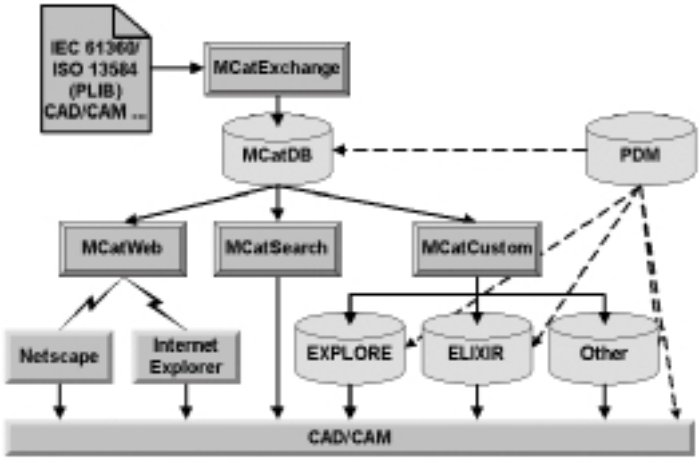

Figure 12 – Architecture of the SPRING Technologies Library Management System

The librarian uses the Import and the Customizing tool, whereas the designer uses only the Explore tool. Figure 12 shows the modular structure of MASTERCAT V2.0.

– MCatExchange - parses ISO 13584 STEP Physical Files to import component information into the LMS database (MCatDB);

– MCatEdit - enables the librarian to edit dictionary, to capture content and to connect the LMS data base with the corporate database;

– MCatCustom - enables the librarian to map supplier families with corporate families;

– MCatSearch - enables the designer to navigate within the LMS database, search, select, execute external model (Simulation, CAD, etc ...);

– MCatWeb - enables the designer to access the LMS database through an Intranet, search, select, execute external model (Simulation, CAD, etc ...).

We briefly present below MCatWeb and MCatCustom.

4.3.2 Generating on-line catalogue pages from database: MCatWeb

When MASTERCAT is accessed through Internet or Intranet, all the navigation is done through HTML pages. The first step is to navigate within the class hierarchy (see Figure 13).

Figure 13 – MCATWEB: Navigation within Supplier families

In the MASTERCAT data base, both corporate and supplier families are available. Once a family is chosen, an HTML page is generated on the fly (the HTML representation of the ISO 13584 definition of the family). It enables the user to:

- consult in a document form;
- download a piece of information (Part number, related models, properties definition, tables, the whole content);
- querying components..

A first HTML page enables the user to define the parameters of the query. Only properties with multiple values are selectable. It is also possible to select the properties which will be viewed in the report.

A second HTML page includes the result. The report is divided into two parts (see Figure 14):

- the list of the components found, described with the selected properties;
- the list of functional views available for the family (Simulation, CAD, Corporate Data base, etc.).

For each view, the related models may be accessed. It can also be run in the local workstation thanks to a mime-type mechanism.

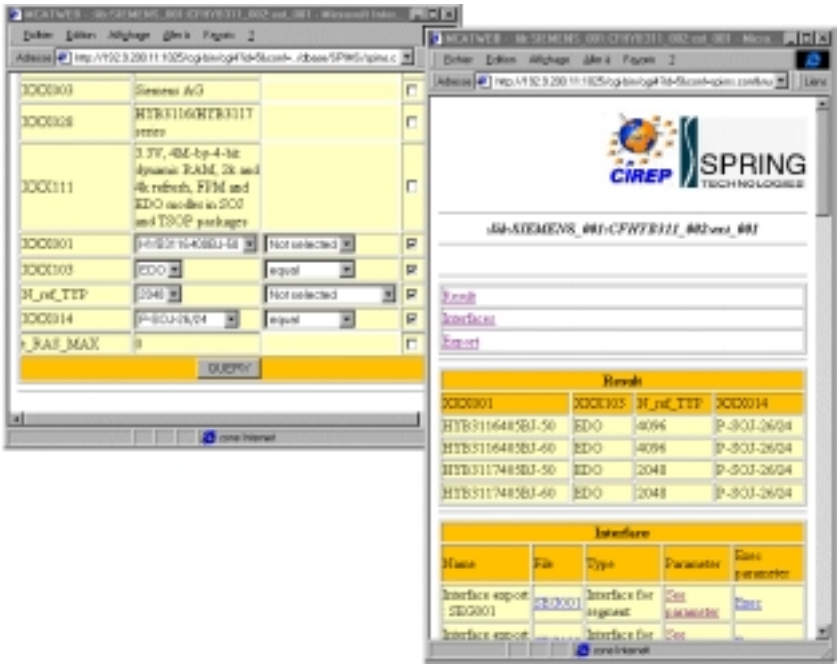

Figure 14 – MCATWEB: Querying for components

4.3.3 Mapping supplier families onto corporate families: MCatCustom

Mapping between a corporate family and a supplier family is handled through the MCAT Link entity. It enables first to associate the two families, then to establish the correspondence between the properties.

There is no restriction concerning the number of links for a corporate family (see Figure 15).

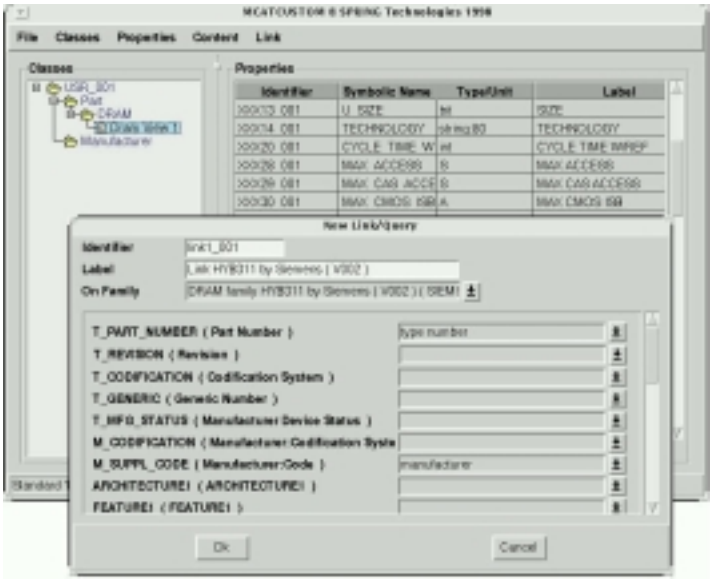

Figure 15 – MCatCustom: Mapping between a corporate family and a supplier family (class & properties)

CONCLUSION

In this paper we have presented the capabilities that were developed within the PLib standardization initiative. The main goal of the PLib Standard is to develop data models that enable full digital information exchange between component suppliers and component users. We have shown that these models are

very flexible and may be used to exchange information at various level of granularity and in various I.T. infrastructure environments. We have, in particular, discussed three features that should prove useful in the CALS context:

– capability to build and to reference dictionaries of technical properties and of categories of components,

– capability to establish a full digital information flow from component supplier onto corporate database,

– capability to reference PLib libraries from corporate products.

Then, we have discussed the relationship between a data model oriented approach ("component libraries") and a document oriented approach ("electronic catalogue"). We have shown the advantage of the former, thanks to it capability to constraint data and therefore to ensure the consistency of the data values that may be exchanged. The integration of both approaches is proposed and various tools and systems that enable to create documents that are either controlled or automatically generated from PLib database have been presented.

In the future PLib should play a major role for electronic commerce about technical components. Electronic Commerce is not only about ordering, but it is also about selecting a component and fetching all the technical data about this component. These capabilities are precisely those addressed by the PLib data model.

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EXAMPLES OF RELATED WEB SITES

Other PLib Product: http://www.comnes.jp

PLib-based project: http://www.codus.co.uk/CIREP