15 PRODUCT DATA MANAGEMENT

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One task in the PRODNET II project was the realization of a Product Data Technology concept based on a neutral approach. For the management of product data PDM (Product Data Management) systems are increasingly used. In the project the ProSTEP PDM Editor acts as an PDM system substitution. This chapter introduces the scope, architecture and concepts of PDM systems.

INTRODUCTION

“A PDM system is used within an enterprise to: 1) organize, access, and control all data related to its products, and 2) manage the lifecycle of those products. A PDM system may work with a wide variety of software applications, and with traditional non-computer systems that generate or use product data (such as paper documents). It also may be delivered on a mix of computers, workstations and associated hardware. This mix of applications and hardware is referred to as heterogeneous environment.” [PDMBUY97]

Because of the broad spectrum of technologies in this field and because of the heterogeneous demands to PDM systems, several names and abbreviations are common for this subject:

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- PDM: Product Data Management
- EDM: Engineering Data Management (or Engineering Document Management)
- PIM: Product Information Management (or Computer Integrated Product and Program Information Management)
- TDM: Technical Data Management (or Team Data Management)
- Other terms for several specific aspects of PDM, like document management, image data management and so on.

Who will work with PDM systems?

There are three general categories of people involved with PDM: end-users working with product information (e. g. engineers or shop floor personnel), administrators (for both PDM specific and organizational data) and managers responsible for products and organization.

An end-user, for example an engineer, will use a PDM system beside his usual tool set (like CAD- and CAE programs). The PDM system automates many access and modification functions (e. g. data storage, retrieval or backup). He will use the PDM system as a shell over software applications that perform these tasks or as additional menus and functions within an application environment.

The tasks of PDM administrators are implementation and maintenance of the PDM system. This includes the underlying databases and all the middleware, networking, user interfaces and so on.

Project planning, task assignment, tracking, budget management and approvals, are some of the tasks which are carried out by managers with the help of PDM systems.

COMPONENTS OF PDM SYSTEMS

PDM systems mostly are huge units, consisting of many different programs and utilities of high complexity. All PDM systems are based on relational or object oriented databases (see below), middleware and user interfaces. To understand the possibilities of PDM systems, it is a good help to know these part systems.

[PDMBUY97] introduces the following components of a PDM system:

- Data Vault and Document Management
- Workflow and Process Management
- Product Structure Management
- Classification and Retrieval
- Communication and Notification / Data Transport
- Data Translation
- Image Services.

Due to the importance of these components they will be discussed more detailed in the next chapters.

Data Vault and Document Management (DVDM)

This part of a PDM system is its core; all other programs are built on this base. It provides secure and controlled storage of all the data sets managed by the PDM system. The metaphor of an “electronic vault” describes this important role in the system. Following types of data are stored in the vault:

- Data produced by CAD, CAM, CAE, MRP or other engineering or manufacturing systems
- Meta-data associated with PDM managed product information
- Administrative data
- References to non-digital or other external data
- Records in the database management system
- Electronic forms such as Engineering Change Orders (ECOs).

The DVDM has to ensure the secure access of users to all data in the vault. It provides functions to identify user authorizations and to perform check-in and check-out procedures for data sets, documents and other product information. It may maintain different release or approval levels and user authorizations. The function of check-in is to place newly-created, modified or promoted elements of a product design under PDM control. Modified elements are approved by the personnel that is authorized for this task and then the elements are checked-in as newly-released revisions or versions. Check-out processes are taking place when product information in the PDM system is required by a user. Reasons for a check-out may be:

- Use without change (e. g. for red-lining, markup or comment)
- Modify or change
- View.

The PDM systems contain locking mechanisms for checked-out elements, so it can be prevented that multiple users attempt to modify the data simultaneously. A common use for the check-out function is to execute an Engineering Change Order.

The internal structure of data sets (e. g. CAD models) is normally not interesting for a PDM system. It stores the data in the vault and manages only the meta-data about these files in its database. Compared to the amount of storage capacity used for the data sets, the storage of the meta-data requires only small space in the database. The meta-data is generated by the PDM system itself, but is also created by non-PDM applications like CAD/CAM or office programs. PDM systems maintain information about each piece of data, including information about the manipulation of the data sets (date, user, reason, tools, etc.).

Another important task for the DVDM is to keep track of information about the association of multiple data sets with the same part or assembly. Engineering

drawings, CAD models, NC programs and other data pertaining to one part are examples for this aspect of a DVD. The PDM system has to ensure proper version compatibility as members of such data sets are modified.

Figure 1 shows an example for managed data in a PDM system as a snapshot.

Workflow and Process Management (WPM)

Site-defined business rules can be used to define and implement change processes and workflows. PDM systems offer tools for doing these tasks in conjunction with Data Vault and Document Management. The workflow design is done with graphical user interfaces that look much like orgchart editors.

Elements of workflows could be change authorizations, processes for modifying or adding product definition data and methods for incorporating changes into released or baselined product data. One of the most important tasks of the WPM is to synchronize this product data. The change to any related product data must not invalidate other product data relationships.

Figure 1 - Example for PDM data

Product Structure Management (PSM)

This part of a PDM system creates and manipulates structures of parts, assemblies, product configuration and Bill of Material (BOM). Other managed elements of the PDM system are related to these structures. The basic parts-list form of a bill of material can be extended into a more complete product structure, adding relationships like options, versions, substitutes and so on. Tasks taken out from users are, among other things, creating and modifying BOMs and product configurations, associating product information with PDM data and creating reports.

Different users and departments in a company have different views on bills of material, product configuration, and parts-list structures. Functional hierarchical lists are interesting for design engineers. Manufacturing engineers need to see assembly information and relationships. Therefore, the user interface of a PDM system must have the ability to display these different views, which partly are related to the same data in the PDM system. Examples for this aspect of PDM systems are design-oriented views, engineering oriented views and production oriented views.

An example of the types of data relationships is shown in Figure 2.

Figure 2 - Relationship Among Parts and Other Data

Classification and Retrieval

Product data can be associated with attributes, so that similar item can be found by

retrieving these specific attributes in the database. Topics for retrievals are attributes e. g. like part function code, shape classification code, data type, project, status and user. Users of the PDM system can retrieve information in the system by performing queries to find parts matching appropriate criteria, or they may browse through a hierarchical view of the product data. Hierarchical views are efficient and easy to use, if the user doesn't know which attributes to search on.

Another function of a classification and retrieval system could be the gathering of product information into standard part libraries, which can be used for personnel across an organization. The use of standard part libraries are a way to reduce inventory in manufacturing, also they can reduce the cost for maintaining parts and to store them.

Communication and Notification / Data Transport

Concurrent engineering needs efficient communication infrastructure between the engineers and other personnel related to the design process. The information transported with the communication system is the notification of tasks that are to perform by the users, changes in items that may affect data users are working with and the exchange of general messages supporting day-to-day operations. These communication tasks can be carried out by E-mail systems. PDM systems use partly own E-mail applications, partly they have an interface to standard E-mail systems.

The knowledge about the location of specific data items or objects and how to manipulate this data is difficult in great installations of soft- and hardware. Thus, one of the tasks of a PDM system is to support the user in working with that great amount of data. The execution of networking and operating system commands are hidden by the PDM system, the user locates and manipulates desired data using standard methods which are independent from the physical location and organization of the product data. Operations like copying or moving files, scheduling and routing of files to appropriate translators, running the translation and so on, are performed automatically by the PDM systems.

Data Translation

The information in a PDM system can be used in several systems that are involved in the product lifecycle process. CAD/CAM, other CIM systems and business systems can take a benefit from accessing data in a PDM system. Data moved between two applications frequently must be translated from one application's format into the other's or a standard neutral format (like STEP, IGES etc.).

The manufacturers of the applications (e. g. CAD vendors) usually supply the necessary translators for this process, rarely by the PDM vendor. Translators can be integrated into PDM systems. One benefit of this integration is the possibility to use the information in the PDM system for the translation process. The translator itself

may be subject to the configuration management capabilities of the PDM system. Translations can be performed automatically by the PDM systems, users can also choose to start a translation process manually.

Image Services

Raster and vector graphics in a PDM system can be visualized with the help of special functions of the system. The purpose of this viewing capability is mainly the reviewing of existing documents (like CAD models or manufacturing information). This allows the access to these documents without requiring that the users (e. g. managers, clerks, shop floor personnel etc.) have access to the applications that created the data.

Most PDM systems have the additional functionality to markup and comment ("redline") the documents. These capabilities can improve the communication between reviewers and others, e. g. in approval processes.

User Interfaces

User interfaces of PDM systems are increasingly implemented in the shape of graphical user interfaces (GUI) using standards such as OSF/Motif or MS-Windows. In comparison with the traditional, forms-based user interfaces, graphical user interfaces can significantly simplify PDM user interaction.

ADMINISTRATION

Main tasks of PDM administrators are to define and maintain meta-data, manage user-authorizations and data distribution and to work with archive and backup facilities. Examples for the managed meta-data are creator identification, supplier ID code and release level. The management of user authorizations is done typically with the help of the operating system's control utilities. Besides the normal data manipulation rights of the operating system (like read, write and copy functions), PDM-specific authorizations are handled, e. g. product structure modification authorization, reviewer approval and promotion authorization.

Modern IT installations are built of a variety of different hardware and software concepts. The trend to client-server-systems with various client platforms and the use of distributed data storage concepts requires administrators with appropriate skills and the competence to ensure data consistency and security. The hard- and software systems have to be maintained, synchronized and coordinated.

CONCLUSION

Today's PDM technology allows companies to organize the product life cycle

efficient, to improve product quality and to reduce costs in design, manufacturing and distribution processes. Especially firms with a wide spectrum of products that are built of many different components will profit by the use of PDM systems.

Because of the complexity of the processes involved in the product life cycle, PDM systems are products that have to be tailored on the specific needs in a company. In most cases, they can be integrated in the existing environment of hard- and software systems. Modern user interfaces allow the users to work with PDM components in an easy, efficient way.

Small and medium sized enterprises that are focussed by the PRODNET II project normally cannot afford such systems. But their customers force them to process PDM information in digital representation. For these users ProSTEP provides a tool for the low price segment, the PDM Editor. This tool is used in the project for managing, viewing, and editing of product data in design processes. The PDM Editor enables SME's to exchange product data in a neutral way based on the STEP PDM Schema (MACH, 1998), (ProSTEP, 1997).

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