



## PDM Systems - An Overview

### Introduction

Product development is the process by which a product comes to market. PD is among the most complex of human endeavors, involving such distinct disciplines as manufacturing, marketing, design, finance, sales, organizational theory, and strategic planning. The variety and complexity of these disciplines require that PD can no longer be the domain of a few talented individuals, but must be shared by many persons and organizations.

An automobile has over 10,000 parts. Its development requires three or more years of effort from 750 to 1000 people within the manufacturing organization, and hundreds of others in supporting companies. An airplane can have well over 1,000,000 parts, and its development may involve 3000 to 5000 engineers, at costs of several billion dollars. With so many resources at stake, organizations cannot afford inaccurate or incomplete information passed haphazardly among poorly integrated teams.

However, the typical industrial PD process is burdened with problems such as these, and the costs of this inefficiency are exorbitant. Much product development research has de-emphasized the interfaces between different PD disciplines. Instead, research has focused on individual disciplines or aspects of product development (such as computer-aided design, cost analyses, etc.). A thorough understanding of each aspect is important, but it cannot guide the overall process. A process directed primarily by marketing, for example (or engineering, or finance, etc.), may optimize the process locally but jeopardize it overall.

Product development requires the collaboration of many disciplines, and healthy product development requires a creative clash at the interfaces between these disciplines.

*At CIPD, they study the interfaces where people and organizations pass information. Because the PD system spans traditional organizational boundaries, they shape their research around the interplay between technical, business, and social forces. Our faculty, staff, and students from MIT's engineering and management schools join with governmental and industrial partners that span many industries-automobile, aircraft, heavy industry, precision machinery, consumer products, software, and microelectronics-to understand how boundaries between disciplines can become gateways to successful product development.*

[.....Excerpted from the Center for Innovation in Product Development \(CIPD\), MIT](#)

## Giga Research

Collaborative product commerce (CPC), or alternately product life-cycle management (PLM or ePLM), are terms currently being used to describe long-awaited changes in product development that are being driven by Internet and enterprise application integration (EAI) technologies. CPC is focused on collaboration across the extended enterprise, which encompasses marketing, purchasing, sales, customers, suppliers, external design partners, OEMs, etc. The vision is to provide a secure, real-time view of product data across this extended design community, often in a portal-type interface that is structured to allow role-based viewing of the data. The data comes from back-office applications, such as product data management (PDM), materials requirements planning (MRP), CAD/CAM/CAE and enterprise resource planning (ERP), as well as tools such as supply chain management (SCM), component supplier management (CSM) and customer relationship management (CRM). Ultimately, CPC is about using collaboration tools to quickly and cost effectively deliver a quality product to a receptive market by designing the product with manufacturability and serviceability in mind. CPC tools are meant to help with the following:

- Decrease time to market and increase product quality.
- Make sure the products that are launched are the right products. Are they in line with customer (either OEM or end customer) needs?
- Greater collaboration with outside companies is partly a result of increased outsourcing. Some companies are outsourcing more and more design to contractors and thus require more external collaboration with these contractors.
- Facilitate design for assembly, design for manufacturability and design for serviceability. In other words, the more collaboration (between internal department and external partners) that goes on in the early design phases, the more relevant the end product and the smoother the transition to manufacture of the product.
- Make sure the products designed at the lowest possible cost through greater collaboration between design engineers and manufacturing process engineers.

None of these are new ideas, but with the increased use of collaborative tools and Internet technologies, they are becoming more of a reality. Companies seeking continuous improvement of product development processes are increasingly using information technology to strategically aid and change these processes. Vendors in this space are primarily approaching it from the PDM realm. Companies that fit this description include **Agile Software**, **Parametric Technology Corp.** (PTC), **MatrixOne**, **SDRC**, **Unigraphics** and **IBM/Enovia**. ERP companies, such as **SAP** and **Oracle**, also have their eye on this space, as does **i2**, from the SCM perspective: Oracle with its Product Development Exchange, SAP with its PLM suite which has more of a transactional, PDM-focused offering, and i2 with its TradeMatrix Design. Finally, companies such as **NexPrise**, **Engineering Animation Inc.** (EAI), **Alventive** and **eRoom** offer less comprehensive point solutions, primarily geared toward Internet-enabled collaboration between disbursed design teams.

## Related Giga Research

- Planning Assumption, Building Blocks for Establishing a Document Management Strategy - Part 1, Connie Moore
- Planning Assumption, Building Blocks for Establishing a Document Management Strategy - Part 2, Connie Moore
- Planning Assumption, Key Trends for 2001: Information and Knowledge Management, Dan Rasmus

## Toolset Features of PDM Systems

PDM tools generally have the following functionality:

- Capture and management of data - collecting and managing the new and revised data (such as engineering change orders, standard parts, specification documents, BoMs, notes, microfiches, etc.) generated during the product development process
- Process management - workflow tools that distribute and guide the processes that constitute the product development process
- A vault - a repository to securely store product development data
- Process tracking - a record of what is done to the data through the product development process

Core PDM functionality is meant to address/allow for the following:

- Fast distribution of information
- Information accuracy
- Information visibility
- Information security
- Revision and version control of documents: PDM tools manage the messy complexity that arises from myriad intermediate instances of documents (drafts/versions).
- Product structure definition (BoMs): (usually refers to part-to-part relationship) The primary challenge in this area is dealing with the entire product life cycle (in design, creation, as-released, revisions/versions, integration with CAD and ERP).
- Part to document relationships: to drawings, manuals, parts in other contexts (e.g., parts libraries)
- Workflow management: Automates processes where information, documents or tasks are passed from one participant to the other for action, following a set of procedural rules. Workflow ranges from unstructured (ad hoc) to highly structured.

## Primary Vendors

The main vendors in the space, listed alphabetically, are the following:

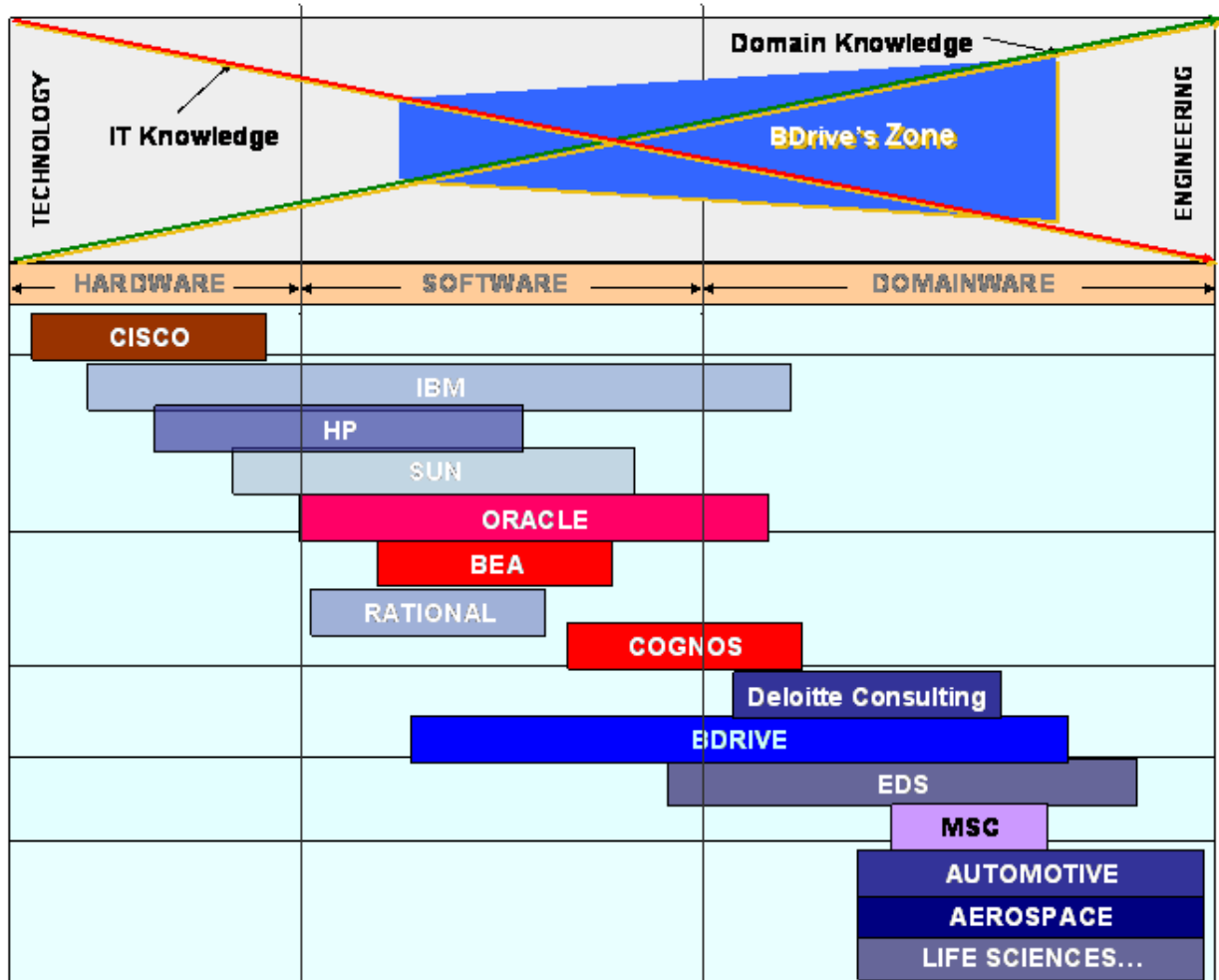
- **Agile Software**
- **CoCreate** (subsidiary of **Hewlett-Packard**)
- **Eigner + Partner AG**
- **IBM/Enovia**
- **MatrixOne**
- **Parametric Technology Corporation (PTC)**
- **SAP** (with its PLM module)
- **Structural Dynamics Research Corporation (SDRC)**
- **Unigraphics Solutions**
- **Workgroup Technologies Corporation (WTC)**

Most PDM vendors address all of the above functionality, but with varying degrees of competence in specific areas. When assessing workflow, collaboration and document management capabilities that thread through most of PDM, it is important to note that there are stand-alone vendors outside of the PDM space that specifically address these areas (see Related Giga Research below). Clients that aren't satisfied with how the PDM vendors address these functionalities should assess the stand-alone vendor offerings, but they should understand that there is a lot of benefit to having a PDM system in which the vendor has already solved many integration issues (both within its own suite of products and with third-party vendors) and can provide an engineering document management platform whose maintenance and upgrades are supported by a vendor. Because of this, Giga recommends that clients first look to the established PDM vendors before considering patching together stand-alone vendor options.

Customers should also understand that many PDM vendors are adding products to their suites that emphasize Internet technologies, called collaborative product commerce (CPC) or product life-cycle management (see [IdeaByte, The Strategic Initiatives Driving Collaborative Product Commerce](#), Gillian Glasser). Companies should realize that while PDM may be critical to their product development processes, it is of a more tactical nature. CPC entails a more strategic approach to product development, and many companies that see the need for business process reorganization around product development are turning to CPC as an enabler of this reorganization. Giga recommends that companies looking to acquire a new PDM system (or upgrade an existing one) make an assessment of which strategic initiatives in product development they will be embracing and how their PDM vendor of choice is addressing their strategic initiatives. The process for selecting a product should be expanded beyond the core PDM feature/functionality level and could actually drive CPC efforts that are well beyond the typical scope of a PDM implementation project. In terms of forward-looking CPC vision, and progress toward that vision, the two primary vendors at the fore are MatrixOne and PTC.

## Our Perspective

BDrive's innovative concepts in application development, knowledge management and process optimization will help enterprises achieve full collaboration and integration capabilities to pull/push information using state-of-the-art technologies in RDBMS, XML, J2EE and Web Services. It will enable companies to be proactive rather than reactive to technology and market changes and better predict their future and make them amenable to changes.

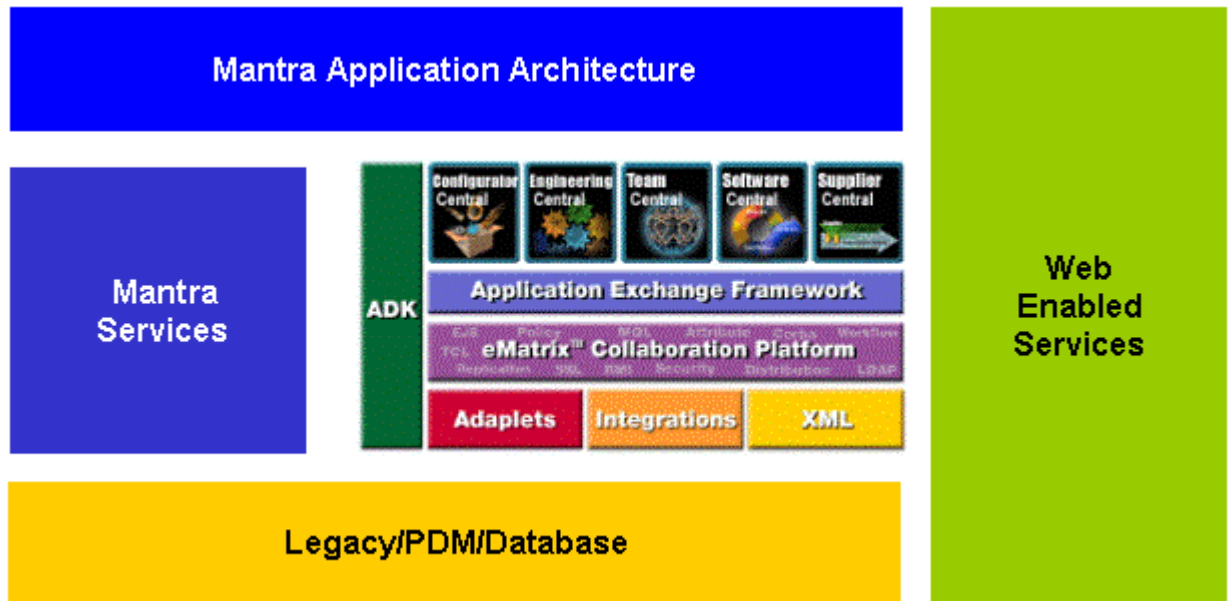


The above diagram shows a perspective of BDrive's expertise. We believe in the coordination of IT and Domain specific Knowledge to build Intelligent Collaborative Infrastructures.

For PLM, where BDrive has focused its current effort, applications that span the end-to-end management of the lifecycle of designing, developing, manufacturing and maintaining (servicing) products will enable organizations to grow organically based on the external environment with anticipation to changes.

## An Example Integration - The MatrixOne Interface

To enable the quick creation of eMatrix databases, we have embedded the philosophy of creating attributes, types and their relationships so that a catalog of parts (for an automotive company, for example) can be visually created. Using MANTRA's collaborative development platform, we have included the capability of creating eMatrix databases in conjunction with other sources (currently Relational Databases) and enable the building of application frameworks that can seamlessly access information directly thru eMatrix or via MatrixOne Adaplets to other CRM, PDM and ERP systems.



The above framework represents the joint infrastructure, where MANTRA provides the build, manage and deploy portions for the application and MatrixOne provides the backend source in terms of eMatrix or connectivity to legacy systems.

The benefits of such a system are:

1. Creating eMatrix databases would be enabled via a collaborative visual web-based environment.
2. Applications that talk to the database could be managed more efficiently.
3. History of all logs and metrics can be maintained for review.
4. Tenets of Application/Database build can be re-used in the next project. These include design patterns, lessons learned and best practices
5. Having auto translators between phased out systems (Sherpa) and MatrixOne - Both Metadata, Records and Ancillary Files
6. Build and Configures Mechanisms, Connectors and Adapters to external systems such as ERP and Legacy Systems that are currently not available as adaplets in MatrixOne

## Including Test data in PDM systems

Current PDM systems consist of managing CAD data in terms of cataloging them by part descriptors and making them available to rendering software. Some automotive companies have modified these systems to include attribute specific CAE meshes to reside alongside

with their raw geometry descriptors (CAD files) so that mesh specifications, boundary conditions (for analysis) and material properties can also be cataloged. Alongside with this they also have the ability to store the analysis result files for historical review. Our plan is to also include Test data - be it from prototypes, production systems or competitive data so that a rich correlation capability can be established between CAE, Test and Competitive data. Thus not only does design collaboration get facilitated by PDM systems (as is the practice currently) but also process collaboration in terms of Benchmarking and its cascading to requirements is also enabled.

### **Enabling Correlation and Building Quality Systems**

A Quality process balances Cost, Time and Functionality to create a robust and sustainable infrastructure to meet and exceed the goals of a product development environment. With the emphasis on more simulation (CAE) and less testing because prototype build is expensive, automotive manufacturers are constantly faced with the question whether the software tools that they used to predict model behavior was correct or wrong. Using Statistical Process Control Techniques, BDrive has enabled the Safety Engineers at Ford Motor Company to assess the capabilities of the simulation softwares so that requirements-based confidence can be assigned while doing simulation runs. This not only allows for more CAE analysis to be done with limited testing, but also weeds out alternative bad software which do not come close to actual behavior of systems.

### **Summary**

In conclusion, PDM systems are the heart of any process oriented enterprise that is forward thinking in implementing a robust PLM system that interacts with ERP, MRM, SCM and CRM systems. Using the latest technologies for collaboration and integration, BDrive is poised to service any industry that can benefit by time and cost optimization.