Product life cycle management An introduction

Conference Paper · May 2011

CITATIONS
9

READS
40,607

1 author:

Lakshminadh Javvadi
Cognizant Technology Solutions
6 PUBLICATIONS **11** CITATIONS

SEE PROFILE

White Paper

Introduction to Product Lifecycle Management

Lakshminadh Javvadi
Associate Vice President & Lead PLM (Manufacturing)

MPHASIS
an HP company

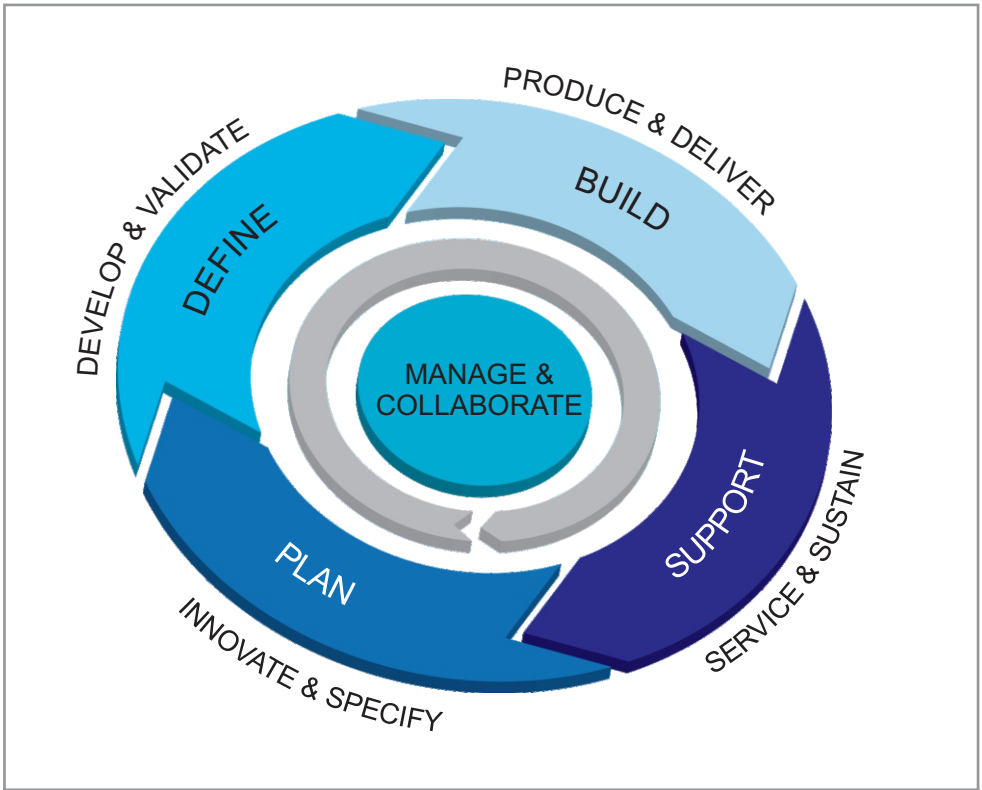
Table of Contents

1. Introduction

Product Lifecycle Management (PLM) is an integrated, information-driven strategy that speeds the innovation and launch of successful products. It is built on common access to a single repository of all product-related knowledge, data, and processes. As a business strategy, PLM lets distributed organizations innovate, develop, support, and retire products throughout their lifecycles as a single company. It captures best practices and lessons learned, creating a storehouse of valuable intellectual capital for re-use.

Definition

Product lifecycle management is the process of managing the entire lifecycle of a product from its conception, through design and manufacture, to service, and disposal. PLM integrates people, data, processes, and business systems and provides a product information backbone for companies and their extended enterprise. It can be represented as shown below.



Source: http://www.ugs.com/

PLM is one of the four cornerstones of a corporation's information technology structure. All companies need to manage communications and information with:

1. Their customers through Customer Relationship Management (CRM) and their suppliers (Supply Chain Management or SCM),
2. Their resources within the enterprise (enterprise resource planning or ERP)
3. And planning (systems development lifecycle or SDLC).
4. In addition, manufacturing engineering companies must also develop, describe, manage and communicate information about their products (PLM).

History of PLM

Inspiration for the burgeoning business process now known as PLM came when American Motors Corporation (AMC) was looking for a way to speed up its product development process to compete better against its larger competitors. In 1985, AMC began development of a new model, that later came out as the Jeep Grand Cherokee.

The first part in its quest for faster product development was a computer-aided design (CAD) software system that makes engineers more productive. The second part in this effort was the new communication system that allowed conflicts to be resolved faster, as well as reducing costly engineering changes because all drawings and documents were in a central database. The product data management was so effective that after AMC was purchased by Chrysler, the system was expanded throughout the enterprise connecting everyone involved in designing and building products. As an early adopter of PDM technology, Chrysler was able to become the auto industry's lowest cost producer, recording development costs that were half of the industry average by the mid-1990s. This innovation motivated the software companies and the OEM's to invest in the development of various CAD and PDM tools.

Some of the milestones in evolution of PDM/PLM include:

1960's: New display methods and equipment, first CADD draft and design applications, sketchpads and light pens bring innovation into the design process

1970's: Introduction of CAD/CAM systems, automated 2D drafting, first independent production workstations

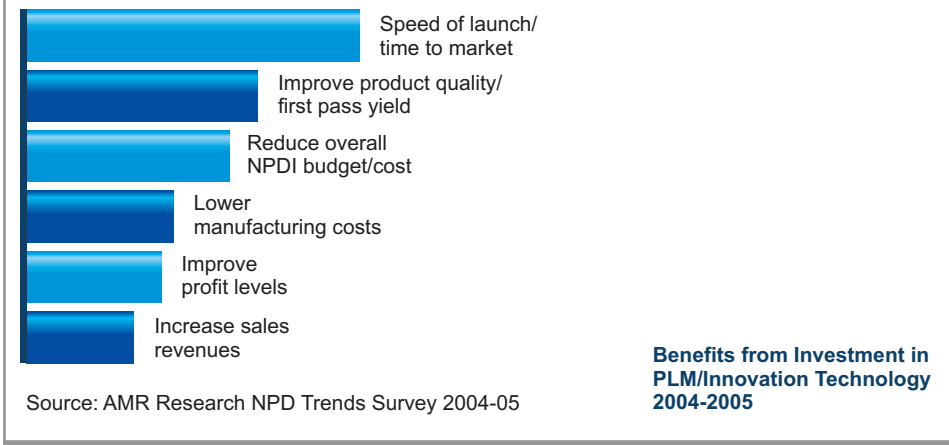
1980's: PC systems were born into the real word, introducing 3D systems, PDM problematic grows up on importance

1990's: Parametric CAD/CAM/CAE systems integrates together with other PLM components, global market brings large PLM systems cooperation through all over the word, HW components prices and introducing IT systems rapidly grows the CAx/PLM market area

Profit from Innovation

PLM extends the advantages of design automation beyond product design to achieve higher levels of corporate benefits. PLM leads to corporate value by extending design information and processes across multiple organizations and implementing consistent corporate processes and control. PLM enables collaboration that allows people to work together more effectively to increase innovation and leverage it appropriately. PLM can also enable corporate initiatives such as strategic sourcing, eliminating undesirable raw materials for regulatory or “green” purposes, or reducing proliferation of raw materials that lead to increased inventory, and overhead costs. In short, PLM has proven value in helping companies harness innovation for profits. The ongoing success of a company is strongly linked to how effectively it can capture and leverage its intellectual property and product-related knowledge; PLM also provides value as the corporate “repository” for product information.

- **Reduced time to market:** PLM optimizes design cycle efforts through immediate and managed access to all the historical design data that can be reused in new designs
- **Improved product quality:** Product quality is improved because of tight integration of customer, product, quality and regulatory information within a closed-loop corrective action system
- **Reduced prototyping costs:** Re-use of existing data will lower the cost of new prototypes
- **Savings through the complete integration of engineering workflows:** The time taken for global workflow process is very much saved with PLM
- Faster release cycles of products
- **Reduced design times:** New designs take lesser time in a PLM environment because of the digital workflow
- **Faster deployment and rollout of new products:** The evaluation of a product from concept stage to manufacturing stage is very much controlled and automated which results in faster rollout of new products
- **Reduced administrative overheads:** PLM simplifies the development or production process. When subjected to external audit for certifications, a PLM product can simplify review and acceptance.



Benefits from Investment in PLM/Innovation Technology 2004-2005

Source: http://www.tristar.com/

2. Introduction to Product Development Process

The core of PLM is in the creation and central management of all product data and the technology used to access this information and knowledge. PLM as a discipline emerged from authoring tools such as Computer-aided Design (CAD), Computer-assisted manufacturing (CAM) ,Computer-aided Engineering (CAE) and Product Data Management (PDM), but can be viewed as the integration of these tools with methods, people and the processes through all stages of a product's life. It is not just about software technology but a business strategy.

There are four primary areas in PLM:

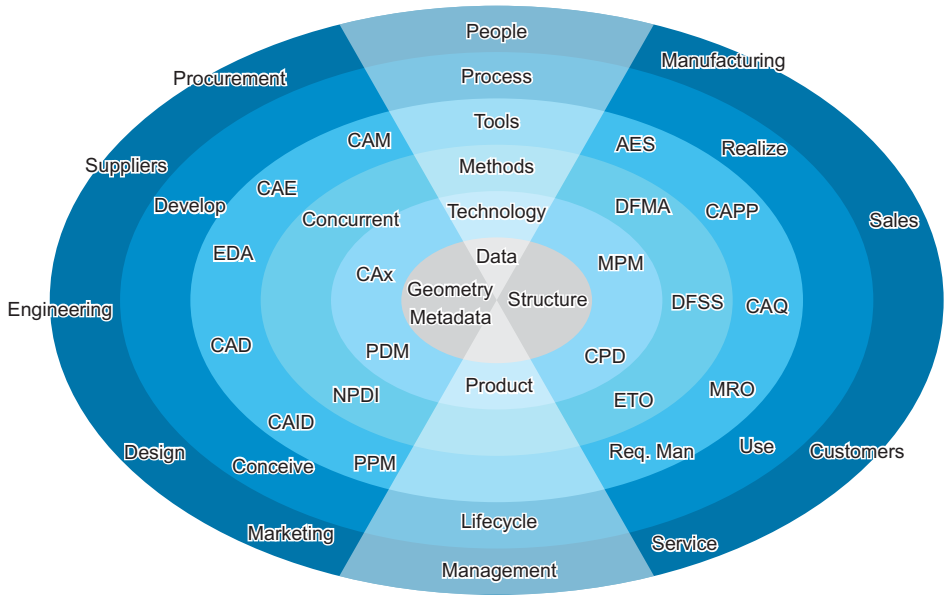
1 Product and Portfolio Management (PPM).

2 Product Design CAx (CAD/CAM/CAE)

3 Manufacturing Process Management (MPM)

4 Product Data Management (PDM)

This can be viewed in the following diagram



Source: http://www.johnstark.com/

The stages described above are in a traditional sequential engineering workflow. The exact order of events and tasks will vary according to the product and industry, but the main processes are:

- **Conceive**

  This is the requirements phase of the customer. From this a specification of the product's major technical parameters is defined

  - Specification
  - Concept design

- **Design**

  Detailed design and development of the products will start in this phase which progresses to prototype testing, through pilot release and to full product launch.

  - Detailed design
  - Validation and analysis simulation
  - Tool design

- **Realize / Build**

  Once the design of the product components are completed, the methods of manufacturing are defined and this will also involve analysis tools for process simulation operations such as casting, molding, machining etc.

  - Plan manufacturing
  - Manufacture
  - Build/Assemble
  - Test quality check

- **Service**

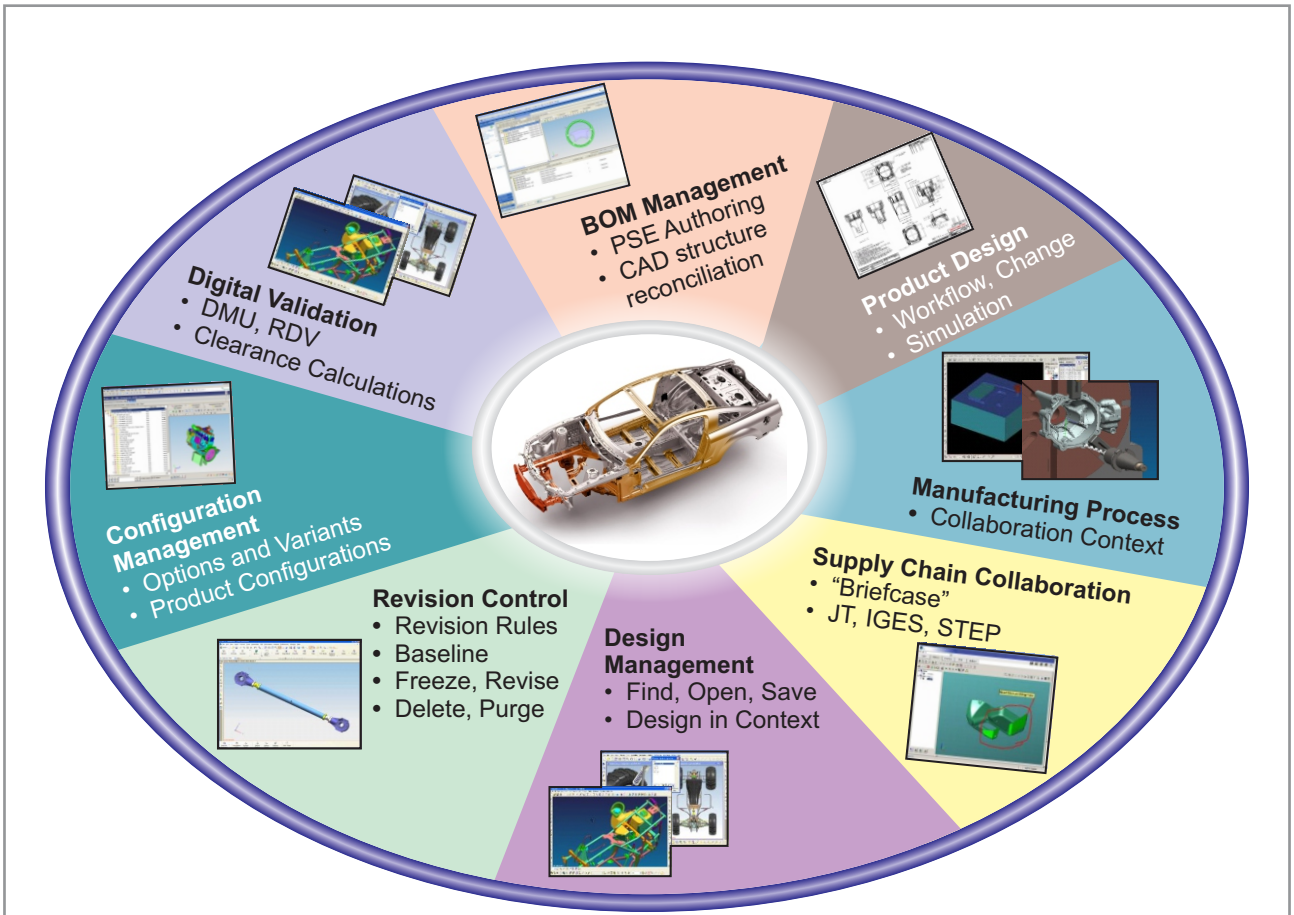
  The final phase of the lifecycle involves management of service information providing customers and service engineers with support information for repair and maintenance, as well as waste management/recycling information. This involves using tools for maintenance, repair, and operations management -MRO software.

  - Sell and Deliver
  - Use
  - Maintain and Support
  - Dispose

Many software solutions have been developed to organize and integrate the different phases of a product's lifecycle. PLM should not be seen as a single software product but as a collection of software tools and working methods integrated together to address either single stages of the lifecycle or connect different tasks or manage the whole process.

None of the above phases can be seen in isolation. In reality, a project does not run sequentially or in isolation of other product development projects. Information is flowing between different people and systems. A major part of PLM is the coordination and management of product definition data. This includes managing engineering changes and release status of components; configure product variations; document management; resource management scheduling; and risk assessment.

The coordination of various departments in making a product into reality is shown below:



Source: http://www.ugs.com

3. Authoring Tools

PLM tools are used for configuration management of the digital mockup. PDM/PLM solution brings together the product, tooling and production line around a single database.

Some of the PLM tools used in industry are described below.

SIEMENS

Teamcenter

Teamcenter is an integrated suite of Product Lifecycle Management applications from Siemens PLM Software.

Teamcenter Components

- **Community Collaboration**

  Teamcenter Community is a web-based collaboration utility that allows companies, suppliers, and customers to share information in a secure environment. Since Teamcenter Community is built on Windows Share Point Services, there is a tight integration between Teamcenter Community, Microsoft Windows, and Microsoft Office. Teamcenter Community 2007 is based on Share Point 2007.

- **Engineering Process Management**

  Teamcenter Engineering, Teamcenter Express is a PLM software package designed for CAx data management. Users can integrate with the engineering client application with many different CAx products. The program called Teamcenter Engineering is designed for large companies, while Teamcenter Express is targeted for mid-size to small engineering companies.

- **Enterprise Knowledge Management**

  Teamcenter Enterprise, formerly known as Metaphase is a large-scale PLM product.
- **Maintenance, Repair and Overhaul**

  Teamcenter for MRO, a solution that aids organizations in maintenance, repair, and overhaul activities.
- **Manufacturing Process Management**

  Teamcenter Manufacturing is an information management engine based on Teamcenter Engineering, with several extensions that optimize its applicability to the manufacturing environment. Teamcenter Manufacturing serves as the foundation for UGS' Tecnomatix suite of digital manufacturing solutions, enabling companies to quickly assess the impact of their decisions on product, process, plant, and resource requirements.
- **Program and Project Management**

  Teamcenter Project provides project management capabilities for companies and project managers.
- **Systems Engineering**

  Teamcenter for Systems Engineering gives project planners of integrated mechanical, electrical and software product design, a powerful tool to create and communicate requirements.
- **Sourcing Management**

  Teamcenter Sourcing a collection of configurable strategic sourcing solutions that allow professionals to provide input to design decisions earlier in the product development process.
- **Lifecycle Visualization**

  Teamcenter Visualization gives the ability to view CAD data in a CAD neutral format.
- **Reporting and Analytics**

  Teamcenter for Reporting and Analytics provide a basis on which to establish, measure, and analyze key performance metrics to drive processes across the product lifecycle.
- **Simulation Process Management**

  Teamcenter for simulation provides a single organized and secure source of simulation data and processes that can be embedded into the product lifecycle to better assess product performance and quality while improving development efficiency.
- **UG NX**

  NX powers innovation through digital product development. With the industry's broadest suite of integrated CAD, CAE, and CAM applications, NX addresses the full range of design, engineering and manufacturing activities to transform the product development process.
- **Solid Edge**

  This is a 3D CAD parametric feature solid modeling software that runs on Microsoft Windows and provides solid modeling, assembly modeling, and drafting functionality for mechanical engineers. Through third party applications, it has links to many other PLM technologies.

PTC

- **Pro/ENGINEER**

  ProE is a 3D CAD parametric feature solid modeling software created by Parametric Technology Corporation (PTC). Its direct competitors are UGS-NX, CATIA, SolidWorks, Autodesk Inventor and Solid Edge. It runs on several UNIX flavors, Linux and Microsoft Windows, and provides solid modeling, assembly modeling, and drafting functionality for mechanical engineers.
- **Windchill**

  Windchill is an integrated suite of PLM applications from PTC.

- **Content and Product Data Management**

  Windchill PDMLink manages and controls product information and processes through the product lifecycle.

  - Windchill MPMLink - Allow design and manufacturing engineers to concurrently develop manufacturing processes and engineering designs.
  - Windchill Supplier Management – Helps companies select suppliers and manufacturers to create an approved manufacturer list (AML) and Approved Vendor List (AVL).
  - Windchill PartsLink Classification and Reuse – An internal design software that allows companies to better reuse parts and part designs.
  - Windchill Business Report Author – Uses Cognos 8 Business Intelligence to create and modify reports.
  - Pro/INTRALINK – Manages Pro/ENGINEER data for the engineering workgroup. These capabilities are included with Windchill PDMLink.

- **Collaboration and Project Management**

  Windchill ProjectLink - For managing product development projects.

  ProductView Lite - Visualization collaboration capabilities that are included with Windchill PDMLink and Windchill ProjectLink.

  - **Enterprise Integration**

    Windchill Enterprise Systems Integration (ESI) – Synchronize information between Windchill and ERP systems. Windchill Info*Engine® – Standards-based integration tools.

  - **Product View**

    Product View enables to view, markup, and interact with all forms of digital product data.

Dassault

- **DELMIA**

  Digital Enterprise Lean Manufacturing Interactive Application is a digital manufacturing and simulation solutions from Dassault Systems

- **Abaqus**

  Abaqus/CAE provides computer-aided engineering concepts such as feature-based, parametric modeling, interactive and scripted operation, and GUI customization.

- **ENOVIA SmarTeam**

  Enovia SmarTeam is a PLM Product targeted for mid-sized industries.

- **ENOVIA MatrixOne**

  ENOVIA delivers new levels of 3D digital collaboration in companies large and small, and allows companies to fully master the creation and lifecycle management of products whether they are complex or simple.

- **SolidWorks**

  SolidWorks is computer-aided design (CAD) Product .

- **CATIA**

  CATIA product design application which addresses all manufacturing organizations, from OEMs through their supply chains, to small independent producers.

- **Oracle Agile**

  Agile's PLM solution is used in a variety of industries, including high-tech, life sciences, industrial manufacturing and consumer packaged goods.

- **SAP PLM**

  SAP PLM solution creates a collaborative environment to manage, track, and control all product and project information over the complete product and asset life cycle through a quality-driven, extended supply chain.

  SAP PLM solution consists of 4 environments that are fully integrated:

Product Management: Includes the planning and decision-support capabilities to align high-level product plans and objectives with corporate growth strategies – supported by product portfolio analysis and management.

Product Development and Collaboration is Consists of business processes that engage multiple roles and communities-of-practice across the enterprise and business network to drive continuous product innovation, performance, and quality.

Product Foundation All product-related data is managed along the entire life-cycle. This includes the development and planning phase, technical document management, part management, product and process structure management. Classification and variant configuration. For discrete manufacturing, bills of materials and routings are included. For process manufacturing, specifications and recipes are used.

PLM foundation is about product enterprise search, product compliance, product costing tool and workgroup integration, project and resource management and document management.

All PLM environments can be integrated with the SAP R/3 backbone system. Web-based functionality and XML-based interfaces allows integration with third party design (CAD-CAM) and manufacturing systems (MES/PLC level).

4. Global PLM Service Providers

Some of the PLM Service Providers available in the market are:

SIEMENS PLM Services, EDS, MindTree Limited, Infosys, Satyam Computer Services Ltd. Altair, MSC Software Corp., T-Systems, Intergraph PDM Solutions, Computer Sciences Corporation, Tata Consultancy Services, PRTM, ITC InfoTech, HCL Technologies Ltd, PRION Group, Keane, Capgemini, Wipro Technologies, Accept Software Corporation, Access Commerce Inc, Access Systems LLC, Actify, Inc., ACS Software, Inc., Active Sensing, Inc., Agile Software, AIM systems, Allegria Software Inc., Alibre, Amadeus International, Apriso Corporation, Aras Corporation, Arena Solutions, Artemis International Solutions Corporation, Assetium Assyst Bullmer Ltd., Autodesk, Auto-trol Technology Corp., Bamboo Solutions, BigMachines, Inc., Business Management Systems, CADD Solutions Pvt Ltd, Cadman Corporation, CEIMIS Enterprises, INC., CENIT, Centric Software, Inc., Cimage NovaSoft Ltd, Cimmetry Systems, CMstat, Coastal Logic, Inc., CoCreate Software Inc., Engineering PLM Solutions, Engineous Software, Inc., Enginuity, Enovia, EPM Technology, eQuorum Corporation, eQ Technologic, Eurostep Commercial Solutions, Exertus, FeaturePlan, Federation Software, First Trace, Inc., Formtek, Framework Technologies, Freeborders, Inc., Fujitsus, Full Circle Systems, IBM, INCAT, Intergraph, Interneer, Orcon GmbH

5. Future Trends in PLM

One of the known problems in any product industry (OEM's) is that the industry consists of many departments such as business/project management, engineering department, quality control management, operations, sales etc., using their own custom software applications. Along with that, the company also uses products for ERP, CRM, SCM. and BOM management system etc. All these applications lack interoperability among them. Because of this, whenever any decisions are taken by the organization for new products or modifying existing products, the complete data (data may be from ERP or from SCM, CRM etc.) for estimating the costs, tooling, changes, and others are not directly available even though the company uses PLM and hence the organization needs more time for obtaining all the data from various systems which impacts their product into the market. Hence there is need for a kind of architecture which can bridge all these applications and provide a common platform of application for all the departments.

One such architecture is Service Oriented Architecture (SOA).

- A service-oriented architecture is essentially a collection of services. These services are independent and can communicate with each other.
- The communication involves either simple data passing or it could involve two or more services coordinating same activity.
- SOA is an IT architecture for request - reply applications for modularizing and presented as services.
- Application functions with services are loosely coupled, and service interface is independent of implementation.

How SOA can help in PLM Integrations

The demand for loosely coupled integration is increasing day by day as new authoring tools are adding up in large enterprises and also the maintenance of legacy application integrations are becoming costly. This situation influenced major PLM vendors to introduce an SOA interface in their product architecture.

Most of the OEM's are revisiting / re-drawing their product roadmaps to make use of this SOA in their enterprise integration scenario. This is enabling the PLM systems to become an enterprise application and not restricted only to engineering data.

6. PLM – An IT Service Provider's Perspective

PLM is not just a technology, but rather it is a strategic business approach that applies a consistent set of business solutions in support of the collaborative creation, management, dissemination, and use of product definition information across the extended enterprise, and spanning from product concept to end of life-integrating people, processes, business systems, and information. PLM forms the product information backbone for a company and its extended enterprise.

PLM Services portfolio will ensure an understanding of the vital steps required to move in the right direction. The portfolio of any major IT service providers broadly falls into following categories:

Pre Implementation Planning	Services ranging from “industry workshops” to “product education”, ensuring a clear understanding of Enterprise Vision and their targeted savings and drawing up a strategic business plan for the corporate .
PLM Assessment & Planning	Services for leveraging consulting methods and tools to assess a customer's PLM business challenges, benchmark PLM maturity level with other companies in the same industry, develop a decision mechanism for choosing the current PLM
Industry Specific Solutions	Set of offerings to optimize the solution value by leveraging repeatable and rigorous PLM processes and methods. Business process mapping and Re-engineering the industry specific business process to suit the PLM implementation. Usually these services are developed by PLM software providers.
PLM Deployments	Services package to minimize project cost by aligning project deliverables with the product roadmap.
PLM Migrations	Services to define, validate, perform and test the migration or co-existence of the current environment into PLM solution platform.
PLM Re-hosting	Services to re-deploy the PLM environment on a different platform or different locations.

PLM Implementation	PLM implementation services provide the necessary framework for an organization ensuring that product information is available at the right time for the right function. Also to help customers to manage enterprise assets, standardize processes and ensure reusability while facilitating process adherence, collaboration and long term sustainability
PLM Tool Customizations	Customization services complement PLM implementation by addressing organization's specific customization needs with minimal and optimized customization. Customization services optimize value of PLM implementation without affecting base product functionalities and performance.
PLM Application Support & Maintenance Services	Services for leveraging consulting methods and tools to assess a customer's PLM business challenges, benchmark PLM maturity level with other companies in the same industry, develop a decision mechanism for choosing the current PLM

7. MphasiS PLM Practice

MphasiS is building a strong PLM Practice for catering to the fast growing PLM market. Setting up a core group of PLM subject matter experts (SME) is a step towards developing a strong practice. The PLM Practice SME's will be utilized to train resources on PLM skills and also execute Business consulting , solution design PLM frameworks, methodologies and other activities.

8. Conclusions

The need for PLM service providers is increasing year on year as the market demand for manufacturing the products with less cost and more functionalities are increasing. Implementing a PLM solution requires in depth knowledge of industry processes as well as PLM tools. The PLM products are becoming more matured and implementations need functional resources who can configure the business processes in PLM tools.

Large enterprises with multiple application integrations are now looking for consolidating their applications for operational excellence. The “SOA” a new paradigm in software architecture solutions is enabling the enterprises to revise/revisit their PLM road maps. The PLM software vendors are also re-architecting/rewriting their tools to facilitate the SOA functionalities.

The MphasiS PLM practice focuses on value-added PLM services as well as high volume high revenue services such as PLM support, maintenance, and development activities.

9. Additional reading

“Automotive Survey Affirms Vital PLM Role, yet Key Potential Remains Untapped”, Marc Halpern, Gartner, June 23 2008. Gartner ID Number G00158639

10. References for PLM information

Siemen's PLM solutions and components:

http://www.plm.automation.siemens.com/en_us/products/open/index.shtml

Oracle's Agile suite for PLM:

http://www.oracle.com/agile/index.html

IBM's PLM solution:

http://www-01.ibm.com/software/plm/

Parametric Technology:

www.ptc.com

Dassault Systèmes:

www.3ds.com

American Society of Mechanical Engineers:

www.asme.org

American Society for Quality:

www.asq.org

Association for Configuration and Data Management:

www.acdm.org

Automation.com (industrial automation, process control, and instrumentation):

www.automation.com

Engineering Automation Report:

www.eareport.com

JT Open (Jupiter Technology) data format:

www.jtopen.com

PLM Alliance (University of Michigan-Ann Arbor):

plm.engin.umich.edu

About the Author

Lakshminadh Javvadi

Associate Vice President & Lead PLM (Manufacturing)

Lakshminadh is a post graduate in machine design from JNTU college of engineering and has 15 years of extensive experience in providing PLM and engineering solutions. He is with MphasiS in the PLM practice as Associate Vice-President & Lead PLM (Manufacturing) since four years. Prior to MphasiS he was with TCS, Satyam and Wipro Technologies in their PLM Practices. His core competencies are solution design, presales and consulting and program execution. He is instrumental in building tools and frameworks as solution accelerators.

ABOUT MPHASIS.

MphasiS is a $1 billion global service provider, delivering technology based solutions to clients across the world. With currently over 40,000 people, MphasiS services clients in Banking and Capital Markets, Insurance, Manufacturing, Communications, Media & Entertainment, Healthcare & Life Sciences, Transportation & Logistics, Retail & Consumer Packaged Goods, Energy & Utilities, and Governments around the world. Our competency lies in our ability to offer integrated service offerings in Applications, Infrastructure Services, and Business Process Outsourcing. To know more about MphasiS, log on to www.mphasis.com

For more information, contact: sales@mphasis.com.

USA: 460 Park Avenue South, Suite #1101, New York, NY 10016, USA
Tel.: +1 212 686 6655, Fax: +1 212 686 2422

UK: 88 Wood Street, London EC2V 7RS, UK
Tel.: +44 20 85281000, Fax: +44 20 85281001

AUSTRALIA: 9 Norberry Terrace, 177-199 Pacific Hwy, North Sydney, 2060, Australia
Tel.: +61 2 99542222, Fax: +61 2 99558112

INDIA: Bagmane Technology Park, Byrasandra Village, C.V. Raman Nagar, Bangalore 560 093, India
Tel.: +91 80 4004 0404, Fax: +91 80 4004 9999

1211

MPHASIS
an HP company