IBM PLM Solutions
May 2009

IBM Product Development Integration Framework

The foundation for industry-wide integration to manage the product lifecycle

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Executive Summary

In many industries, the management of a product's lifecycle presents a unique challenge – product configurations are complex and dynamic and must be managed from inception to decommissioning. This is essential to meet customer needs, comply with regulations, meet safety requirements, minimize maintenance costs, and optimize use of enterprise resources. In order to meet these complex requirements, companies have invested heavily in multiple best of breed software systems to meet specific needs. Unfortunately, these systems do not always integrate well with each other and have become islands of fragmented product information.

Managing this complexity associated with the product development lifecycle is addressed by IBM's Product Development Integration Framework (PDIF) and its core component, the PLM Content Pack. PDIF bridges the gap between general purpose middleware and industry specific business applications. Based on a Service Oriented Architecture (SOA) with support for open industry standards, PDIF can shorten the development cycle by improving collaboration across a complex supply chain of enterprise product development and manufacturing partners. It makes finding, reusing and changing product data more efficient by improving access to product information distributed among disparate systems, resulting in a reduction of errors as data is moved through the product lifecycle. By enabling a coherent and integrated design approach, PDIF will unify processes for product development that combine a mix of electronics, mechanical and embedded software components. PDIF facilitates better use of skills through the common processes, thus offering increased opportunities for innovation.

The challenge

Product development is becoming increasingly complex. Product development includes multiple functions ranging from requirements, portfolio management, design and development, manufacturing, supplier management, marketing, sales and distribution. All of these must be integrated, often across numerous design partners, to ensure the highest product quality with the lowest cost and reduced time to market. Multiple engineering disciplines must act in concert, with all stakeholders able to efficiently collaborate across these disciplines and functions.

To address changing business needs, companies have attempted to integrate business systems within their extended enterprise. However, connecting various business systems that sit in organizational and functional silos and across the value chain has been difficult. Figure 1 illustrates the challenges. Many of the business applications that need to be integrated have been deployed in isolation without considering the needs of an integrated business process and data standards. In addition, inconsistent architectural strategies have led to multiple point-to-point interfaces created on an ad hoc basis and deployed to solve short-term, tactical problems. The outcome is an IT environment that is difficult to maintain and expensive to change.

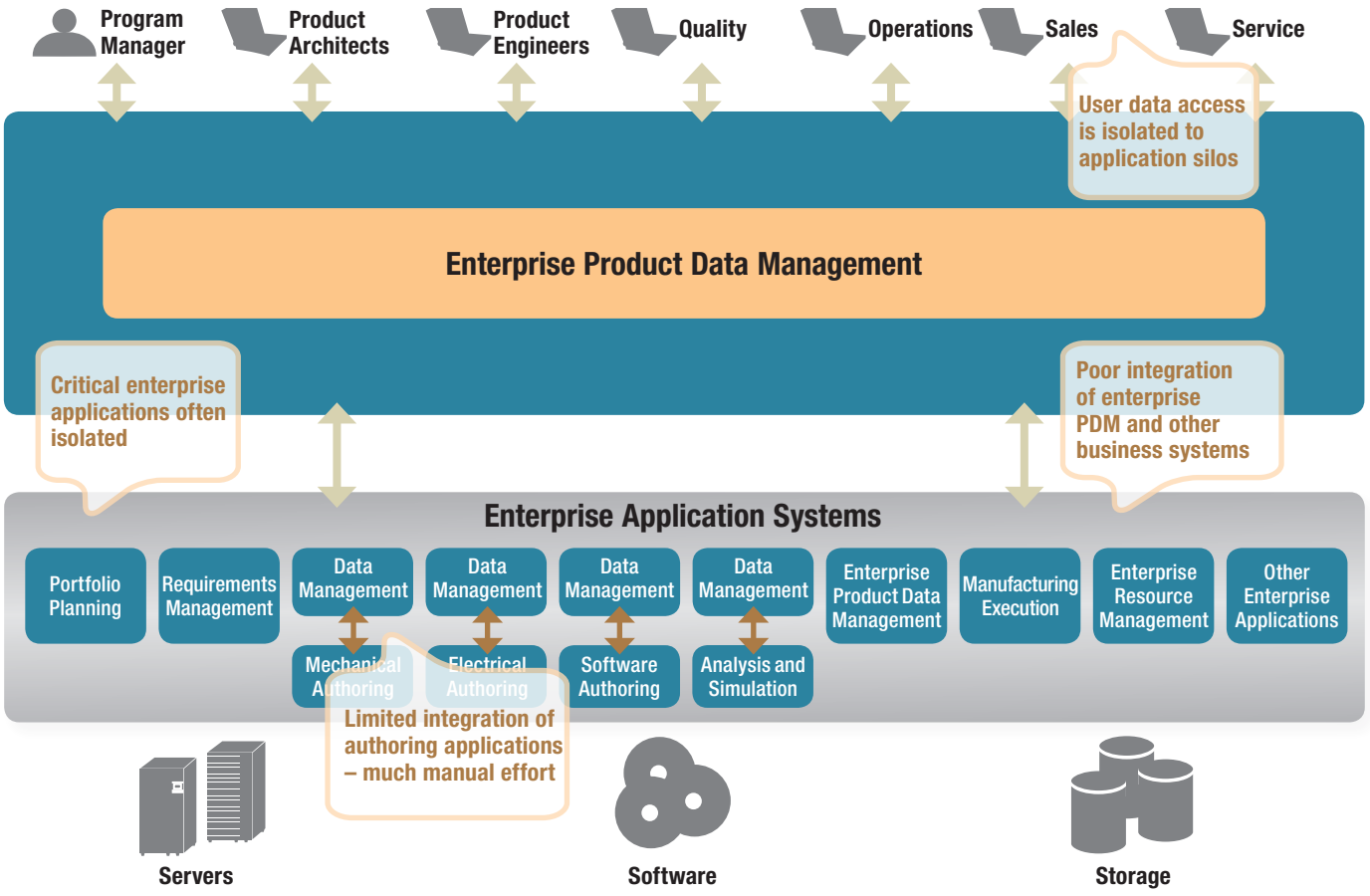

Figure 1 – The challenge

IBM Product Development Integration Framework

Today, most product development environments do not have the required levels of process, data and application integration. PDIF and its core component, the PLM Content Pack provides the foundation to build industry-wide integration across multiple solutions and is applicable to multiple industries such as Automotive, Aerospace and Defense, Electronics and Industrial Products.

As illustrated in Figure 2, PDIF enables the efficient and effective linkage of the design and development of products with core business processes, elevating product development from an engineering-centric function to a strategic business process that improves executive decision-making abilities across the enterprise. It provides the ability to leverage the investment in existing applications, thus maintaining the best of breed environment. PDIF is comprised of a set of pre-built assets and a governing architecture that accelerate the development and deployment of Product Lifecycle Management solutions and provide a flexible platform that can be easily extended to meet future business needs.

PDIF improves time to value and return on investment by:

- *Shortening lengthy product development cycle time by improving collaboration across a complex supply chain of development and manufacturing partners*
- *Automating the current manual transfer of data between systems thereby reducing errors and time*
- *Increasing opportunities for innovation by providing contextual role based access to product information distributed amongst disparate systems*
- *Efficiently finding, reusing and changing product data by federating views on product data wherever it exists in a heterogeneous, multi-vendor PLM and enterprise systems environment*
- *Enabling a coherent and integrated design approach by unifying processes for product development that combine a mix of electronics, mechanical and embedded software components, thus improving overall program management.*

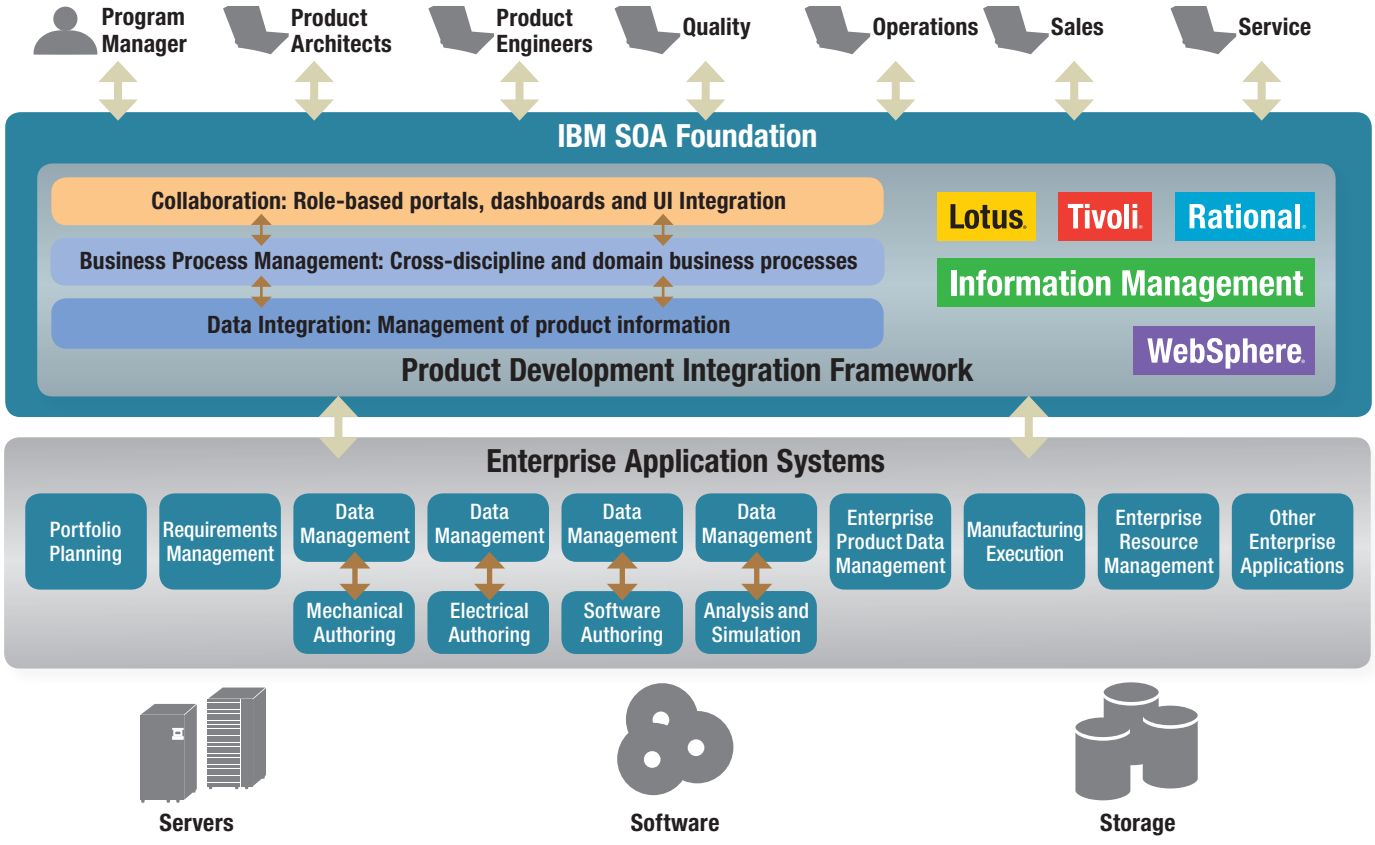

Figure 2 – PDIF Conceptual Architecture

PDIF Architecture

IBM addresses problems of collaboration and integration within the product development environment with a Service Oriented Architecture (SOA) based approach for PLM. A fundamental underlying principle of this effort is based on open IT and industry standards. An SOA approach to PLM is deigned to make product information available to any person or system that needs it and allow flows to be orchestrated to support company-specific business processes.

SOA depends on common services of an Enterprise Service Bus (ESB) and a lightweight interface for suppliers and design partners enabling business functions to be broken into repeatable business tasks that can be re-used. The automatic instantiation of services in the IT infrastructure enables business flexibility and improves innovation capabilities.

Business Process Management (BPM) is the ability to optimize and manage the multitude of business processes that exist in an enterprise. BPM is a discipline that combines software capabilities and business expertise to accelerate process improvement and facilitate business innovation. BPM, enabled by SOA, provides a flexible architectural style in support of efficient process change and rapid process deployment.

SOA solutions can help bring necessary agility to business capabilities. After identifying business processes that need to be refined and enhanced to meet the business objectives, these processes can be defined as compositions of SOA-based business functions that can dynamically adapt to changing business needs. These functions are called business services and are reusable across multiple products, services and geographies.

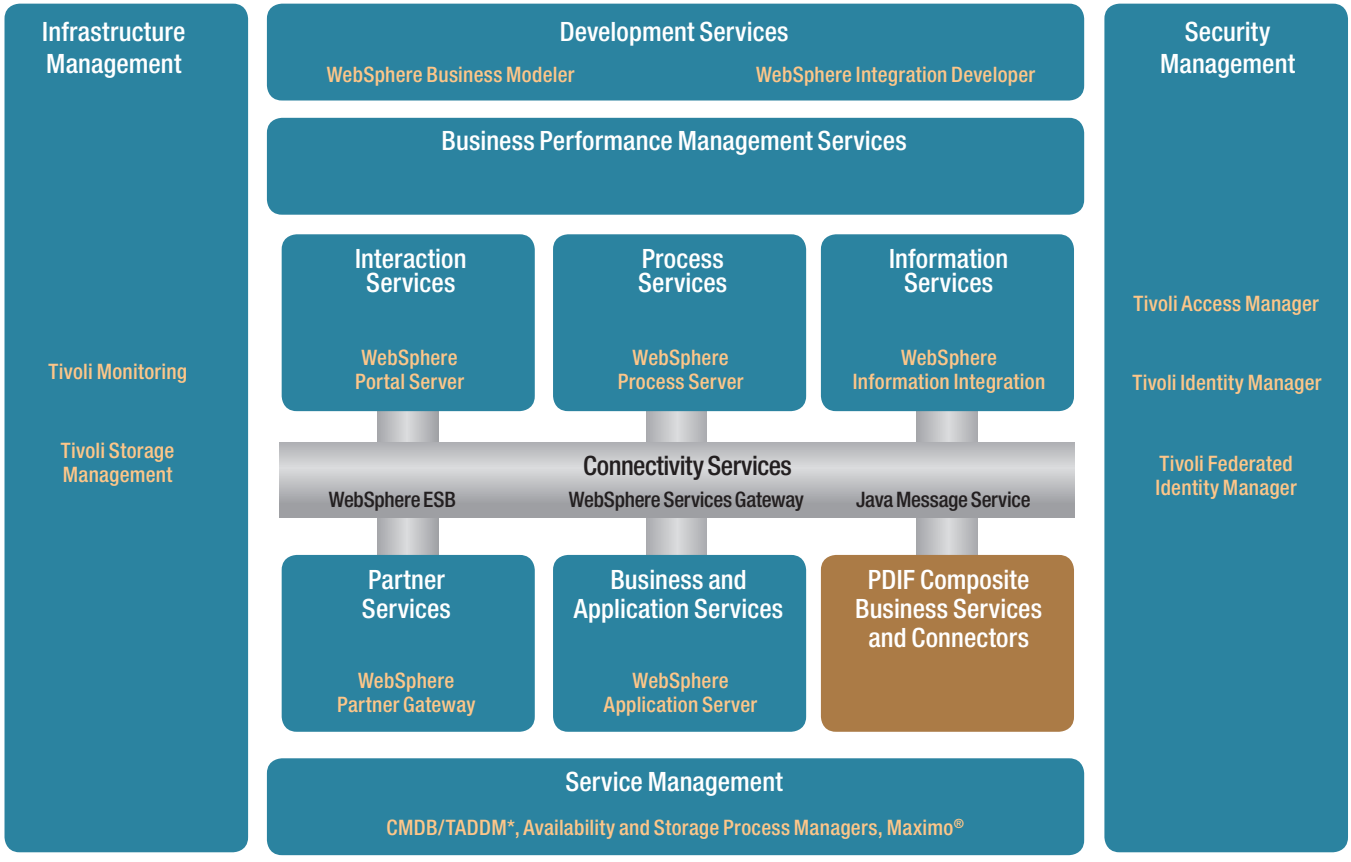

Figure 3 – PDIF Reference Architecture

**Change and Configuration Management Database/Application Dependency Discovery Manager*

The PDIF Reference Architecture, as seen in Figure 3, is based on IBM's SOA Reference Architecture. PDIF and its related assets were developed following the basic tenets of BPM and SOA architecture, beginning with the assets needed for basic integration and building upon those assets to produce business services and Composite Business Services.

IBM's overall solution strategy links business and IT objectives to give you the capabilities you need to be successful. We provide industry solutions to help meet specific strategic objectives.These solution offerings leverage IBM and business partner industry assets and best practices.As seen in Figure 4, the IBM Product Development Integration Framework supports industry solutions from our ecosystem of business partners. Key components of the framework include SOA foundational products and industry-specific accelerators that are key to product development process transformation. These enable new capabilities for your infrastructure. The Smart SOA™ approach is the foundation for delivering process agility.
With SOA, you can integrate 'loosely' using business services. New services can be built and reused across the enterprise. This allows the IT organization to deliver a service to their clients rather than a hard-wired 'function' that is difficult to modify as business needs change.

For product designers and manufacturers who need improved product development collaboration, increased business flexibility and executive level business decision support, Design Chain Management enables manufacturers to distribute the product design and development process across the extended value chain. It is supported by IBM's PDIF and built using SOA.

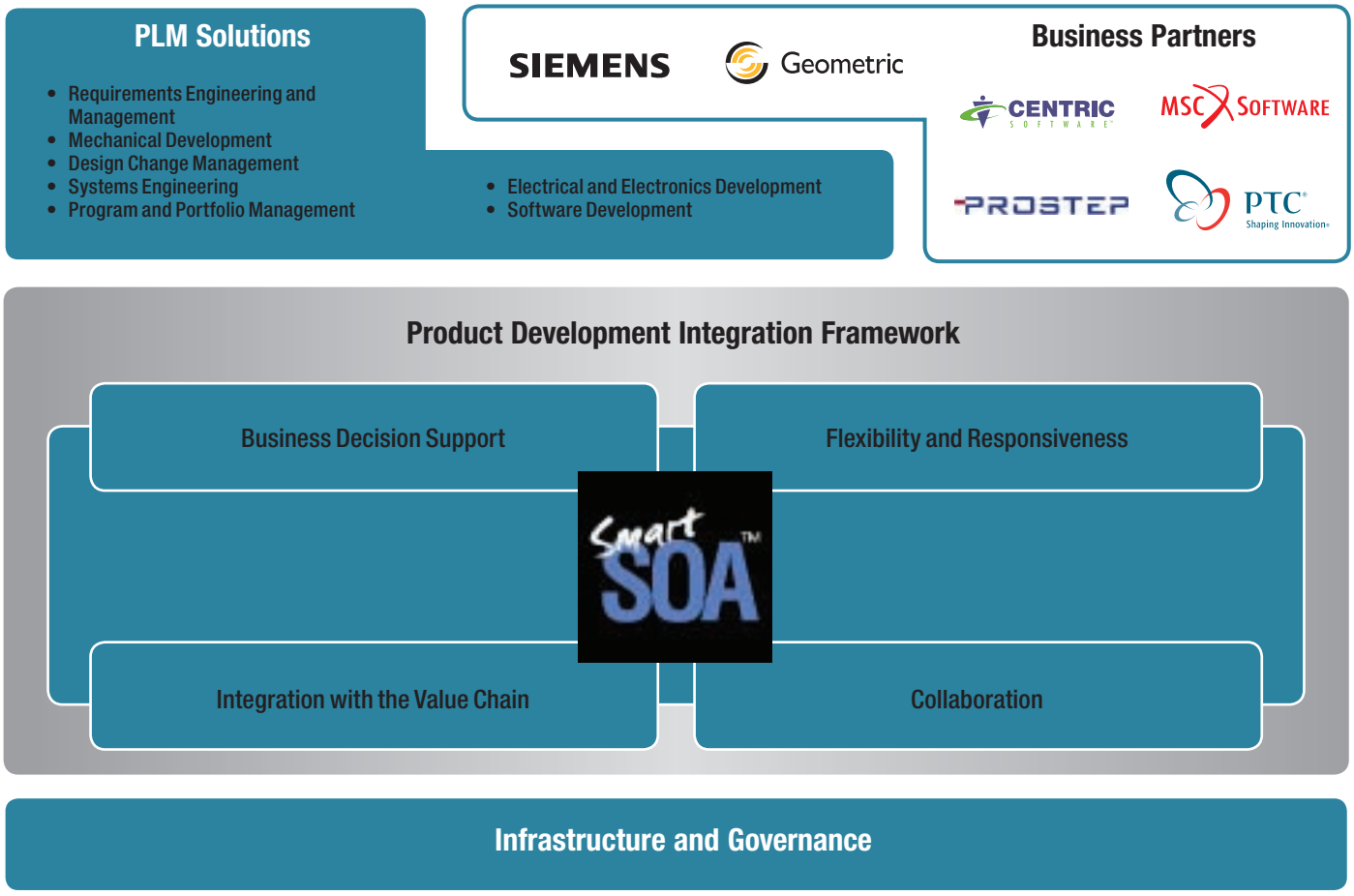

Figure 4 – PLM Solutions enabled by PDIF

With Design Chain Management solutions based on an SOA-enabled framework,integration is achieved through a federated information mechanism that all applications can access and share. Business processes exist independent of specific applications and can be viewed and accessed by all companies participating in the product development value chain, while portals provide access and visibility to all business processes relevant to individual users and their roles.

IBM is focusing on four key design chain management capabilities which combine software and hardware technologies as well as the integration services and business process management expertise to better equip a business to be more innovative and competitive.

The following describes IBM's PDIF Design Chain Management solution capabilities

Enterprise Engineering Change

Product Data Management Integration

Within a single enterprise or across the partner value chain a variety of Product Data Management (PDM) systems can be found, each used with a specific focus and usually containing only pieces of a whole product. It is therefore necessary to integrate the various PDM systems in order to efficiently exchange data during the product lifecycle.

PDIF provides examples of integration scenarios involving multiple PDM systems.
The scenarios include transactions involving basic PDM operations such as:

- *Creating part references and instances*
- *Creating assembly relationships*
- *Creating document attachments*
- *Managing product configuration*
- *Part lifecycle management.*

Engineering Change Management

Engineering Change Management regulates the business process by which an engineering change is requested and propagated throughout the product development pipeline. PDIF supports this process in the context of inter- or intra-enterprise collaboration. The Engineering Change Request (ECR) process is provided as a reference implementation for the PLM Content Pack.

Simulation to PDM Integration

Simulation is increasingly seen as a key function for product development as customers seek to:

- *Reduce product development cycle times through faster iterative design cycles*
- *Optimize cost and reduce time to market by reducing the number of physical prototypes required to validate designs*
- *Enable better designs to meet safety standards and reduce costs associated with manufacturing and field engineering changes*
- *Optimize existing environments to maximize performance, productivity, insight and collaboration, greatly reducing time to market.*

One way to meet these challenges is to improve synchronization and integration of PDM data with simulation processes. PDIF supports the initiation of a simulation request from a PDM system, retrieving data from the CAD system, invoking the Simulation Manager and returning the results back to the PDM system.

New Product Introduction – Release to Manufacturing

ERP Synchronization

Synchronization of PDM with ERP ensures consistent use of product information by personnel in design and manufacturing. Release of product data from PDM to ERP systems usually occurs in the context of the engineering change process. PDIF supports both change and object controlled releases from PDM to ERP. It is able to synchronize released product data between PDM and ERP systems as it relates to product release from design to manufacturing. In some organizations, strict change control is employed for all releases, including the initial product release. In others, incremental change control may be optional.

Integrated Product Change Management

Mechatronics Integration

Today, more and more products contain a mixture of hardware, software, and electrical components. To integrate these separate and distinct components, including their unique data management requirements and numerous development processes, into a single over-riding Product Lifecycle Management process (utilizing PDM applications), PDIF provides PDM integration with IBM software development tools (Rational ClearQuest®, Rational ClearCase®, Rational Requisite-Pro®, and Rational Portfolio Manager®).

Decision Support and Collaboration

Supplier Collaboration

Supplier collaboration enables suppliers, OEMs and other partners to work together during product design and development. It involves transactions and business processes to facilitate the collaboration.

PDIF provides an Industry standard based data exchange platform, using business partner ProSTEP, which allows the translation to and from different or proprietary systems into a common data model. The solution assets provide the mapping capabilities and connectivity to the enterprise PDM systems. In addition, they provide the business visibility and views to monitor Key Performance Indicators and various business integration adapters to provide features such as e-mail notification and archiving.

IBM leverages SOA techniques to offer a platform that is extensible and agnostic to the nuances of the endpoint systems.

IBM PLM Content Pack

A key element of the PDIF industry solution is the IBM Product Lifecycle Management (PLM) Content Pack for WebSphere Business Process Management.

The IBM PLM Content Pack consists of pre-built assets and a governing customization framework that accelerates delivery of PLM composite business applications, supporting automotive, electronics, aerospace and defense and industrial verticals, as well as on business areas such as product data management, engineering change management, bill of material and supplier collaboration. It delivers assets aimed at an ecosystem of OEMs, suppliers, service providers, and other manufacturers. The PLM Content Pack is extensible and configurable to support specific client needs.

Figure 5 illustrates the packaging of the PLM Content Pack. PLM specific SOA solutions (called composite business applications) are the top layer. The middle layer is the PLM content pack which provides assets, based on PLM standards and best practices, that can be reused across the composite applications. The reference architecture of the PLM pack makes it easy to consume and extend these assets using IBM's SOA methodology. The bottom layer is IBM middleware, on which the content pack assets are pre-certified, tested and supported.

As a reference implementation for the PLM Content Pack, a Composite Business Application was developed for the Engineering Change Request businessprocess. It uses Business Policies at runtime to determine the flow of the process. This demonstrates the ability to achieve dynamic, adaptive behavior of the PLM Content Pack for WebSphere Business Process Management.

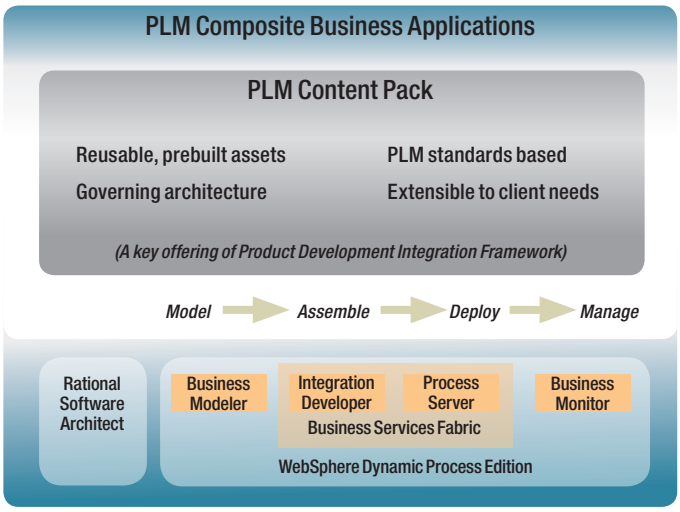

Figure 5 – Positioning and packaging of the PLM Content Pack

Summary

IBM's PDIF and the PLM Content Pack elevate product lifecycle management and development from an engineering-centric function to a strategic business process that improves executive decision making abilities across the enterprise. They provide the foundation for industry-wide integration of processes and product data across multiple disciplines and functions, as well as the means of collaboration amongst the complex supply chain of enterprise development and manufacturing partners. The pre-built assets and governing architecture of PDIF, along with the PLM Content Pack, accelerates the development and deployment of PLM solutions and provides a flexible platform that can be easily extended to meet future business needs.

The coherent and integrated design approach of PDIF unifies processes for product development that combine a mix of electronics, mechanical and embedded software components. The final result is the ability to produce the highest quality product with the lowest cost and reduced time to market which, in turn, allows increased opportunities for innovation.

Further information

An IBM Redbook®, SOA Approach to Enterprise Integration for Product Lifecycle Management, has been published. It documents the Product Development Integration Framework (PDIF) architectural approach toward Enterprise Integration around the Product Lifecycle Management application space. The primary focus is the integration of Product Data Management (PDM) systems to other PDM systems, and PDM systems to Enterprise Resource Planning (ERP) systems (mainly SAP).

Access the IBM Redbook at:
www.redbooks.ibm.com/redpieces/abstracts/sg247593.html?Open

For more information about PLM, got to:
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