IBM Global Business Services

Executive Brief

Aerospace & Defense

Advancing Collaboration within the Aerospace and Defense Product Lifecycle Ecosystem

Becoming an 'innovator' in collaboration may be the key to dominating product lifecycle management

Over the last few years, an evolution, or perhaps revolution, has been taking place in the Aerospace and Defense (A&D) industry. Reflecting on widely publicised issues in the current generation of aircraft and defense systems, companies have been driven to improve how they develop, manage and optimize their product lifecycles. A new 'ecosystem' has arisen, requiring suppliers and manufacturers to operate and work together, collaborating with partners across the globally extended enterprise.

Within this new ecosystem, companies must face the decision whether to proceed with a traditional, 'Dominator' approach where proprietary practices of collaboration are dictated, or move towards an 'Innovator' based strategy, promoting open standards, greater flexibility and improved coordination between ecosystem participants.

This new approach is made viable through innovative technology approaches delivering flexibility and effectiveness while embracing existing IT investments. These include the development of an Hub and the adoption of Services Oriented Architecture (SOA).

In this paper we will explore the factors that have emerged leading to this new opportunity and approach for the way in which new Aerospace and Defense products are created and developed.

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I. The Imperative to Improve Collaboration and Coordination in the A&D Product Lifecycle

Against a backdrop of continued long-term growth and record results, the Aerospace & Defense industry is going through a significant change. With a series of unforeseen events resulting from the US sub-prime mortgage situation and the resulting new economic climate, the fallout on Aerospace & Defense (A&D) customers could potentially be dramatic. The industry is facing a range of short-term challenges in the form of rising costs, fluctuating fuel prices, sizeable order backlogs, increased dependense on global supply chains and an urgency to address some of the environmental and regulatory issues. But even with the current uncertainty brought about by the economic climate, the demand for new aircraft continues. It is clearly an opportunity for the thoughtful executive to position their companies to grow by reducing cost and at the same time continue increase revenues, preparing themselves by targeting and accelerating the development of new innovative products and services better suited to the market requirements and superior performance in the years ahead.

CEOs recognize the need for improvement and change

Amidst all the challenges and changes, CEO's understand the key to fuel growth in the rapidly changing globally integrated enterprise is to find ways to adapt their business models and increase emphasis on product and process innovation, collaboration, and operational excellence. According to the 2008 IBM CEO survey CEO's today are moving aggressively toward global business designs, deeply changing capabilities with focus on innovation and more extensive partnering. The current need is to evolve a new business model to support innovation, help their businesses become agile and responsive to changing market requirements and equip them with the capability to quickly respond to shifts in supply, production and demand.

It is no surprise Leaders look at innovative technological advances as instrumental in achieving their desired business results. Within the context of product innovation we have the strategic capability called Product Lifecycle Management (PLM) which includes the tools, applications, IT systems, manufacturing systems, company business processes and data spanning the full lifecycle of a product from initial idea through to end of the product life in service. Companies are today focusing on deploying innovative PLM strategies and aspire to cost-effectively share data and integrate processes across the global value chain, whilst struggling with the heterogeneity of their systems, applications and lack of open, industry-based standards.

"Today's PLM solutions provide essential support for innovation. PLM has steadily evolved from engineering centric solutions focused on engineering data management to extended enterprise intellectual asset management solutions that support the collaborative creation, management, dissemination and use of project definition information from concept to decommission."

John MacKrell, Senior consultant, CIMdata

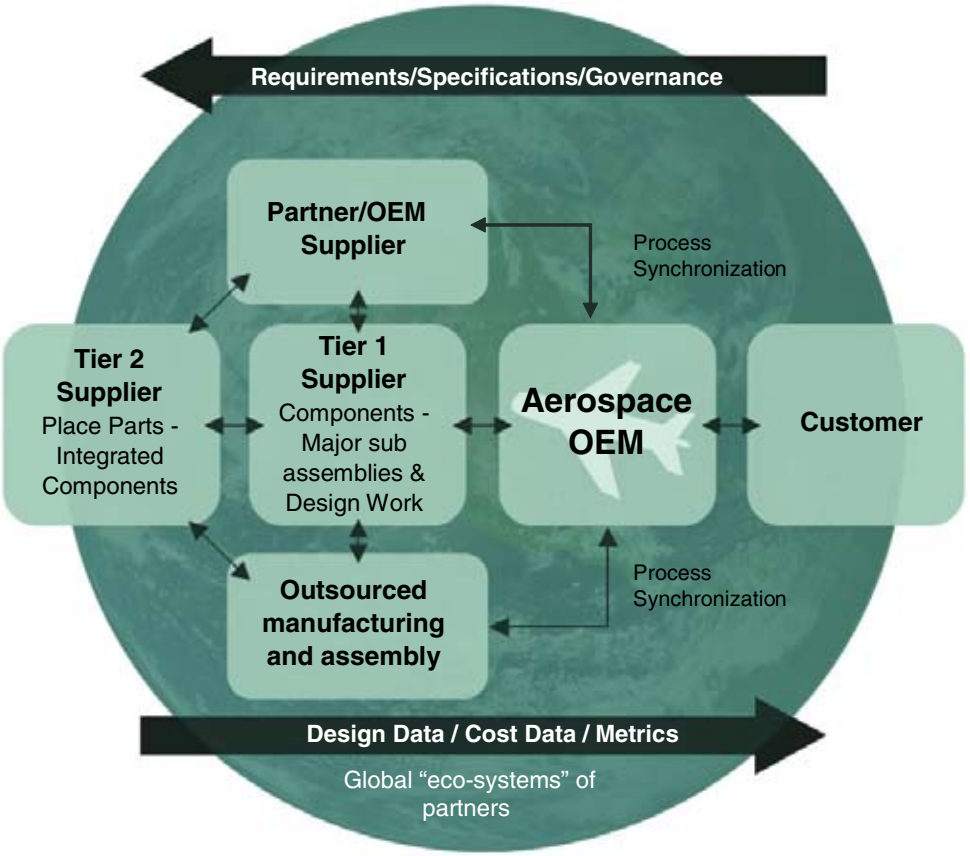
The emergence of a new ecosystem changes PLM

As companies focus on their own core competencies and outsource non-core activities, new relationships and models are emerging on a global basis where partnerships and suppliers assume a much greater percentage of cost and risk in the design and manufacturing capacity previously owned by the Original Equipment Manufacturer (OEM). This differs from a traditional and fairly static 'hierarchical' Design and Supply Chain where the dominant OEM sits at the top of this chain. With the emergence of a more horizontal landscape, we are witnessing the vertically integrated enterprise unbundle into its horizontal components, allowing partnerships to be formed and structured with a degree of flexibility to be adapted quickly and easily from program to program .

OEM as Vertical Manufacturer (1985)

OEM as Horizontal Systems Integrator (Today)

Collaborative Product Design & Development



This results in an “ecosystem” of partners – or value nets – working in unison to create and deliver the final product or service. The participants in the eco-system (e.g., the Consortium, OEM’s, Partners and Suppliers) need to align their product development strategies to their new roles within the industry. This requires the development of capabilities to enable innovation in a distributed product lifecycle in order to sense market dynamics and respond, successfully delivering new, improved products and solutions.

“We cannot grow without innovation. We need to develop globally accepted products.”

CEO Japanese A&D Company, CEO 2008 Study

Exciting opportunities are emerging to minimize risk and maximize return, but each company must evaluate their position within its ecosystem to better respond to market dynamics and to understand the influences on, the roles performed by, and the interactions of the participants. A key issue and now decision point is how members should work best together and in unison.

Working the ecosystem requires a new view to collaboration

We believe an answer to this issue is through significantly improved Global Collaboration.

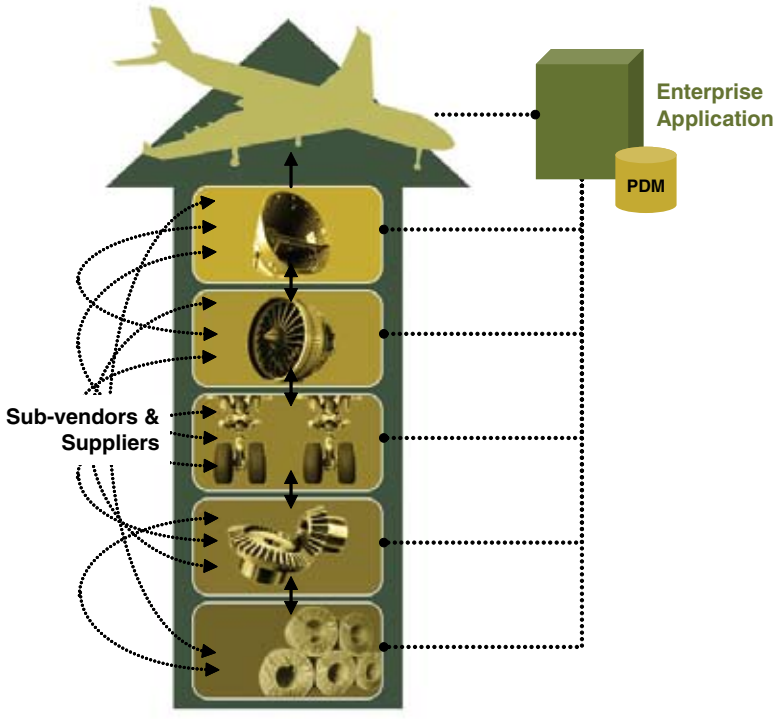
Our vision for collaboration across the global ecosystem is to create "a secure environment where all Partners are able to collaborate and work concurrently on a global basis, using their own preferred tools, methods and processes, in a managed and controlled manner, throughout the Product Lifecycle".

To meet this vision, there are four challenges for effective Collaboration:

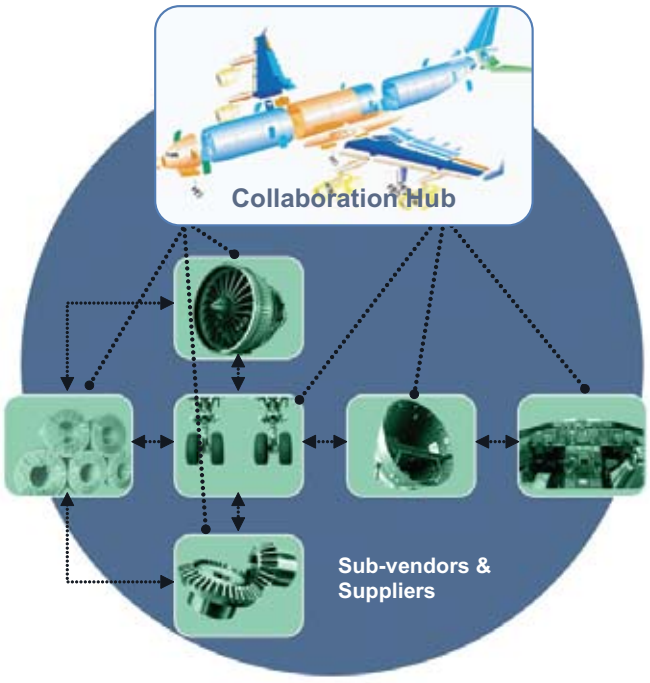
- Identification of the sources of competency, skills and business value.
- Motivation of the partners who need to collaborate.
- Need for a process framework that imposes only applicable and minimum levels of commonality between participants' information and processes.
- Organizational alignment to enable partners to interact effectively and flexibly, while minimizing the impact of change within their organizations.

Two alternate Collaboration Strategies are now emerging which will drive the selection and alignment of the resultant process, organization and technological capabilities. The two alternate collaboration approaches we call the Dominator and Innovator Strategies.

Dominator
Collaboration is managed by a PLM application



Innovator
Collaboration is delegated to a hub



Characteristics of the Dominator:

The role of members is to perform tasks and activities as directed or instructed.

- Similar to an invasive species with no natural predators, dominators attempt to drive off competitors by controlling the entire ecosystem. These powerful organizations integrate vertically and horizontally to own value creation capabilities and push proprietary systems.
- They expect other companies to adhere to their processes and requirements, locking out organizations that refuse to comply or attempt to establish proprietary rivals.
- Collaboration is fully achieved by a PLM application, typically the primary PDM system, with a focus on creating and managing data.

Characteristics of the Innovator:

- Innovators understand the role and competencies of all members within the ecosystem including the contributions of niche players.
- Focus is not on controlling the eco-system but on attracting other complementary organizations and striving to sustain value creation while capturing and balancing value extraction and sharing.
- Using an Hub, the Innovator connects partner organizations via open and common standards, enabling collaboration within the ecosystem by establishing platforms and services the innovators are quickly and easily able to tap into.
- A key driver is to continually improve the overall health of the ecosystem from program to program, maturing and improving knowledge and best practices within the ecosystem and its participants – 'self learning'.
- Focus on use of data an information as the source of knowledge for business decision making and control.

A strategic tilt towards Innovator is the right approach

In the age of continuous flux, there is a growing realization developing a shared ability to innovate will be a competitive advantage where value may be derived from any partner. Hence the strategic tilt is towards an Innovator model to promote the concept of value net participation. In the next Chapter, we explore the practical strategies that must be foreseen by an organisation to make the value chain adaptable and provide a clear view on the implications on technology and applicable systems.

II. Enabling an Innovator Model with an Hub: Connecting business goals with IT

New technologies have emerged to enable enterprises to connect and collaborate in far more flexible ways, allowing companies to vary the level of integration depending on the needs of the process and the organizational scope to be addressed. The resulting set of systems and connectors to enable internal and external collaboration are called a "Hub." Because of the wider organizational impact and scope of inter-enterprise collaboration, the extent, degree and type of functionality required from an Hub will vary based on the kind of collaboration strategy a company adopts, with "innovators" requiring the most flexibility.

Companies will spend some $80 billion by 2008 on solutions to align their business strategies with product development where maximum emphasis of A&D CEOs would be on Product/Service innovation.

The Hub enables participants to:

- Share and coordinate information using the same definitions and formats.
- Transfer and access information seamlessly, in real-time, and with fewer errors.
- Reduce manual rework and entry of data and work products.
- Boost efficiency and effectiveness of communications and collaboration.
- Work together in a more integrated fashion, allowing for more exploration, more productive iterations and more time focused on product development, not managing data exchange.
- Continue working with their own, preferred applications, processes and competencies without adhering to a mandated position.

In the past, building a collaborative Hub has typically been too difficult or too expensive to achieve. Current industrial enterprises are being challenged by the heterogeneity of the environments made of disparate, disconnected applications, IT infrastructure, processes, teams, information sources, and standards. While there is a need for integration of processes, information and people, until recently, integration tools and methods did not permit coordinating these different approaches. Connecting the various business systems that often sit in functional silos has been difficult and are potentially fraught with the following challenges:

- Applications deployed without rigorous examination of the business need, processes, standards and commonality.
- Lack of consistent architectural strategy, integration and execution throughout value chain; across departments, functions, divisions, partners and suppliers.

- Point-to-point interfaces created on an ad hoc basis to solve short-term, tactical problems.
- IT applications functionality deployed inconsistently in response to mergers and acquisitions.
- Incomplete or incompatible information available.

The outcome is an IT environment which is difficult to maintain and expensive to change with hard-coded, rigid connections that work well as long as the business process is fixed and doesn't change. However, as we have seen, CEOs expect change and want an affordable, agile and integrated infrastructure, easy to adapt and change. Hence, the strategic ability of a company to be competitive in the marketplace is affected by how a company implements its PLM and related enterprise systems and supporting architecture.

Over the last decade, Enterprise systems such as Product Data Management (PDM) or Enterprise Resource Planning (ERP) have served as the primary technology to facilitate 'product' related collaboration within the enterprise. This technology creates a tight coupling of processes and data, mostly in real time. This is valuable, but practical only within a limited organizational scope typically at the departmental, functional or product group level. Historically, PDM systems have been architected in a centric fashion with all of their distinct functions tightly integrated, while the collaborative model requires an end-to-end connectivity, federated across many internal and external organizations. Today, the requirement is for a new technical architecture to enable a flexible, "loosely" coupled collaborative model.

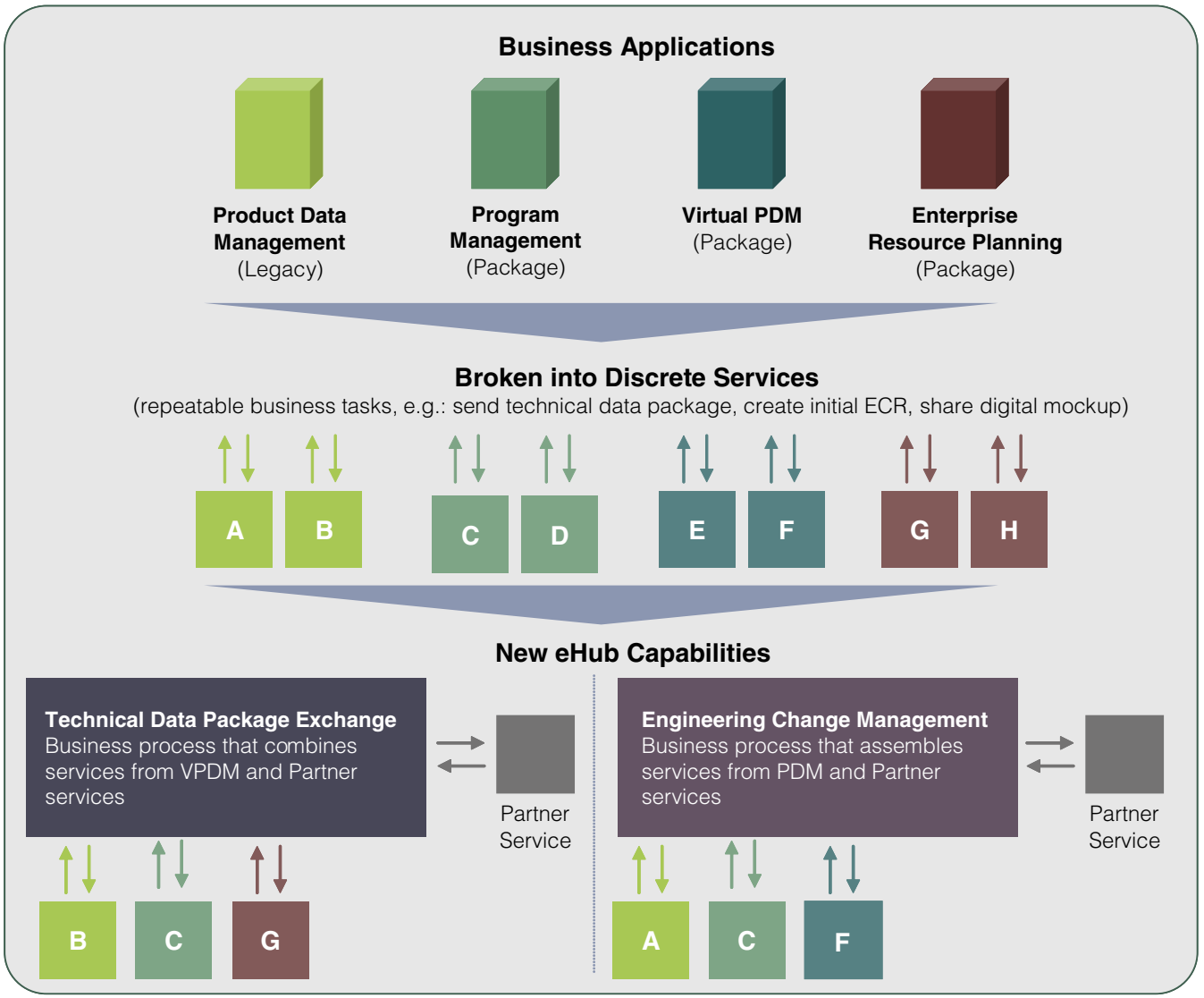
Such an enabler has emerged and is called an Services Oriented Architecture (SOA). SOA enables the convergence of business and technology and finally makes practical the ability to collaborate extensively across enterprise boundaries and to support the Innovator model. It enables enterprises to be able to meet these new, emerging requirements and to be able to extend and expand the value from the tools combined with the agility and flexibility derived from today's PLM processes.

A basic understanding of SOA can be achieved by examining the name itself:

What is a Service? A repeatable business task with the inherent flexibility to be snapped together like building blocks to form a larger business process.

What is Service Orientation? Service Orientation is a business philosophy of integrating a business as linked services where services are grouped together to relate to a functional context in a business process.

What is Service Oriented Architecture? An IT architectural style to support integration of business as linked services; supporting the Service Orientation thought process and making it a reality. It holds the promise of transforming business today by changing the way in which applications are built and managed, offering significantly greater flexibility, more rapid response to changing business processes and requirements. In addition, SOA doesn't require the rip-and-replace of existing systems, allowing past investments to be foundation for the future.



Delivering Value in PLM through SOA

The SOA approach to PLM allows business functions and processes to be broken down into small parts known as services (such as 'send data package, raise and engineering change request etc) which may be reassembled to support different business models. These services are functions which accomplish a specific task when invoked. They hide implementation details, exposing a well-defined interface and are scalable using open standards mechanisms.

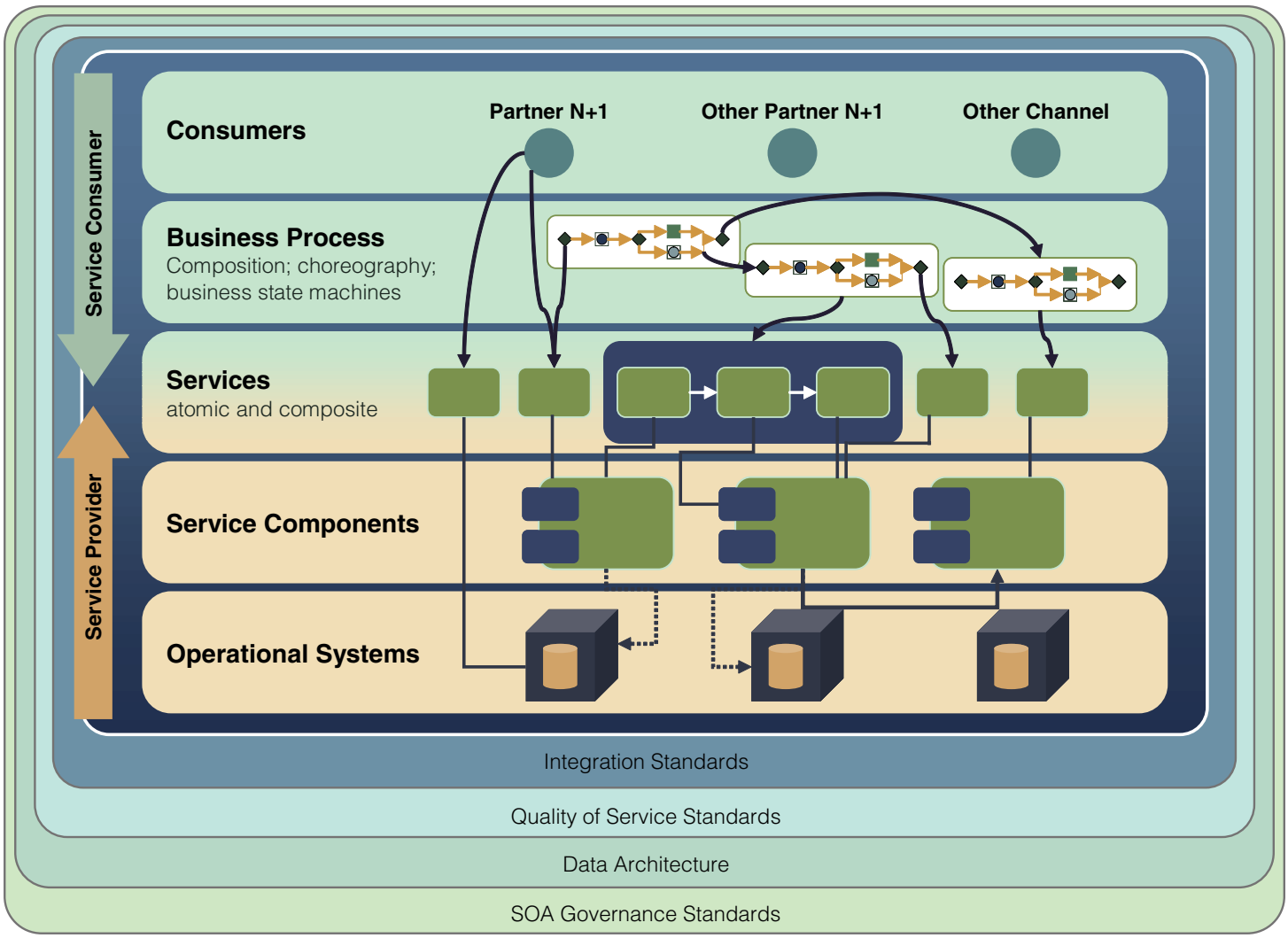
A flexible business model achieved through combining PLM with SOA also delivers the flexibility vital to enable innovation and achieve desired outcomes. By integrating PLM with the rest of the enterprise, SOA integrates the product development processes with other business operations by providing a framework for heterogeneous systems and processes to operate in a homogenous manner.

SOA strategies are achieved by first identifying the key business processes and decomposing these into elements or components called services, targeted to achieve business goals. These are decomposed to a level of granularity against which IT is used to deliver these services using related IT components and applications. This service-oriented approach simplifies communications among IT systems to the point where it doesn't really matter what application or whether a particular "service" resides on your own computers or those of your external partners.

There are two forces behind SOA that differentiate it from previous architectural approaches:

- Maturing technology standards (web services) are the game changing aspect permitting a new level of interaction and providing common standards.
- A paradigm shift in designing software as linked services changes the way software is designed and developed.

To have a better understanding of SOA, it is essential to understand the various layers encountered within an SOA. The following architectural diagram shows an abstraction of how to construct an SOA as a set of logical layers. Note this representation is not designed to imply a strictly layered architectural style in which one layer solely depends upon the layer below it. Rather, an SOA is a partially layered architecture in which a company has a set of layers which are more service consumer oriented (consumer layer, business process layer, and service layer) and a set of layers to support its service provider role, the service layer, service component layer, and operational systems layer. Cutting across both the consumer layers and the provider layers is a set of non-functional layers: integration, quality of service, data architecture, and governance layers.



Open Standards for the Hub

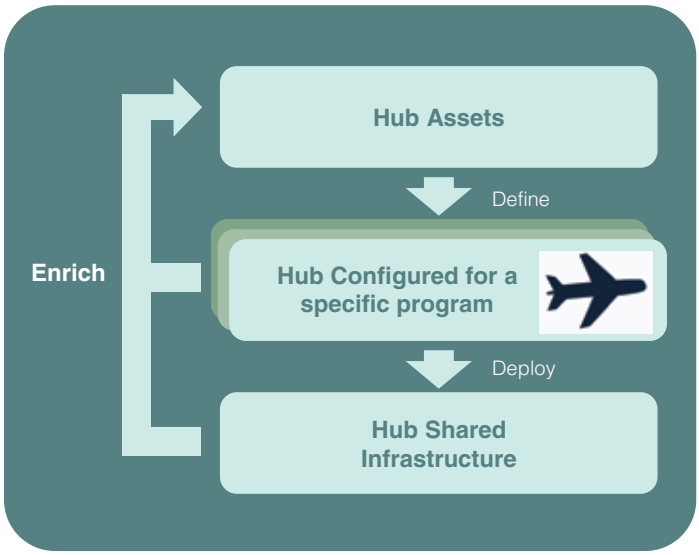
For an end-to-end integration framework, open standards for product data and product meta-data play a key role. Standards for detailed geometry-related product data are required for consistent interpretation of product geometry specification, verification, and for interoperability across engineering systems such as Computer-aided Design (CAD), Computer-aided Manufacturing (CAM), Computer Aided Engineering, CAx, etc. The table below shows examples of applicable Hub standards for different SOA layers.

SOA Layer	Applicable Standards for an Hub
Operational Systems	PLM Architecture Harmonization-Product data management, Program management
Service Components	Component Architecture standards – SCA, SDO, J2EE
Services	OMG PLM Services
Business Process	Process standards defined by industry standards – APQC Process Classification Framework

The convergence of open standards for product meta-data and SOA creates an integration framework to enable sharing information at the correct level of granularity required by the specific process and task. Noteworthy standards developed for PLM using SOA include: PLM Services 2.0 [31] which covers a superset of the STEP PDM Schema entities and exposes them as web services, OASIS PLCS PLM Web Services and ISA-95/OAGIS SOA in Manufacturing.

Improving the Hub from program to program

In an extensively networked collaborative environment, the role of the Hub is not just limited to providing an infrastructure for enabling collaboration in the ecosystem. It consists of components which may be consistently improved from program to program.



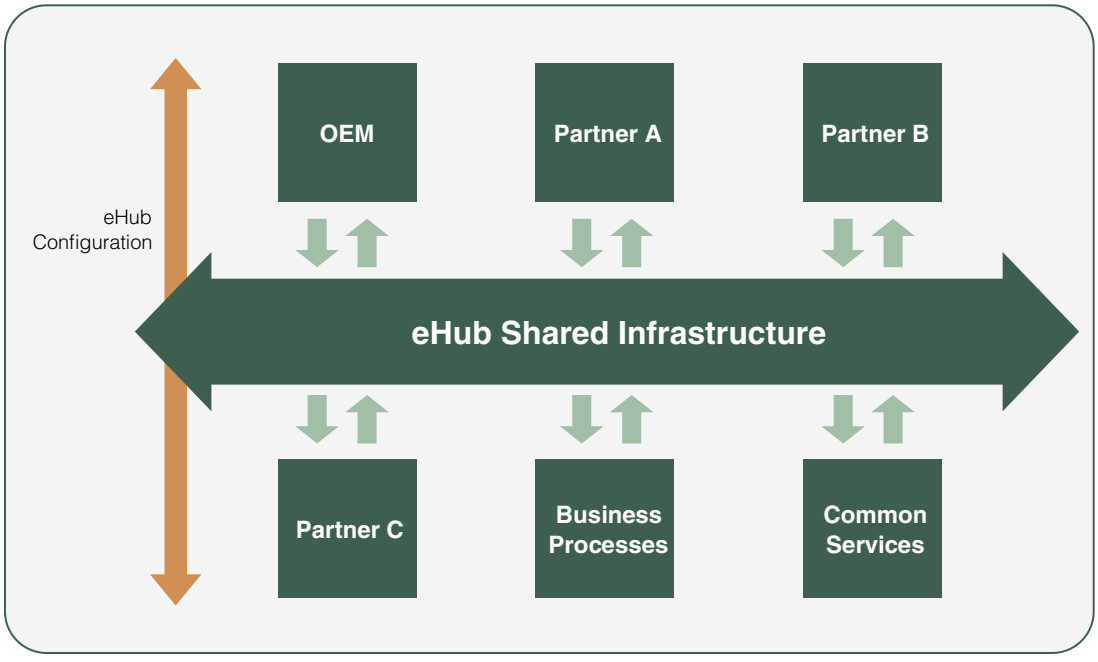
A Hub first consists of a collection of re-usable assets. These assets are used to define a new Hub configuration for a specific program. Using the assets, once the Hub configuration is completed, the Hub configuration is deployed on the Hub shared infrastructure. At any time in this lifecycle, Hub implementers and users are able to enrich the Hub Assets store. As a consequence, from program to program, the overall efficiency of the Hub improves, leading to an efficient collaborative ecosystem.

Hub assets: Hub assets are ready-to-use elements complying to industry standards used for defining a new program-specific Hub configuration. The various assets used for the Hub could be Business Process Classification Framework (BPCF), Business Process Templates (BPT) Business Services Templates or Shared Information Model. These are fundamental assets describing the standard data representation of the various messages exchanged and common functional services maintained by Hub, assets, packaged as reusable code and connectors allowing a PLM application to connect to the Hub

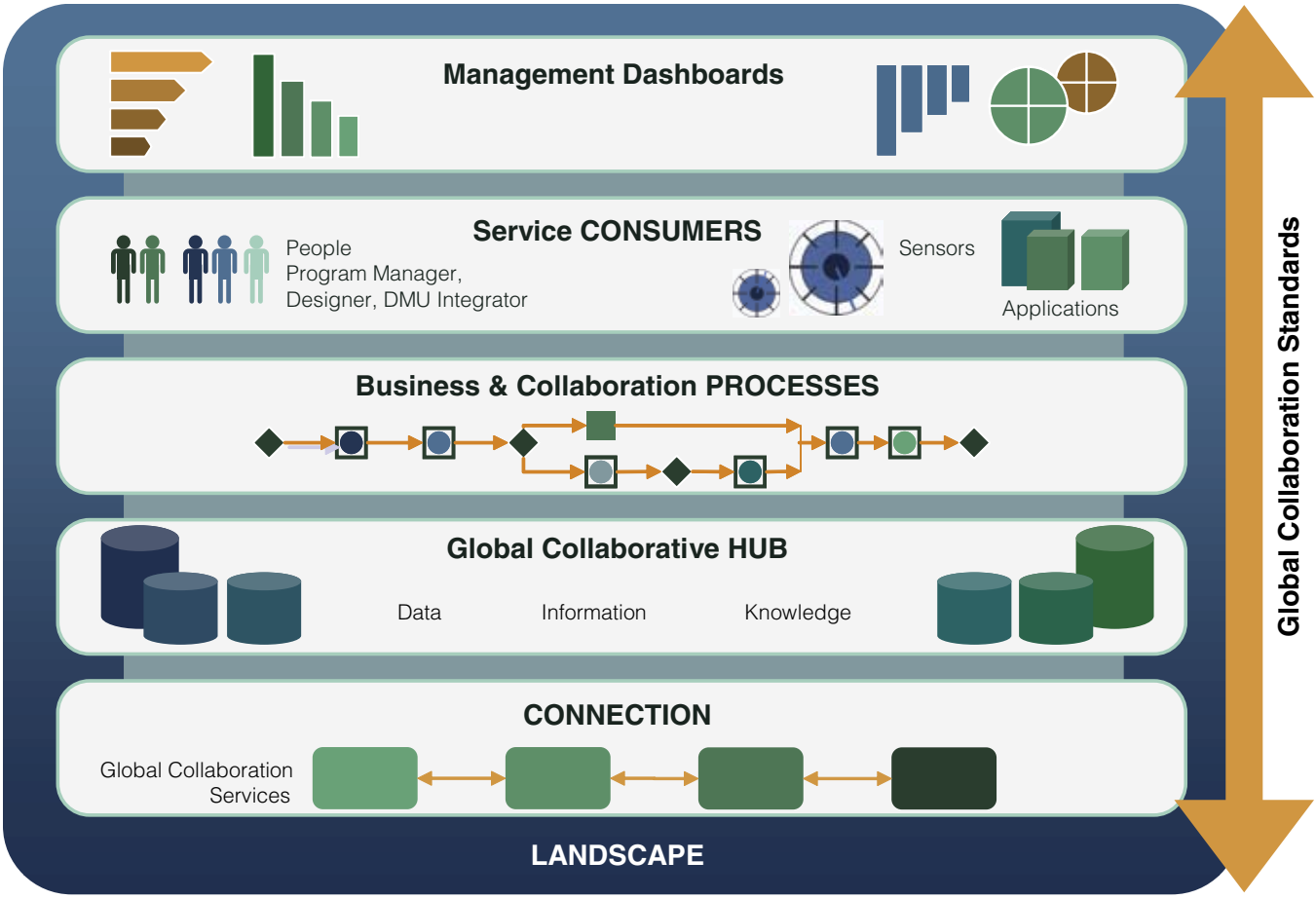
Hub configuration: Each Hub configuration is specific to a given program with the partners setting the business process definitions and re-usable services. If Hub assets are well managed, most of the configuration effort will consist re-using existing Hub assets. Only elements specific to a given program will have to be developed or re-configured.

Hub shared infrastructure: An Hub configuration is deployed on a shared infrastructure used by the Hub participants. The shared infrastructure consists of the layers described earlier (e.g., consumer layer, business process layer, service layer) except layer "operational systems". The illustration below shows how participants may all interact with the Hub Shared Infrastructure.

Envisioning the Global Collaboration Architecture Blueprint



In bringing together all the components and the approaches used to define and implement a new solution, a consistency in design may be achieved by considering the simplified logical architectural model as shown in the image below:



The components of this blueprint are described below from bottom up:

Landscape: At the bottom most level of the figure and moving upwards, the entire horizontal ecosystem is illustrated at the landscape layer. This represents the physical and logical structure and boundaries of the eco-system

Connection: We need a connection between the Landscape and the Hub, which is delivered by a Global Collaboration Services and Components layer used to link the service components into the existing systems. When the different systems are connected, we are able to expose the services contained within the individual applications using OMG PLM Services to provide defined services for handling the data and allowing workflows to be built for information and data exchange based on Web Services.

Global Collaboration HUB: Above the connection layer we have the Global Collaborative Hub serving to orchestrate the interconnection and exchange of data, information and knowledge between the companies in the eco-system

Example: Consider the example of an existing environment to illustrate the function of connection layer, in which we have two or more PDM systems, several requirements management systems, multiple ERP systems etc, and all linked, working together and collaborating across processes. In order to integrate the different systems, 'Connectors', based on open industry standards, are used to join the existing applications through the horizontal landscape into the Global Collaborative Hub. These connectors are provided by niche, specialist companies for which IBM has a number of partners.

Business and Collaboration processes: From the previous section, we now need to consider how the collaboration processes, which are a lower level of abstraction, are used and support the higher level Business Process. The collaboration process describes a set of interconnected activities and represent the orchestration of the exchange between two or more companies.

Service consumers: The exposed services and resultant collaboration process are consumed by the service consumer channels. These may be accessed by sensors, by applications or by people acting in specific roles, for example as a designer, a DMU integrator or a program manager, etc.

Management Dashboards: In addition to providing the capability to orchestrate the collaboration between the various companies, Management Dashboards are a means to track data and information about what is happening across the ecosystem and thus able to show key performance indicators (KPIs) and related status information. From a management and business intelligence perspective, we are measuring and reporting on how well the collaboration and related processes are working, with reports compiled to serve and aggregate at the full program level and not constrained at the local, departmental or even company level.

Additional advantages of the Hub approach

While collaboration within the ecosystem is the primary reason for this Hub approach, there are other benefits to further differentiate advantages over collaborating through use of a PDM (or ERP) system alone. These advantages include:

Implementation cost and time: PDM implementations are typically phased by an entire, often global, functional process. This makes implementation time-consuming, expensive and risky. In constructing a Hub, implementation is sequenced by work roles, not functions, which reduce and simplify development and maintenance costs.

Organizational impact: the tight coupling of PDM systems requires extensive change to organizations and processes across the enterprise. However, the looser coupling of systems and data a Hub allow, limits change to only what is essential for the collaborative operating model.

Productivity: PDM systems bring increases in productivity for processes that are already implemented. However, a Hub provides total connectivity throughout the product lifecycle, resulting in dramatically increased employee productivity.

Reporting: PDM systems provide excellent reporting and detailed levels of information on those areas included within the PDM footprint. A Hub provides greater reporting opportunities in a number of areas across different dimensions of data such as across disciplines, product lines, geography etc. by aggregating and synthesizing data from all participants.

Problem solving and Business Decision Making: The hub plays a critical role in capturing, structuring and presenting information to support new levels of critical business decision making, often on a real time basis across the entire eco-system.

Security and delivery assurance: The Hub enables additional assurances for data security and successful delivery as it creates processes for security and delivery across participant systems.

The above factors show that although the enterprise PDM is de facto becoming a key integration component, companies looking to be 'innovators' within the collaborative ecosystem should understand and pursue an Hub and SOA approach to their collaboration challenges and solutions across the globally integrated enterprise.

III. Deploying the Hub: IBM approach

In order to successfully implement and deploy a global collaborative hub with IT tools and infrastructure to support and meet the strategic business goals and objectives, IBM has developed methods and an approach based on the following steps:

1. **Strategy and vision:** Analyze the Strategic Business direction and define the role of the company within the overall ecosystem

- **Establish an SOA vision:** Getting started with SOA requires a vision which may be realized by creating and executing a roadmap or plan.
- **Determine the scope of change:** Determining the scope and related business challenges is a key step in gaining an understanding of vision. For example, what are the pain points in current and planned IT systems and understanding what are the objectives for SOA.
- **Component Business Modeling (CBM):** A methodology has been developed called Component Business Modeling (CBM), to analyze and prioritize opportunities for a company within and outside its four walls (i.e., the ecosystem.) It allows organizations to be seen as comprising autonomous, manageable 'components' offering business services to serve business needs. This enables flexibility and provides a focus on the core capabilities needed to run the business and to drive the business strategy.

IBM delivers PLM and SOA through proven industry frameworks

PLM solutions offered by IBM are guided by the SOA Reference Architecture that promotes alignment between the business and IT domains through service oriented principles. It enables collaboration through an orchestration of information and process flows in an Integration Framework built on industry standards. These industry frameworks are pre-defined software patterns and middleware with industry-specific extensions to provide a software platform to solve industry-specific business problems.

Based on the reference model, the IBM SOA community has created a Product Development Integration Framework to federate access to multiple enterprise applications, model business processes spanning the value chain, and provide role-based access to relevant information and applications. This model becomes the logical choice for companies looking to implement SOA as they use industry standards for most of the services they provide and facilitate cross-platform interoperability.

2. Requirements and capabilities: Specify the requirements and capabilities required (by role) and detail the business process to be supported

- **Assess and address capability gaps:** While beginning to develop a full roadmap, it is important to understand what the vision is and where the company is today. With the help of IBM's Service Integration Maturity Model (SIMM), the as-is business maturity and defined targets for the to-be maturity level can be determined and assessed.
- **Business Process Management (BPM):** is a discipline, combining software capabilities and business expertise to accelerate process improvements and facilitate business innovation. With the adoption of BPM enabled by SOA, organizations are provided with a solid understanding of the efficiency and effectiveness of their business processes.

Best Practice: Process Classification Framework (PCF)

In an emerging industry standard developed by the American Productivity & Quality Center (APQC) organization, a number of key processes and activities specific to the Aerospace and Defense industry have been defined using a process taxonomy called Process Classification Framework (PCF) to serve as a best practice process template.

3. Technology and infrastructure planning: Define the SOA based infrastructure required to support the business objectives. Service Oriented Modeling and Architecture (SOMA) is an analysis, modeling and design method for the design and construction of service-oriented architectures (SOA) to enable target business processes.

4. Implementation: Implement the desired solution and then manage the deployment to ensure the business requirements are being met, adjusting as required.

- **Develop implementation roadmap:** A critical step is to identify the approach an organization will be taking to successfully meet their strategy and the technological roadmap to implement. Asking questions such as; continue with an existing technology model or look for a fundamental change? How can this change can be brought – through a "big bang" approach or through deploying a culture-changing technology discipline in an incremental and iterative fashion to allow for an organizational learning curve? In essence, an SOA roadmap provides an iterative and incremental way to capture your organization's unique plan as you progress.
- **Take an incremental approach:** Fundamental to our approach is the ability to incorporate improvement using an incremental approach. It may begin by automating tasks we typically find today performed manually in an ad-hoc mechanism. From this starting point, activities may be automated to improve visibility and traceability in existing processes. A simple example would be to delegate a manual task of sending a CD-ROM for work-package exchange to an FTP system.
- **Select a pilot project:** While taking an incremental move towards implementing SOA vision, selection of a pilot project is essential. The idea here is not to attempt to solve each and every problem of enterprise through a single huge project but instead begin with a small, manageable pilot project to demonstrate early success.

A smart and disciplined approach enables the organization to learn as it goes, capitalizing on successes, reaping early benefits prior to complete transformation, and correcting failures as the occur. As with all transformations, a timeline for realization should carefully balance the costs, resources, goals and the organization's appetite for change.

IV. Competitive advantage in action: A case study

To stay ahead of the competition, Bombardier Aerospace, a global transportation company, adopted a new PLM approach to speed time-to-market. Bombardier needed to cut two years from its design-to-manufacture cycle without disrupting its core business focus. A managed-services model, outsourcing all aspects of its PLM systems was the answer to Bombardier's problem. This model enabled Bombardier to ramp up for new aircraft programs faster and extract the maximum benefits from the newest PLM capabilities. Bombardier achieved a 40% efficiency increase of complex machining processes with an estimated $30 million reduction in PLM costs over 5 years, improving its ability to meet increasingly demanding customer delivery schedules.

"Bringing new planes to market faster is a key challenge facing all aerospace companies. By taking an out-of-the box approach to PLM, we're able to meet even the most demanding delivery schedules."

Jocelyn Gauthier,
IT Director, Engineering & Supply Chain, Bombardier Aerospace

Like many militaries, the Finnish Defense Forces (FDF) faced the challenge of managing and adapting to increasingly dynamic and complex situations with limited resources. The FDF realized the importance of a closer coordination; however entrenched silos in its command, control, communications and computing (C4) systems were becoming its major barrier. The FDF teamed with IBM to create an SOA-based service hub that enabled all branches to share common C4 applications and – by enabling the dynamic reuse of services – allowed the FDF to get new applications out to the field in a fraction of the time. Finally, 80 percent reduction in time required to develop new C4 systems via SOA service reuse was achieved with a projected 75 percent reduction in required infrastructure through consolidation and virtualization.

Complexity in the systems is such that a small change in the cycle makes a lot of difference for top-line growth and bottom-line profits. IBM internally went through PLM-based restructuring which not only increased IBM's overall efficiency and productivity but also helped it learn valuable lessons on culture change, consistency and adoption of open standards to ease the pain of data migration. Today, IBM is down to approx. 3 percent in terms of abandoned development expense. What's amazing is that in 1992-93 it took 73 months for IBM to get products out but now IBM is down at about the 18-month timeframe.

"In an environment where innovation is all about collaboration, where ideas can move around the world with a click of the mouse, and where other nations are gaining on us, can we be a new kind of global leader? One focused not on defensive dominance, but on agility, change and collaboration?"

Sam Palmisano, IBM CEO, at the Rensselaer Polytechnic Institute's National Innovation Initiative (NII) Regional Summit, 09/2004

"The solution we are developing with IBM will give us the flexibility and resource efficiency our military needs to adapt to a more dynamic and uncertain world."

Mika Hyytiainen,
CIS Chief Architect, Finnish Defense Forces

V. Beginning your journey towards innovative collaboration in PLM

After establishing and understanding the needs and benefits of an Innovator strategy, organizations should look internally to identify the next steps in their evolution. This look inward should include assessing strengths and weaknesses, establishing clear direction, choosing a route forward, and looking for the best ways to implement. To get started, it is important for an organization to examine some of the following questions to provide focus and direction:

- What is our position and role within its ecosystem and how do we understand interactions and amount of influence we hold among the participants?
- Should we pursue a Hub strategy and approach ? How should we direct and lead this charge within the ecosystem?
- Are we ready to understand and adopt SOA approaches within our technology environments? Where do we begin and what are the first steps?
- How do we determine which process, organization, and technological capabilities we will need to implement?
- How could the organization's competencies and skills be utilized to support current/planned change in enterprise strategy and what would be the implications on the technology used?

As the aerospace and technology industry changes, new approaches to product lifecycle management become an imperative. Companies today need to consider a move away from the traditional, top-down "dominator" approach which dictates a proprietary development environment and transform into more of an "innovator" model where open collaboration produces more efficiency and effectiveness throughout a smart network or ecosystem.

Achieving this new vision requires new technological approaches to allow ecosystem participants to network together quickly, based on open standards, and flexible IT architectures. At the center of this strategy is the Hub to connect participants, based on Services Oriented Architecture strategies to enable greater flexibility while retaining investments in existing systems, providing a foundation for the future.

Companies who pursue this improved vision for collaboration and flexibility should begin by taking a thoughtful inward look at who they are and envision their role in the future. Through careful business and IT planning approaches, they can establish a roadmap to guide successful implementation and ultimately realize the advantages and benefits of optimal product lifecycle management.

For more information

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