Increasing complexity, growing globalization, and the need to reduce costs and shorten product cycles have made product lifecycle management (PLM) a necessity for global manufacturers. With the reach and impact of PLM now extending to all facets of an organization’s product operations and processes, the implications are clear: choosing a PLM solution is a matter of selecting both the right solution and the right partner.

Evaluating and selecting a Product Lifecycle Management (PLM) solution supplier to become a long-term strategic partner can be a difficult and time-consuming process. Ultimately, asking the right questions can help you better understand both your needs and a solution supplier’s ability to meet them.

PTC has created this response to help you understand how our PLM solution, Windchill, meets the needs for the 10 areas that CIMdata believes are critical to a PLM solution as addressed in their white paper “Ten Questions to Ask PLM Solution Suppliers – What You Need to Know to Make an Informed Decision”.

1. How do you support multi-CAD design and change management across distributed environments?

With PTC’s Windchill®, manufacturers can capture, control and share even complex design information from different ECAD/MCAD packages within a single enterprise environment – and even within a single product structure.

First, for those internal reviewers and contributors throughout the supply chain who lack access to the authoring tools, Windchill provides ProductView, an embedded visualization tool that lets them view any part or object in 2D and 3D CAD geometry. There’s no need for them to have, use, or learn the native CAD tools.

For those users who create CAD models, drawings, and other artifacts in their native CAD tools, Windchill Workgroup Managers extend Windchill’s capabilities into the engineering desktop and allow Windchill to understand CAD data.

Windchill Workgroup Managers help design teams collaborate by storing design information directly within Windchill PDMLink. This ensures that the CAD data is managed in a secure environment and is available throughout the enterprise. Windchill Workgroup Managers are seamlessly integrated into the menu of the standard CAD program’s user interface, so that CAD users can interact effortlessly with the Windchill environment. For example, they can check files in and out directly through their CAD application’s user interface, or pass part attributes from the CAD file and have them populated in Windchill PDMLink. Once the information is stored in Windchill PDMLink, all of Windchill PDMLink’s capabilities are available, including search, product structure, and revision/version control.

In addition to Creo®, PTC offers Workgroup Managers for all of the leading CAD and ECAD tools, including: AutoCAD, Autodesk Inventor, CATIA, Solidworks, UGS NX, Altium, Zuken, Cadence, and Mentor Graphics.
2. How do you support integrated MCAD and ECAD design and configuration management (i.e., how do you support mechatronics)?

As companies build more intelligence into their products, they need to fully leverage all the mechanical, electrical and software data created during the product development process – no matter what the tool or format. PTC addresses this issue by enabling customers to combine the heterogeneous CAD capabilities of Windchill with the proven EDA tools in InterComm as well as pre-defined integrations with a number of software development tools. This means companies can capture, control, and share even complex design information from different ECAD/MCAD/Software packages in a secure, collaborative environment.

With PTC’s Workgroup Manager for ECAD, Windchill users can directly manage electrical information and use that data to create structures and assemblies in an integrated PLM environment. Users can build enterprise-level product information models by creating association links between ECAD objects (boards, assemblies, schematics, and filegroups) and Windchill objects and product structures. Enterprise objects managed by Windchill can also contain additional product information, such as technical specifications, process plans, routing documents, and engineering change orders. The Workgroup Manager for ECAD ensures the security of electrical data and automatically makes this information available to other applications in the Windchill environment.

Windchill offers pre-defined integrations with Integrity SCM as well as a number of Open Source tools to allow customers to expand their use of Windchill to include software with the appropriate hardware configuration. By creating a single system that simultaneously manages both hardware and software deliverables and with support for heterogeneous software development environments, Windchill helps ensure that the correct software builds are linked to a product structure throughout its lifecycle.

Users that manage any of this content can perform a wide range of tasks in environments with multiple concurrent users, including:

- Managing broadly defined engineering data and concepts.
- Performing design automation integration by sharing a common manipulation mechanism with the Windchill system. This allows users to manage, update, and associate enterprise parts.
- Creating and updating product structures in the Windchill solution environment.
- Submitting and approving changes to the product structure.
- Moving configuration-managed design into engineering.
- Sharing product information throughout the enterprise.

3. How can your solution enable the standardization of our business processes as well as the consolidation of our applications?

Standardization of business processes

Windchill enables continuous improvement in product quality and productivity by managing both product data and the processes that control and drive the product lifecycle. This gives organizations the power to respond to changing market conditions, deliver products of the highest quality, more closely meet customer needs, and drive down costs. PTC supports each of the processes detailed in the product lifecycle landscape below (Figure 1) within one integral platform.

Windchill offers a world-class workflow engine that enables repeatable, effective, well-defined and optimized business processes. These processes support users as they work collaboratively, a far more efficient process than the ad hoc processes most organizations use.
Organizations can design any Windchill project or process to conform to a specific standard, and Windchill provides a complete record of every project or process through the change histories of the individual objects, combined with the history of the executed project or process instance. This helps organizations identify and remedy problem areas and bottlenecks. Windchill’s workflow, lifecycle, and project management tools offer a number of options for establishing rules, all of which are flexible, easy to maintain, and do not require editing or compiling rule lists.

Users define workflow or ad hoc processes with Windchill’s built-in graphical Process Editor tool. With it, organizations can: create activities and assign them to certain people or groups of people; automate activities to be executed by the Windchill system; define the flow of control for the activities; and specify how data will flow from one activity to another. To speed things, Windchill provides support workflow templates as a standard product feature. Workflow Process templates are iterated objects, so they can be checked out for performing maintenance then checked back in to activate the new update.

Figure 1 – Product Lifecycle Landscape
Consolidation of Applications

As businesses grow, whether organically or by acquisition, many find that their IT environments have evolved randomly and are fragmented, making it nearly impossible to optimize processes and resulting in brittle environments and high TCO due to multiple vendors and multiple maintenance contracts. Many companies are responding by implementing IT consolidation initiatives built around the product lifecycle. These initiatives are enabling them to consolidate locations of product information, eliminate legacy/redundant systems and tools and optimize product and service processes.

In order to optimize product development processes, manufacturers need a system that offers best-of-breed applications that all work well together. As the backbone of many PTC products, Windchill provides key product lifecycle management capabilities on an architecture that supports the global product development needs of today’s companies.

PTC offers a comprehensive solution that supports the entire product lifecycle and supporting processes, offering customers many opportunities for IT consolidation. In the image below (Figure 2), the blue boxes that ring the outside of the diagram are additional modules within our Windchill product family. The grey boxes represent the ancillary capabilities or systems that can be plugged into Windchill.

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**Figure 2 – Windchill; an integral technology platform**
4. How can your solution grow with our business from a basic PLM implementation to enable more advanced PLM capabilities?

To be effective, technology solutions must be more than a disconnected bundle of features and functions; they must be designed and tested to work together to optimize real business processes, from start to finish. PTC supports the typical landscape of processes relevant to manufacturers, so that technology can be applied to solving real business problems and delivering true business benefits. PTC's process-based framework is ideally suited to a phased deployment strategy, so companies can extract value sooner by addressing the highest priority processes first.

Windchill PDMLink is typically the first component in the PLM deployment for a PTC customer. Windchill PDMLink is easy to install, adjust, and roll out to large communities of users. The software offers many built-in features to drive adoption through ease of use. These include:

- A change process evaluation interface, allowing managers to find and fix short-term process “bottlenecks” and to make process adjustments based on accurate metrics.
- An easy-to-use interface that gives the user access to the tools and information they require for each task, while simplifying many operations, such as searching for an object or creating a new one.
- A Web-based master product data management repository, enabling global access to current, accurate information from myriad sources.
- Managing the evolution of configurations over time using out-of-the-box lifecycle templates that can be modified and reused.

With Windchill PDMLink established as a strong foundation for PLM, companies can then explore other Windchill modules and capabilities to expand the PLM footprint into other departments, disciplines, and even the extended supply chain. This includes integrations with leading MCAD, ECAD, software development and office productivity packages as well as the leading MRP/ERP systems.

5. What best practices do you provide and include in your out-of-the-box solutions that support our specific industry?

PTC solutions include best practices for the Aerospace & Defense, Automotive, Electronics & High Tech, Medical Devices, and Retail, Footwear, Apparel, and Consumer Products industries.

Aerospace & Defense (A&D)

Together, PTC’s suite of products, including Creo, Windchill PDMLink, and Windchill ProjectLink, create an integral System for A&D manufacturers. The optional Windchill Aerospace & Defense Module provides additional capabilities specific to the complex requirements of A&D customers. The capabilities include support for standards such as ANSI/EIA-649, MIL-HDBK-61A, CMII, DOD Form DD 1423-1 and ASME Y14.41-2003.

Automotive

PTC’s offering for the Automotive industry supports best practices in six key areas: Vehicle and System Development Management; Automotive System Design and Mechatronics; Regulatory Compliance and Fuel Efficiency; Manufacturing Process Management; Vehicle Owner’s Manuals and After-Sales Service Documentation; and Design, Supplier and Manufacturing Collaboration. PTC gives all collaborators the ability to work with a ‘single point of truth’ for all product information throughout the development process, including CAD data from Creo, CATIA® and other systems.

Electronics & High Tech

With the PTC offering for Electronics & High Tech, companies have the solutions they need to optimize processes across every facet of the product lifecycle. Most significantly, PTC enables companies to synchronize ECAD, MCAD and software disciplines, thereby reducing costly late-stage design changes, and adhering to ever-changing environmental compliance regulations.

PTC offers best practices support for the Electronics & High Tech industry in six key areas: Electromechanical Product Development; Increased Use of Preferred Components and Designs; Design for Environmental Regulatory Compliance; Global Bill of Materials (BOM) Management; Collaboration with Distributed Design Partners; and Publications Efficiency and Quality.
Medical Devices

PTC supports best practices in Medical Device manufacturing by providing companies with a single version of critical compliance data and documents. PTC’s offering also delivers critical content and process management that facilitates compliance with global regulations pertaining to quality systems management and electronic records and signatures. For maximum productivity, many tasks are automated, including creating a Design History File, generating links between requirements and product designs, and capturing audit trails of all electronic activities.

This allows Medical Device manufacturing companies to comply with 21 CFR Part 11, 21 CFR Part 820, ISO 13485 and the European MDD (2007/47/EC) as well as easily manage and gather all product information necessary for audit requests including the Design History Files (DHF) and Device Master Records (DMR).

Retail, Footwear, Apparel, and Consumer Products

PTC created the Windchill-based FlexPLM specifically for the Retail, Footwear, Apparel and Consumer Products industry. In addition to supporting the complex information structures typical of product development in this industry, FlexPLM supports best practices by including specialized modules for seasonal calendar management, line management and planning, color management, and the generation of SKUs from the approved product definition. This web-based solution also includes the collaborative features essential to global operations, such as support for discussion threads and automatic notification of affected users when changes occur. FlexPLM is easy to implement in a secure environment, while at the same time supporting the integration of external vendors, suppliers, and customers within the product development process.

6. How do you support secure interaction and collaboration across our supply chain?

Windchill’s pure Internet architecture makes full use of J2EE, Internet standards, and commercial application server capabilities. All solutions feature a common Web-based user interface with a consistent look and feel. It is high-performing, fault-tolerant, and highly scalable architecture through multi-threading, caching, server load balancing, server clustering, replication, and federation.

Security

Windchill is a fully secure application supporting all Internet security models, ensuring that only authorized users and groups have access to product information.

Windchill delivers industry-standard security at every level of the implementation. Windchill’s security features take full advantage of Internet standards for firewalls, encryption, secure networks, and VPN. It supports all Internet security models by using the existing Web infrastructure for a secure, firewall-friendly deployment. Windchill’s authorization, provided at the application level, ensures that only the appropriate users and groups have access to product information at the appropriate lifecycle stage of a project. Windchill is also fully compatible with LDAP-based directory services, reducing the administrative burden of adding and deleting users.

Any user accessing information within Windchill must first log in with a username and password. Access to data can be controlled by user, role, lifecycle state, and data location. Attributes can also be added to highly sensitive data to warn users to take extra precautions when viewing. These features are in addition to any that may be included in the network infrastructure, such as multiple firewalls or a VPN.

Windchill provides multi-level, ad hoc access control lists at the object level (folder, document, part). Access Control Lists (ACLs) are based on the user’s group associations. Thus, each user only has access to those specific objects with which he or she is authorized to interact, at the appropriate level of capability (none, read, update, and full).
Collaboration

Windchill ProjectLink provides a project-based collaboration solution for highly iterative design projects. It helps users in an organization, division, or company to work together and with external team members brought in for the project, such as consultants, customers, suppliers, or sub-contractors. Windchill ProjectLink enables users to:

- Bring together project teams in a virtual workspace to take advantage of a specific business opportunity.
- Collaborate on highly iterative designs and documents.
- Define and maintain project schedule and status with visibility to the entire team.
- Schedule and host online meetings.
- Define and execute on standard templates and business processes.
- Work sequentially or in parallel on critical tasks.
- Discuss work in online forums as changes occur.
- Observe the progress of work and take steps to ensure timely project completion.

Project plans can be made and progress can be tracked, either within Windchill ProjectLink itself or through pre-defined integration with Microsoft Project.

7. Are all your PLM applications on the same architecture, data model, and standards (and which are they)?

Yes, all Windchill products share common business objects and process models along with a single login. PTC believes that architecture directly affects how easy a system is to deploy, scale, integrate, and maintain over time. System architecture has a significant effect on deployment risk, costs, and total cost-of-ownership (TCO). Since its initial design in 1997, Windchill has provided a multiple-tier, J2EE-based, fully-Internet architecture. It exemplifies the three distinguishing attributes of a successful PLM architecture:

- A common set of services for PLM. These services include CAD data management, change management, configuration management, lifecycles, workflows, common look and feel, and an integral 2D/3D visualization capability.
- It is purely internet architecture with full system functionality available through a standard browser and accessible anywhere. It is designed to make full use of mature internet standards, is J2EE compliant, and can be made secure anywhere on the web through the use of industry-standard commercial web security products.
- Integrates with standard desktop applications, and enterprise systems using industry standards to provide data and process federation and an open API for other applications to use.

8. What tools are available and/or needed to configure and extend your solutions’ data model, user interface, functionality, workflow, etc.?

Most customers are able to use out-of-the-box Windchill for customer-specific enhancements such as adding business-specific attributes to existing objects; creating new, business-specific objects based on existing objects; and creating business-specific reports. These actions do not require programming, and are simply customer-specific configurations of the standard product. Windchill users can also create workflow process and lifecycle gates specific to their business from provided templates.

9. How can the proposed PLM solution be integrated with your current business systems and processes?

Windchill includes integration modules to connect with other enterprise and legacy systems. The Windchill interoperability architecture offers two sets of capabilities for system integration:

- For commonly-implemented enterprise systems, such as SAP or Oracle Manufacturing, PTC offers Windchill Enterprise System Integration (ESI) for standards-based, pre-packaged enterprise system integration. Windchill ESI provides pre-built, configurable business logic that defines how the enterprise integration operates, including what and how information is shared between systems.
For other types of integration, Windchill Info*Engine provides powerful tools for acquiring or transmitting data with external systems. It intercepts presentation-tier requests for data and brokers the request to the appropriate system, whether Windchill itself or another enterprise system. Windchill Info*Engine capabilities are used to normalize, filter, and transform the returned data so that the presentation logic is independent of the source of the data. Finally, Info*Engine can be used to update the source system(s) from the Windchill page, applying the security protocols of each source system to the update process.

Together, these capabilities enable PTC to provide both standardized integrations that are easy to implement and maintain, and the tools necessary to develop customer-specific integrations to legacy and internally-developed systems.

10. How does your architecture scale with an increase in the quantity of data, users, locations, and functionality, and what are the sizes and typical configurations of your largest implementations?

Windchill can be deployed locally for a single engineering workgroup or on a global scale to support international business, design, manufacturing and contracting. Because the user interface is web-based and accessed via a standard web browser, users can access Windchill from anywhere, at anytime, by opening a URL and supplying a valid username and password. Windchill is fully internationalized, supporting all possible types of character sets, including Asian multi-byte characters. The application user interfaces are available in ten languages.

The Windchill architecture supports true global scalability with capabilities such as:

- **Pure Internet** – Because Windchill is 100% Web-based it easily deploys into existing IT infrastructures for the Internet.

- **Federation** – Windchill servers and/or other data sources can be federated, eliminating the need to duplicate data.

- **File vaulting** – Large content files can be stored in local file vaults while object meta data is stored in the central database which improves performance both locally and globally.

- **Replication** – Windchill also provides replication capabilities, either by maintaining a single central server and replicating vaulted content files, or by replicating databases among multiple servers.

Windchill is capable of supporting a truly global enterprise deployment. Independent tests by HP and SUN have proven Windchill’s ability to support 10,000 concurrent active users. With every customer having their own IT infrastructures, organization structures, and ways of working, Windchill’s powerful and flexible architecture allows them to select the scalability capabilities that best suit their needs.