PLM Components
Support tools for CAD, CAM, CAE and PLM software development and interoperability
Throughout the global manufacturing industry, companies employ a wide array of information technology solutions designed to increase productivity, reduce costs and promote innovation at all points in the product lifecycle. Manufacturers select from a myriad of product lifecycle management (PLM) applications – in addition to developing software of their own – as they continually seek a new competitive edge that ultimately will translate into increased revenue and higher profits.

Of course, it’s not easy to develop software that keeps pace with this rapidly growing and constantly changing environment. It is no longer sufficient for organizations developing PLM applications to simply solve an isolated problem or set of problems that exist along a product’s value chain. They also must ensure that their solutions seamlessly communicate with multiple applications – developed by a variety of independent organizations – in order to plug into an existing PLM system and operate efficiently across an integrated multi-company process. Independent software vendors (ISVs) in the PLM industry, as well as manufacturers with in-house software development organizations, need access to tools that:
- Promote standardization
- Enable seamless interoperability
- Deliver robust functionality with industry-proven reliability
- Enhance software quality
- Reduce development time and costs

To respond to all of these challenges Siemens PLM Software offers PLM Components, a family of development toolkits, software components and industry initiatives employed in all of Siemens’ own industry-leading PLM applications and openly available to all organizations interested in maximizing the value of PLM. Our solutions solve complex technical problems so successfully that even our competitors license our components.
Introducing
PLM Components

Companies that use PLM software and services to run their businesses increasingly require their suppliers and their own IT departments to provide open solutions that promote seamless interoperability and data sharing. These companies don’t want to worry about incompatible data formats and versioning problems that inhibit their ability to collaborate. They don’t want to deal with PLM suppliers whose proprietary business models prevent the implementation of a multi-vendor solution.

As the world’s leading supplier of open PLM solutions, Siemens has always recognized this need and has built its business and its technology around it. As part of its pervasive PLM Open business model, Siemens builds openness into everything it does from its professional services organization to its global partnerships and alliances to its complete family of world-class PLM software products. That’s why Siemens presents product offerings as open by design solutions.

Consistent with this open business model, Siemens’ PLM Components suite enables any software development organization to access the same technology used in Siemens’ own products on a worldwide basis. As a result, consumers of PLM technology benefit from a rapidly growing universe of suppliers offering compatible solutions that create instant value for their organizations.
Siemens’ PLM Components family includes some of the industry’s most widely used component software and development toolkits, as well as industry initiatives that support and promote these open solutions. The vast majority of the world’s CAD, CAM, CAE and PLM developers – including many of Siemens’ competitors – rely on one or more of Siemens’ PLM Components to provide their applications with proven, robust functionality. This functionality provides customer value, while developers focus on their own unique areas of expertise. Hundreds of applications use PLM Components and these applications enjoy a high level of data and functional compatibility as a result of embedding the same technology.

Marketed and delivered through Siemens PLM Software’s level playing field business model, the PLM Components family consists of the following solutions:

- **Parasolid® software** – the leading production-proven 3D geometric modeling component software provides the geometry foundation for more of the world’s major CAD, CAM and CAE applications than any other solution. Complementary products include Parasolid Bodyshop, robust healing technology for imported data, and Parasolid Translators for most major CAD formats.

- **D-Cubed™ software** – a suite of advanced tools for sketching, part and assembly modeling, motion simulation, collision detection, clearance measurement and hidden-line visualization. D-Cubed components provide vital functionality to most of the world’s leading CAD systems and many other applications.
• **JT Open Program** – a global community organized by Siemens at the request of its customers that establishes the widely-used JT™ data format as the common standard for sharing product and manufacturing information in the PLM industry. JT Open members include many of the world’s leading manufacturers and PLM suppliers, along with prestigious universities and academic institutions.

• **PLM Vis software** – enables the rapid addition of 2D and 3D visualization and collaboration functionality to custom applications and plugins. It is available as both ActiveX controls or Java beans and is 100 percent compatible with Teamcenter® visualization software.

• **NX™ Nastran® SDK software** – a software development toolkit that enables commercial and private software development organizations to enhance their software development and PLM applications by tapping into the power and capabilities of NX Nastran and the worldwide Nastran install base.

• **PLM XML** – Siemens’s implementation of the widely used XML schema for facilitating interoperability among PLM software applications. PLM XML has an open, published protocol that promotes high-content product lifecycle data sharing.

• **Geolus® Search software** – is a shape-based search engine. It finds similar as well as identical shapes and it complements traditional search methods. It is architected as a web component and includes a SOAP interface that has enabled integration with products such as NX, Teamcenter and BCT’s A Class.
Whether you work for a commercial ISV or an in-house IT development organization, you are always looking for ways to improve efficiency and maximize the value of the applications you produce. Employing PLM Components helps you meet these objectives by instantly benefiting from hundreds of man years of development experience, and enabling you to create solutions based on well established, open technology. PLM Components help eliminate the data and operational incompatibilities that can act as artificial barriers to your target market.

Increase customer value by focusing resources on your unique expertise
An efficient, cost effective way for your organization to add customer value to your software applications is to focus your resources on the specific areas of expertise that separate you and your products from your competitors – not by spending valuable development time reproducing code that is already well established.

Many of the component software tools in the PLM Components family have been serving a vital role in end-user applications for years. They provide stable, robust, industry-tested functionality that works quietly behind the scenes so that you can concentrate on the high value innovations that will help your software solutions stand out in your market.

Improve quality with proven technology
Software quality is critical in your efforts to keep maintenance costs low and customer satisfaction high. By using one or more of the solutions from the PLM Components family, you are able to leverage the rigorous quality testing for which Siemens is known. You also will experience the peace of mind that comes from knowing you are using the exact same code that is operating in hundreds of other leading commercial applications all over the world.

Streamline implementation by eliminating incompatibilities
In addition to ensuring robust functionality and high quality, PLM Components are focused on delivering open solutions that promote standardization and interoperability. Incorporating PLM Components into your applications can help eliminate incompatibilities with your customers’ IT environment, thereby streamlining their implementation processes. Offering open software that is easy to implement and compatible with the rest of the industry drives customer demand higher.

Accelerate development and reduce your time-to-market
Substantial coding and quality assurance resources have been deployed in the development of each PLM component. Our customers are able to reap the considerable benefits of these substantial investments within a typical release cycle. PLM Components will also enable your organization to bring rich functionality to market in the shortest possible time.

Maximize size of potential market through open solutions
While PLM Components help promote standardization and interoperability within your target markets, they also can help make your solutions appealing to new and/or expanded markets. The same instant compatibility that makes implementation easier with your traditional customers also creates compatibility – and opportunity – in rising new markets. PLM Components are utilized in hundreds of leading PLM applications which are accessed by millions of users worldwide. This large and rapidly growing cross-industry user base holds unlimited potential for your high value applications.
Parasolid

“We have been more than happy with our choice of Parasolid. Since we started using it in the early 1990s, Parasolid has continued to open up new markets and potential new users for our products.”

Don Babbs
CEO
Vero International Software

Parasolid is the world’s leading production-proven 3D geometric modeling component software, providing core functionality that enables users of Parasolid-based products to rapidly and robustly model the industry’s most complex products. Based on high precision boundary-representation technology, Parasolid supports solid modeling, generalized cellular modeling and freeform surface/sheet modeling within an integrated framework.

Parasolid comprehensive capabilities extend to over 800 functions that include a wealth of model creation and editing utilities such as powerful Boolean modeling operators, feature modeling support, advanced surfacing, thickening and hollowing, blending and filleting and sheet modeling. In addition, Parasolid offers extensive tools for direct model editing, including tapering, offsetting, geometry replacement and detail removal with automated regeneration of surrounding data. Parasolid also provides wide-ranging graphical and rendering support, including precise hidden-line, wireframe and drafting, as well as versatile tessellation functionality and a full suite of model data inquiries. Parasolid functionality is underpinned by configurable mechanisms that help integrate Parasolid tightly and efficiently into diverse applications.

Parasolid provides the modeling foundation for hundreds of the world’s leading computer-aided design, manufacturing and engineering analysis (CAD/CAM/CAE) applications and serves as the corporate standard for Siemens’ own market-leading portfolio of product lifecycle applications, providing 3D digital representation capabilities for the company’s NX, Solid Edge®, Femap™ and Teamcenter software solutions. Industrially proven in high-end mechanical CAD applications, the power of Parasolid is also deployed in many leading mid-range systems and enjoys widespread use in the independent CAD, CAM, CAE and visualization markets.
The global reach of Parasolid-enabled applications spans multiple industries and has grown beyond three and a half million end users – all of whom benefit from the ability to seamlessly share geometric models through Parasolid native XT file format. Parasolid users also benefit from intrinsic, tolerant geometry processing that enables Parasolid to operate successfully with imported data of variable accuracy without loss of robustness.

To further boost interoperability for Parasolid-based systems, Siemens provides complementary tools that augment Parasolid intrinsic capabilities:

Parasolid Bodyshop is an add-on component that validates and optimizes the integrity and reliability of imported data using model healing and repair technology.

Parasolid Translators are toolkits that facilitate high-quality data exchange between Parasolid and most major CAD formats.

These technologies combine effortlessly to provide Parasolid users with the most robust interoperability platform available today.

By coupling unsurpassed 3D modeling functionality with industrial-strength interoperability and proven customer support, Parasolid continues to rapidly expand its market share and enhance its position as the kernel-of-choice for powering the world’s premier product development applications.
D-Cubed provides a family of geometric software components enable key functionality in CAD, CAM, CAE and PLM applications, including sketching, part and assembly modeling, motion simulation, collision detection, clearance measurement and hidden-line visualization. Easy to integrate and compatible with a wide range of modeling systems, D-Cubed components do not require modification of an application’s data structure, making them appropriate for new and mature applications. Most of the world’s leading CAD applications include one or more D-Cubed components.

**D-Cubed product portfolio**

**2D Dimensional Constraint Manager – D-Cubed 2D DCM**

The 2D DCM provides dimension-driven, constraint-based design functionality both in 2D applications and in the 2D variational sketches of 3D parametric modeling systems. Sketches are constructed using a wide range of dimensions and constraints to specify the location of the geometries. The design can then be rapidly modified, by dragging geometry, for example, or by entering new dimension values.

**Profile Geometry Manager – D-Cubed PGM**

The PGM is used to manage higher-level sketching operations on loops of geometry in any CAD/CAM application. The PGM improves the productivity of the end-user of sketching systems, particularly in the areas of profile offsetting and loop constraint operations.

**Hidden Line Manager – D-Cubed HLM**

The HLM rapidly computes accurate hidden-line views, engineering drawings and technical illustrations of parts and assemblies. Compatible with virtually every geometric modeler, the HLM operates in multi-CAD environments and supports combinations of exact, faceted, solid, surface, wireframe, manifold and nonmanifold parts.

“Adige Sala selected Siemens based on its ability to supply and support a broad portfolio of high quality components under its open business model, enabling us to develop a comprehensive new application rapidly for the benefit of our Lasertube customers.”

Lucia Lubich

Laser Applied Research Manager

Adige Sala S.p.A.
**3D Dimensional Constraint Manager – D-Cubed 3D DCM**

The 3D DCM enables the efficient use of dimensions and constraints to position parts in assemblies and mechanisms, control the shape of parts and to produce 3D sketches. A fully three-dimensional system, its support for a comprehensive range of geometry, dimensions and constraints enables designers to efficiently build, modify and animate the most demanding of assemblies and mechanisms. As a highly flexible 3D constraint solver, the 3D DCM is also used to directly specify the shape of 3D parts and is the engine behind several of the most advanced 3D sketching environments.

**Collision Detection Manager – D-Cubed CDM**

The CDM detects collisions and measures clearances on assemblies and mechanisms with exceptional accuracy and speed. Compatible with any surface or solid modeler, the CDM operates on exact or faceted models. Its excellent performance supports interactive operations during the simulation of the motion of assemblies and mechanisms.

**Assembly Engineering Manager – AEM**

The AEM brings the realistic and interactive motion simulation of assemblies and mechanisms to the core of a CAD system. The AEM takes account of the mass properties of parts and the forces that act on them, the motion caused by a range of engineering devices and the interaction of parts as they come into contact and transmit motion. Requiring no special preparation by the end-user, the AEM saves time and money by verifying the function of virtual assemblies and mechanisms, reducing the requirement for physical prototyping.
JT Open Program

**JT**
JT is the world’s most widely used 3D language for sharing product information. JT communication versatility ranges from 100 percent precision 3D product geometry, to lightweight/high-performance product visualization. This full spectrum capability of JT technology makes it possible to view and share product data, manufacturing information and interactive 3D images worldwide, in real time and throughout all phases of the product lifecycle. Thanks to its unmatched flexibility, robust functionality and proven reliability, JT is supported by more PLM applications than any other lightweight 3D data format. When combined with JT2Go, consistent 3D product information is efficiently communicated up and down the supply chain.

**JT2Go**
The JT2Go solution is a set of no-cost 3D viewing products that enable companies to globally share detailed 3D product and manufacturing data using the lightweight JT format. Available via Internet download, JT2Go helps streamline collaboration between manufacturers and their supply chains across all industries. JT2Go is a deploy-on-demand solution that enables data sharing across heterogeneous PLM software environments utilizing existing infrastructure. The JT2Go solution includes JT2Go viewing technology and JT plug-ins for Microsoft Office to provide rich collaboration using standard desktop applications. The Microsoft Office plug-ins enable a JT file to be easily embedded and viewed in any Microsoft Office document.

“Internally, we exchange information between the various parts of a design using JT, even if the parts were originally developed in different CAD tools...There’s a lot of information technology infrastructure that we would have had to put into place that is now not required because of JT. This helps us improve cycle times and reduce costs.”

John Jewel
IT Director, Global Climate Product Groups & Engineering IT
Visteon Corporation
The JT2Go viewer enables product development teams and supply chains to review drawings, view and interrogate 3D product information and collaborate in the context of complete bill of materials using PLM XML. These capabilities facilitate key PLM processes, such as engineering design reviews, requests for quotation, package reviews and manufacturing tooling reviews.

JT Open
JT Open is a unique community of PLM software users, independent software vendors (ISVs) and prestigious universities committed to the widespread adoption of a single, open and lightweight 3D data format based on JT technology. At the request of its customers, Siemens organized JT Open to establish a forum that provides all members equal and open access to JT technology. JT Open members work together to enable the development process efficiencies to improve product development collaboration for all companies worldwide.

Membership in JT Open is available to any and all corporate user communities, as well as ISVs, academic institutions and nonprofit industry organizations. JT Open members include Siemens, General Motors, Ford, DaimlerChrysler, Siemens, Mazda, Renault, Visteon, Caterpillar, Autoweb, Adobe, Bentley, PTC, Alias, Theorem, Opticore, Polyplan, Landmark, sd&m AG, Spicer, T-Systems, Realtime Technology and Actify, as well as such academic members as Brigham Young University, Technical University Darmstadt, Shanghai Jiao Tong University and the University of Michigan.

In addition, other participating members include companies that derive indirect value from the initiative, such as HP, Intel, Microsoft, SAP and Elysium, who are all JT Open advocates.
PLM Vis

PLM Vis facilitates the rapid addition of 2D and 3D view-markup capabilities to applications. PLM Vis appeals to both corporate end-users and independent software vendors (ISVs).

PLM Vis enables:
• Viewing, interrogation, and markup of nearly every popular 2D format as well as JT (3D), NX, Solid Edge and Parasolid XT data in a single environment
• Portable architecture – Java beans and ActiveX controls
• Rapid development of custom visualization solutions through the use of building blocks
• Seamless real-time internet and intranet collaboration
• Extending the value and reach of 2D and 3D intellectual property across the enterprise
• Broadening the scope of product data through the use of PLM XML

Scalable product portfolio
PLM Vis Base, PLM Vis Standard and PLM Vis Pro represent successive levels of functionality and a natural upgrade path. At each service level, PLM Vis will interpret visualization data and automatically generate graphical output in a standard pane yet still support custom mouse interrupts, selection and colors. Functionality highlights include:
PLM Vis Base provides basic viewing of 3D JT data and view-markup on almost all the standard 2D data formats. Printing as well as viewing is supported and much of the data can be exported in alternative formats.

PLM Vis Standard provides base functionality plus the ability to import 3D JT data, NX and Parasolid XT parts. Other 3D formats supported include STL and VRML data. It supports view capture, model navigation, and rubber band selection.

PLM Vis Pro provides standard functionality plus assembly editing, 3D measurement, markup and compare, session save and load, animation and motion playback, plus 3D export to VRML.

Even within these service levels there is a finer level of granularity ensuring that each PLM Vis application has as small a footprint as possible. This is especially important with lightweight applications that are downloaded over the web or are massively deployed throughout an enterprise or along a supply chain.

Corporate end-users
A company’s in-house processes reflect the company. The way it operates and implements processes differentiate it from the competition. These processes contribute to quality control, communications between departments, shave precious production minutes or enable management to keep a finger on the pulse. Companies often develop software applications to support such processes.

PLM Vis is the component that adds a graphical capability to the targeted functionality developed in-house. Developing software in-house from the ground up to support company practices can be daunting. However, PLM Vis is architected as a suite of high-level building blocks that makes producing applications quite painless. Customized viewing can be added to in-house developed applications or to web browsers such as Internet Explorer.

Independent software vendors
ISVs use PLM Vis either because it enables them to focus on their area of core competence and import the already existing view-markup and collaboration functionality of PLM Vis or they use it because PLM Vis offers support for new file formats. PLM Vis often eases the adoption of the ISV technology into an enterprise.

Increased ROI
PLM Vis’ support for so many formats has enabled a number of customers to extend the reach of their data in the enterprise.

“The Siemens PLM Vis toolkit helped us save time by not having to reinvent the wheel for view-markup technology. We were able to better utilize resources and produce a better product utilizing PLM Vis technology.”
Rob McNiff VP Development Visiprise
Nastran provides the world’s most widely used and highly respected software applications for engineering simulation and analysis. For the past 40 years, companies and industries have relied on this extremely advanced tool as a critical part of their engineering infrastructure.

The NX Nastran SDK is the software development toolkit that enables engineering and IT departments to openly and fully access the power and functionality of NX Nastran (the Nastran implementation from Siemens) to maximize the value of simulation. In addition, ISVs can use NX Nastran SDK to leverage the power of NX Nastran in best-in-class applications. Siemens is committed to extend the Nastran legacy of providing the premier tool for high-performance analysis of complex, global models.
Every year, the global manufacturing industry spends billions of dollars trying to achieve interoperability among applications used in the conception, development, engineering, manufacturing and maintenance of products. To gain significant cost savings and deliver important time-to-market advantages, the global market now demands unprecedented levels of interoperability among PLM software applications. These new levels of interoperability are intended to help accelerate the execution of product development process threads. As a result, initiatives to improve interoperability in heterogeneous application environments are vitally important.

PLM XML is a format created by Siemens to facilitate product lifecycle interoperability using XML. It is an open and published format that complies with the World Wide Web Consortium (W3C) XML schema recommendation. Representing a variety of product data both explicitly and via references, PLM XML provides a lightweight, flexible mechanism for transporting high-content product data over the Internet.

PLM XML schemas are the basis of a rich interoperability pipeline that connects Siemens products and third-party adopter applications. PLM XML complements existing and emerging XML-based standards; it supports workflows requiring application integration, interoperability and data sharing by improving collaboration efficiency throughout the product lifecycle.

By taking advantage of the web-friendly nature of XML, and by concentrating top-level data in a format that can be emailed or downloaded depending on security settings and requirements, PLM XML enables collaborating teams to work in ways that accommodate real-world situations such as firewall issues, central web servers or cross-intranet usage.
One very valuable way of improving efficiency is by not doing work that has been done before. The earlier in the PLM lifecycle we identify a proposed duplicate effort, the greater the savings. The conventional way to look for duplicate work is through matching the metadata associated with a part or process. However, there are many reasons why such a search will not be exhaustive:

- An engineer is working on a “new” product with no references to past work
- The company has grown through acquisition and has not unified legacy records
- Progressive management has introduced improved naming conventions for the future that leave past projects behind
- Different departments in different locations work differently
- Past designs are “cast in concrete” with no means to follow new classification procedures

The one characteristic guaranteed to be shared by two similar parts is shape. Geolus Search is a shape-based search engine. It finds similar as well as identical shapes and it complements traditional search methods. It is architected as a web component and includes a SOAP interface that has enabled integration with products such as NX and Teamcenter.

Geolus unlocks the intellectual property hidden in the enterprise. How valuable would it be to cross-reference records of procurement, process planning, and digital validation where the pivot criteria is the shape of the part? Geolus facilitates part and process re-use and also standardization, the best-practice that combats inventory creep.
If you or your company develops software used anywhere in the product lifecycle process, you know how aggressive your customers are, not to mention your competitors. An application that helps a company reduce product design time, cut manufacturing costs or improve innovation will definitely get people’s attention.

However, if the application can’t easily share data with the user’s existing system or if you can’t get your application to market before your competitor, you may never realize the full potential of your own unique expertise. Leveraging the proven capability, widespread adoption and open design of Siemens’ PLM Components not only ensures your applications’ ability to interoperate seamlessly in the most diverse PLM environments, but enables you to develop your applications in the least amount of time with the highest level of functionality and quality.

PLM Components let you focus on what you do best and provide the peace of mind that goes along with knowing your applications contain the same underlying foundation and open data formats used in all of Siemens’ applications – as well as applications developed by leading organizations all over the world. The use of PLM Components helps remove artificial obstacles to your success.

Before you write another line of code, call Siemens PLM Software and explore how using open, world-class component software can help enhance your world-class applications and learn why we say Siemens PLM Software solutions are open by design. Additional product information can be found at: www.siemens.com/plmcomponents.

World-class PLM software needs open, world-class components
About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services with nearly 6.7 million licensed seats and 69,500 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with companies to deliver open solutions that help them turn more ideas into successful products. For more information on Siemens PLM Software products and services, visit www.siemens.com/plm.