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Siemens Digital Industries Software

Parasolid delivers quality components in the drive for success

Rigorous testing processes distinguish Siemens' 3D geometric modeling kernel

Executive summary

Like their manufacturing industry counterparts, application software vendors understand that the quality of the components deployed in their products is a critical factor in the success of their business. Independent software vendors (ISV) are increasingly sourcing best-of-breed software components to add the greatest possible value to their products. Parasolid is just such a component.

Developed by Siemens, Parasolid is a leading 3D geometric modeling kernel that has a unique position at the forefront of high-end computer-aided design/computer-aided manufacturing/computer-aided engineering/architecture, engineering and construction (CAD/CAM/CAE/AEC) and is a key enabler in the growth of mid-range systems across a broad range of 3D applications.

Peter Kerwin,
Product Manager, Parasolid

Introduction

Parasolid® software is a key product in Siemens Digital Industries Software's PLM Components suite of solutions and has been successfully deployed in commercial 3D software applications since 1990.

Siemens uses Parasolid throughout its suite of product development applications, including NX™ software, Solid Edge® software, the Teamcenter® portfolio and the Tecnomatix® portfolio. Parasolid is also licensed to a broad community of ISVs and end-user organizations to provide the geometric modeling foundation for their added-value applications.

Many CAD, manufacturing and engineering analysis applications are Parasolid-based. Parasolid is also gaining popularity with related applications, including systems for architecture, metrology, inspection, reverse engineering and 3D-enabled apparatus, such as computer numerical control (CNC), medical and optical equipment.

Architected as open component technology, Parasolid comprises a comprehensive library of 3D modeling, editing and interrogation functionality that can drive the core capabilities of any 3D application. Software developers gain access to this power in Parasolid via its high-performance application programming interface (API) of over 850 functions. Parasolid adapters can leverage this power to create applications that are leaders in their chosen markets.

Parasolid-powered products benefit from the geometric modeling kernel's unique robustness and reliability, forged over years of exposure to the extremes of industrial usage. They also share the de-facto standard open

XT data format in Parasolid, which facilitates translation-free interoperability with any other Parasolid-based application. There are more than 4 million application end-users creating Parasolid XT files and millions more end-users consuming Parasolid XT files.

Parasolid has a reputation as a high quality, reliable component software that provides customers with the functionality, flexibility and robustness they require, delivered with frequent updates that enable performance and functionality gains to be implemented as quickly and simply as possible.

Delivering on quality

ISVs who develop added-value application software have embraced the concept of sourcing best-in-class software components from specialist suppliers. Whether these suppliers are partners, customers or even competitors, the benefits of licensing high-quality software components are manifold: highly specialized functionality can be integrated at lower costs; ISVs can focus on adding more value for their customers; and innovative applications can be brought to market faster and with higher quality.

Software components are analogous to the components in your personal computer (PC), camcorder or vehicle and should meet similar expectations. In many manufacturing industries, the quality of core components is central to a product's fitness for purpose. For example, computer manufacturers may highlight the speed of the processors they source, but the fact that the processors are also highly robust is taken for granted. Likewise, an aircraft's jet engine must meet stringent reliability and performance standards. It is crucial that quality is built into every stage of the engine's development.

In the software industry, pressure to add functionality can sometimes cause organizations to lose sight of the pivotal role that quality plays in their business' success. By contrast, Parasolid developers understand the significance of software component quality. Parasolid is a trusted modeling "engine" in many leading 3D applications.

Delivering on quality drives the sustained success Parasolid users enjoy. Using a straightforward integration process, application developers can quickly harness that quality to deliver rich value-added applications that build on the tool's history of reliability, usability and functionality.

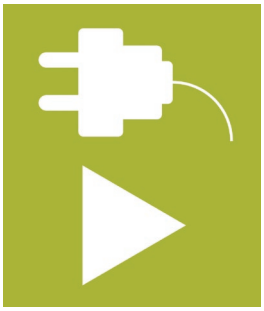
"Parasolid worked like a dream straight out of the box. We couldn't break it," says István Csanady, chief executive officer (CEO), Shapr3D.

Customer quality requirements

The Parasolid team began pioneering software component quality from the outset, working in conjunction with early adopters to establish important criteria for reliability. These principles are regularly validated with Parasolid customers through formal surveys and consultations. The results confirm that quality and reliability continue to be critical priorities.

An immediate fundamental principle is that, in order to be an effective modeling foundation for a wide range of systems, Parasolid must be sufficiently robust to operate in a variety of application environments. As well as being tested in isolation, Parasolid quality must be verified in context using customer applications and scenarios.

Interoperability between different versions of Parasolid must also be robust. When a Parasolid-powered application is updated, Parasolid must still work seamlessly with it. In addition, the frequency of Parasolid releases must be managed to harmonize with a variety of customer release cycles and product acceptance criteria. Parasolid protects customer investment by delivering plug-and-play releases, reduced time-to-market and customer data ownership.



Plug-and-play compatibility

When Parasolid is updated, customers can take the new version and drop it into place in their application deliverables without changing source code or recompiling. This plug-and-play compatibility provides customers with the option of updating their applications whenever Parasolid is updated at no rework cost. It also means that customers can plan release schedules for their own products without having to synchronize with the Parasolid release schedule.

Accelerate customer time-to-market

Everyone benefits the faster customers can develop and release their applications. Parasolid reduces application time-to-market in the following ways:

- By issuing frequent update releases
- By ensuring consistent interfaces that are easy to code against
- By providing appropriately packaged functionality that is easy to integrate
- By making it easy to update an application with newer versions

Empower customers to own their data

When customers integrate Parasolid into their products, they trust they will receive long-term support from Parasolid. In return, Parasolid provides customers with the confidence that their continuing investment in Parasolid functionality and data will be protected.

For example, it is essential for a customer's Parasolid-based applications to seamlessly exchange data even when using different Parasolid releases. And Parasolid customers must be certain that they can work with their existing Parasolid data after integrating an updated version. Similarly, they may need to read newer data into applications using earlier Parasolid versions. Therefore, it is guaranteed that the latest version of Parasolid can open any Parasolid models created using older versions. In return, an older version of Parasolid that is still supported in the field can open Parasolid files from newer versions.

The benefits of empowering customers to confidently own their data extends to the wider community of Parasolid-based applications. Using the open, native XT file format in Parasolid, model data can be saved in one Parasolid-powered application to be opened in any other Parasolid-powered application from any vendor. This concept, known as the "XT pipeline," enables Parasolid customers to enjoy the benefits and security of belonging to a broad-based community of vendors and users who can seamlessly exchange model data.

To further underpin customer ownership of their data, Siemens has published the specification for the XT file format, providing an additional safeguard that Parasolid customers and end-users appreciate.

"The application programming interface and documentation were of the highest standard and, with the collaborative support of Siemens, we brought a product to market within 12 months that was an instant success," says Csanady.

Testing Parasolid

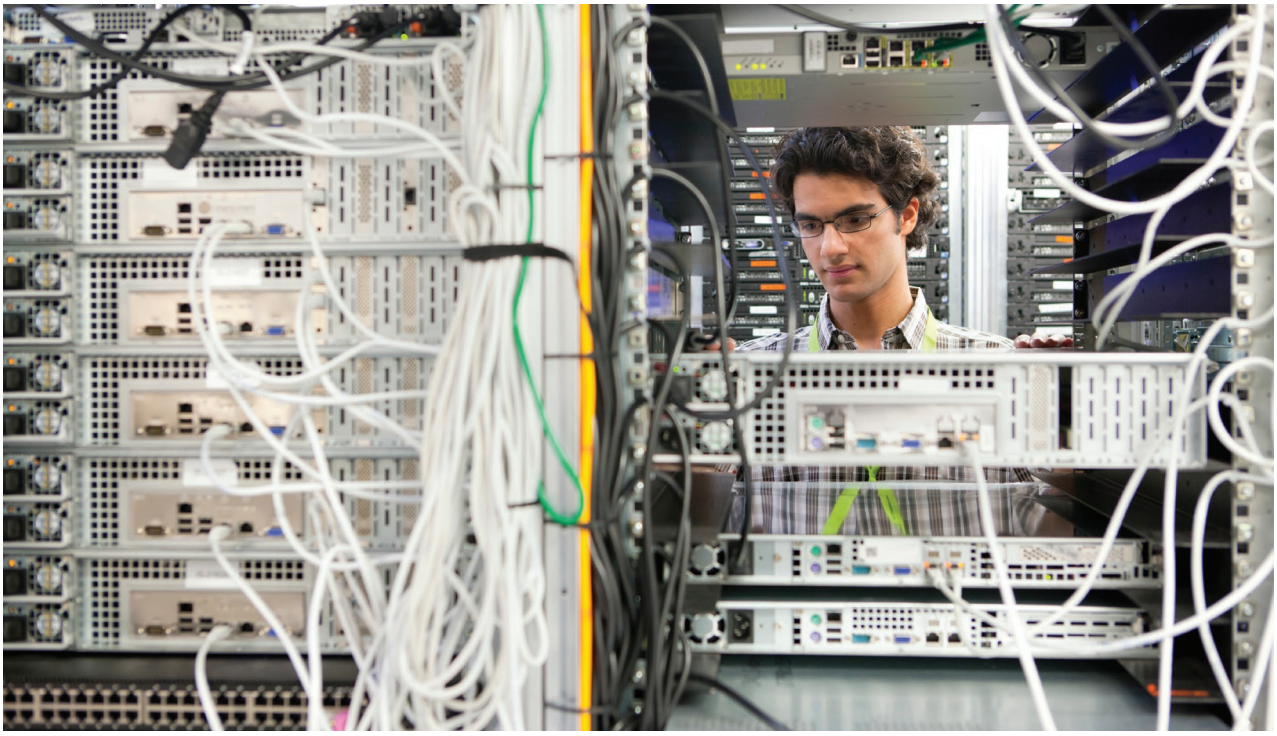
An aggressive commitment to continuous improvement fuels the quality found in Parasolid. Using metrics is vital to successfully manage the quality process. A fundamental activity to measure Parasolid is to heavily test and validate quality at every stage. This includes cycles of monitoring and correction throughout the development and release processes. Doing this in combination with complementary measures improves performance.

It is understood that the cost of failure is proportional to the time between initiation and detection. Parasolid developers perform preemptive testing before submitting a code change for integration testing, which is a comprehensive, overnight process. The preemptive test suite in Parasolid automatically selects the most appropriate tests, from an extensive suite of customer-supplied tests, to exercise the code change. These tests are run on behalf of the developer, who quickly receives a report showing any improvements and regressions.

This prompt feedback enables Parasolid developers to quickly validate code changes, which results in the accelerated development of high-quality software.

When developers successfully complete preemptive testing, they submit their changes to Parasolid and its full battery of over 2.5 million integration tests. These tests run every 24 hours on the latest software builds of Parasolid across all supported platforms. Any regressions are detected and resolved immediately, a zero-tolerance rule which ensures that code changes are robust before acceptance and that they are always submitted into a production-quality environment.

In addition, Parasolid is tested extensively on emerging platforms to eradicate problems long before the platforms become officially supported. During an average six-month major release cycle, each maintained Parasolid version is subjected to over 130 million tests.



The sheer volume of tests alone does not guarantee a quality product; the tests must be the right tests. For Parasolid, a spectrum of different testing strategies aims to exercise the software intelligently at every level. This policy extends to testing Parasolid within application software to validate Parasolid quality in typical end-user scenarios. The benefits of application testing include:

- Exercising combinations of Parasolid functionality in a single application action
- Testing typical user modeling sequences, as opposed to isolated point functionality

Coverage analysis is performed regularly across the entire test suite. This involves analyzing the available tests to see how thoroughly they cover Parasolid functionality. Coverage analysis is used to identify gaps in the testing regime, making it possible to target particular functional areas for deeper analysis.

Continuous improvement of the Parasolid test suite is an explicit objective of the quality management for Parasolid. For example, all new functionality has to be accompanied by the appropriate tests. Also, every customer-reported problem that is fixed is added to the standard test suite and is part of Parasolid's regression testing thereafter, providing the basis for the zero-tolerance policy on regressions inherent in Parasolid. In addition, new tests are continually being devised based on the coverage analysis results. These tests are run nightly on every supported version of Parasolid.

Testing in this rigorous fashion is the only way to ensure the quality of Parasolid is maintained and enhanced. Parasolid testing highlights include:

- Preemptive developer testing
- Total coverage every 24 hours
- Multiple depths of testing
- Zero tolerance on regressions
- Customer scenarios tested
- Application performance monitored

The exhaustive testing and monitoring processes for Parasolid enable production-level quality to be maintained throughout the development and release cycle.

Managing Parasolid versions

It is typical for Parasolid customers to support several releases of their products simultaneously and to be working on their own particular release cycles. It is possible that several successive versions of Parasolid are in production use in the field and must therefore be supported and maintained simultaneously. Moreover, to provide the level of flexibility customers require, the latest enhancements and problem fixes may need to be added to earlier versions.

In order to track changes and maintain quality across each released version, Parasolid has developed an effective version management strategy. Every night, several versions of Parasolid are automatically built: the development version, which is the version of Parasolid currently under development but not yet released, and support maintenance versions, which are ready for update release if needed. The testing regimes described earlier are run nightly on all builds, ensuring that each day's work has been validated by the start of the following working day. Changes and new functionality are first added to the development version and can only be ported into the appropriate maintenance versions if they have caused no failures during overnight testing. This quality gate is backed by equivalent testing in maintenance versions, and code will only be released when all criteria are satisfied.

Close to the release of a new version of Parasolid, the development version on which it is based is frozen and undergoes a period of critical maintenance to ensure that it is as stable as existing maintenance versions by the time it is released to customers. Ensuring the stability of new Parasolid versions from the first release gives Parasolid customers the confidence to upgrade to the latest version with minimal further testing: a simple process as no changes to their own application code are necessary.

Parasolid version management benefits customers by:

- Supporting several releases concurrently
- Ensuring stability of maintenance releases
- Ensuring stability of new releases

Parasolid releases

As well as full customer releases of new Parasolid versions every six months, regular updates of all maintained versions provide Parasolid customers with performance improvements, enhancements and documentation updates. On average, an update release of each active maintenance version of Parasolid is available to customers at least once a month, and across all maintained versions update releases are made at a rate of more than one per week.

Through the rigorous version management strategy of Parasolid, Parasolid customers have the confidence to update their products using maintenance updates. By simply dropping an update release into their application deliverables, they can provide quality updates to their own customers. Many Parasolid customers are sufficiently confident to adopt an update release of Parasolid late in their own product release cycle.

Parasolid has evolved a "release at any time" culture, underpinned by a zero-tolerance regression policy across all supported versions. This means that any maintenance version can be updated at very short notice, providing a high level of customer responsiveness.

Parasolid is only released when it meets a set of strict release criteria that apply equally to new versions of Parasolid and update releases. Parasolid releases should never exhibit any performance degradations or regressions in functionality compared to the last release. Also, all internal documentation for release must be signed off to ensure that there is an audit trail of all changes from requirements through to release.

Plug-and-play updates enable Parasolid customers to:

- Integrate enhancements immediately
- Pass regression fixes onto their customers seamlessly
- Retain control over their own release schedules

Integrating Parasolid

Parasolid quality is a "whole product" concept, encompassing more than just reliability and performance. It also addresses aspects of the customer's experience of working with Parasolid, such as how easy Parasolid is to integrate, and how easy it is to upgrade versions. Does functionality consistently work from version to version? What is new in the latest version?

Customers integrate Parasolid into their software applications by following standard procedures that include accessing functionality via the comprehensive API in Parasolid and implementing simple, predefined downward interfaces to provide file, memory and graphics handling capability.

Integration is primarily a once-only task and is designed to be straightforward so that customers can be up and running. The information provided to customers to help them do this is constantly reviewed and augmented where appropriate.

To enable easy integration, new functionality in Parasolid follows strict conventions and guidelines. The standard API in Parasolid, together with up-to-date, accurate documentation that includes a What's New guide to the latest enhancements, ensures that Parasolid customers can adopt new functionality quickly and easily.

Usability features in Parasolid include:

- Targeted training resources
- Standardized API
- Full reference documentation
- Upgrades that require no changes to existing customer code

Applying quality standards

To make upgrading easy, we have explained that the changes Parasolid updates deliver never affect existing customer code, eliminating any unexpected problems. When upgrading to a completely new version of Parasolid, the same plug-and-play approach applies – the only application code changes being adaptations to take advantage of specific new functionality.

Software companies are keen to assert quality credentials to their customers. Customers in turn can look to independent evidence in their assessment of suppliers, a task made easier if the component manufacturer seeks and obtains an International Organization for Standardization (ISO) 9001 certification.

At its core, ISO 9001 requires a company to follow properly documented processes in developing, maintaining, releasing and supporting its products. The strength of ISO 9001 is its ability to demonstrate the effectiveness of good processes.

An astute ISO 9001-certified company constantly monitors this effectiveness and makes necessary improvements. As part of a wider corporate certification, Parasolid has been ISO 9001 compliant since 1999 and has continued to monitor and improve processes that align with customer needs.

The revised ISO 9001:2000 standard is more robust in validating how well the audited processes are satisfying customer needs. In 2001, the parent organization of Parasolid became one of the world's first to gain ISO 9001:2000 compliance.

As part of Siemens' solution set, Parasolid boasts software development processes that are certified to meet TickIT requirements, the software industry-specific interpretation of the ISO 9000:2000 standard.

Conclusion

This white paper describes how Parasolid has pioneered solutions for developing and delivering dependable, high-performance component software to a global customer base.

In particular, we have explained:

- How we develop and maintain state-of-the-art quality processes by adapting and improving to meet customer needs
- How continuous testing, monitoring and control of the product development process is central to ensuring quality
- How a zero-tolerance approach to regressions enables Parasolid to maintain production-level quality during all development phases
- How we develop a trust-based relationship with customers by delivering frequent plug-and-play releases of a robust, quality-engineered product

We have seen that setting new standards in component quality is a winning strategy for Parasolid, its customers and their end-users. Managing product quality in the ways this white paper describes enables Parasolid to maintain production-level reliability throughout the development process. This in turn enables a "release at any time" culture that delivers mutual benefits through increased responsiveness and ease of integration.

It is for these reasons that the quality strategy for Parasolid is acknowledged as a critical factor in enabling Parasolid customers and its users to be successful in their chosen markets.

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