Java™ Standardization

A White Paper

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Executive Summary

On March 14, 1997, less than two years after the first alpha version of Java was released to the public, Sun Microsystems, Inc. started the process to make Java an International Standard.

Sun Microsystems applied to ISO/IEC JTC1 (International Organization for Standardization/International Electrotechnical Commission Joint Technical Committee 1) for recognition as a Publicly Available Specification (PAS) submitter. This is the first step in the international standardization of Java.

ISO/IEC JTC1 is the premiere information technology standards organization in the world. A PAS submitter can submit its specifications to JTC1 for ballot by the latter's National member bodies. If the specification is submitted in good form, and there are no proposed changes to it from any of the JTC1 member bodies by the end of balloting, then the process of transposing the specification into an international standard could take as little as seven months.

PAS submitters must develop their specifications using reasonable processes for achieving broad consensus among many parties and must be willing to license technologies in a non-discriminatory manner. With its open development and licensing policies, Sun satisfies these criteria. Consequently, when Sun agreed to standardize Java in JTC1, it was suggested that the PAS process was a good match for Sun and Java.

Standardizing Java through JTC1 will guarantee stability and ensure that Java technologies that become International Standards evolve using well-defined processes and procedures by which any materially interested party can contribute, monitor, and vote on proposed changes.

Introduction

On March 27, 1995, the first public alpha version of Java was made available by Sun Microsystems, Inc. Less than one year later, on January 23, 1996, version 1.0 of the Java Development Kit (JDK) was released. By the first *JavaOne* Java Developer's Conference, held in April 1996, it was clear that Sun's Java technologies had opened up a potentially huge new marketplace for software consumers and developers.

While Sun probably could have kept Java proprietary, it chose to keep with its long tradition of being an open systems company and took quite a different approach.

First, it implemented an open process that allowed anyone to actively participate in the development and evolution of the Java Platform (defined as the Java language, the virtual machine, and the application programming interfaces). This process has been in place since the release of JDK 1.0 and has proven to be very successful in achieving broad industry consensus for changes and additions to the Java Platform.

Second, Sun opened up the Java marketplace to competition. Over the summer of 1996, Addison-Wesley began to publish a series of books called *The Java Series...from the Source™* written by people who have been intimately involved in the development of Java. These books contain detailed interface specifications for version 1.0.2 of the Java Platform. The books contain a short and simple licensing agreement whereby Sun grants the purchaser the right to create and distribute clean room implementations of the specifications in their *entirety*.

These books, along with their bound-in license agreements, are essentially saying: Here are the complete, detailed interface specifications for the Java Platform. There are no hidden interfaces. Nothing has been deliberately obscured or left out. You may implement these specifications in products without any legal consequences provided you remain fully compatible.

These two decisions resulted in both industry and academia accepting Java faster than any other programming language in history. The ability to write a program once and then run it anywhere held wide appeal due to the potentially tremendous savings in both program development time and project cost. As of February 1997, there were over 75 major licensees of Java and it has been ported to virtually all high-volume operating system and hardware combinations. Many companies have made large investments in the Java technologies and universities are now actively using Java to teach the principles of computer science to the next generation of software engineers.

Standardization - protecting the industry investment in Java

Sun recognizes that any such rapid and significant investments in new technology are inevitably accompanied by a general desire by the industry to protect its investments. The best way to do that is to move Java into a stable, experienced, formal standards organization: one that is recognized worldwide by government and industry, as well as other standards bodies; one that has well defined processes and procedures by which any materially interested party can contribute, monitor, and vote on proposed changes to the technology.

For technologies like Java, that organization is ISO/IEC JTC1. International standards issued by JTC1 are recognized throughout the world. In many countries in Europe and Asia, they constitute the technical regulatory basis for public procurement of goods and services in the information technology sector. The transposition of Java specifications into JTC1 international standards makes them eligible for such procurement, and widens the market for Java-based products.

The many paths to an ISO/IEC JTC1 international standard

There are many paths by which a technology can reach ISO/IEC JTC1. For example, there are a number of very good consortia, liaison committees, and national bodies that have well-defined processes for discussing, developing and refining technologies until they reach a level of maturity and widespread acceptance that makes them suitable for submission to ISO/IEC JTC1. However, in the case of many of Sun's Java technologies, where the specifications are already stable, well-documented, and internationally accepted, there is a faster, more direct route: the ISO/IEC JTC1 PAS process.

The PAS process

JTC1 created the PAS process to encourage and assist the transposition of technical specifications from sources outside of JTC1 into international standards. It was designed to make the standards process responsive to the needs of the fast-paced information technology sector.

Organizations that are granted PAS status can submit their publicly available specifications to JTC1 for ballot by the latter's National member bodies. The PAS process is responsive to the fast paced needs of the information technology sector. If a specification is submitted in good form, and there are no comments from any of the JTC1 member bodies at the end of balloting, then the process of transposing the specification into an international standard could take as little as seven months. If comments are received, then the process can take somewhat longer because the PAS submitter must address and resolve all comments before JTC1 can issue the new standard.

Any specifications submitted to JTC1 for transposition must be open, fully documented, well tested, readily available, and widely adopted by industry. Furthermore, organizations that apply to JTC1 for PAS submitter status need to be stable bodies that develop specifications using reasonable processes that achieve broad consensus among many parties. They must also be willing to license their technologies on a fair and non-discriminatory basis.

Sun's Java specifications are *barrier-free* with respect to use and implementation, and Java has been so widely adopted that it is already a *de facto* standard in the marketplace. As such, Java is a natural fit for the PAS transposition process. Sun develops and evolves its Java technologies using an open process that has achieved broad industry consensus and has a history of licensing its technologies in a fair and non-discriminatory way. Given this, JTC1 members encouraged Sun to apply for submitter status when Sun approached them to discuss the standardization of Java.

Sun's process for developing and evolving Java

Barrier-free specifications

Sun has stated publicly throughout its entire corporate lifetime that it believes in barrier-free specifications of its technologies – and the Java technologies are no exception.

Barrier-free specifications meet and/or exceed JTC1 Intellectual Property Rights (IPR) requirements. A barrier-free specification must be:

- *barrier-free to use* and
- *barrier-free to implement*.

In order to be considered *barrier-free to use*, there must be no cost associated with writing applications that program to the interface associated with the specification (i.e. no royalties or fees for use). Further, the entire interface must be fully disclosed and well documented. No portions of the interface can be deliberately kept secret or intentionally obscured by the author(s) of the specification.

Many application programming interfaces meet this first condition. You don't have to pay the vendor if your application calls any of the methods or the functions defined by their API and all of the methods and functions that make up the API are well described in the documentation provided by the vendor.

The second condition is much harder to satisfy because it involves allowing open competition. In order to be considered *barrier-free to implement*, there must be no cost associated with a third-party creating its own implementation of the interface described by the specification other than possibly the cost of purchasing a (reasonably priced) copy of that specification.

Thus, in order to have a *barrier-free specification*, a company must not only fully disclose the interface specification (and not charge anyone who programs to that interface) but the company must *also* allow others to build and sell implementations free of charge. In effect, the original company must be willing allow others to compete against them in the marketplace on a level playing field.

An open development process

In conjunction with the release of version 1.0 of the Java Platform in 1996, Sun implemented a new process to guide the future development and evolution of Java specifications. The process is similar to that found within industry consortia and standards bodies and has been very successful in achieving rapid and broad industry consensus. It has allowed the Java specifications to respond quickly and effectively to changing market demands in an industry-neutral way.

While this process has been applied to all aspects of Sun's Java technologies, it is perhaps best understood when cast in terms of the development of the Java application programming interfaces (Java APIs).

An API usually starts out as a rough outline containing requirements gathered from companies, researchers, and experts who have an interest in the API. One or more Sun engineers then turn the rough outline into a draft specification. Sun then improves the specification by circulating it for review (possibly under nondisclosure) to a wider range of companies and consultants who all have expertise and/or a commercial interest in the API.

After the first review period, Sun works to resolve all comments to the satisfaction of the reviewers subject to the need to keep the API cross-platform, industry-neutral, and interoperable with all other Java APIs.

Once the second draft is complete, it is distributed to the over 75 Java licensees for review. Licensees have an excellent working knowledge of the Java Platform and can provide invaluable insights into how the new API might interact with existing and planned APIs. Many licensees, including Microsoft, IBM, Netscape, Novell, and Fujitsu, have been active in providing us with comments and suggestions for improvement.

Following the resolution of comments from this third round of review, the third draft specification is opened up to public review by making it available for free download at java.sun.com. Comments from the public are accepted by electronic mail and in writing in order to make it easy for everyone to participate. The latest API specifications that are open for public review can be found at java.sun.com/products/api/index.html.

The process applied to the JDBC API

This process of reaching consensus on API development and evolution has proven to be extremely successful in practice. It has allowed Sun to rapidly develop usable APIs that have wide appeal. Consider the development of the industry endorsed JDBC (Java Database Connectivity) API.

In late 1995, two Sun engineers perceived a market need for Java database connectivity. After initial consultation with industry leaders Visigenics and Oracle, the engineers settled on a model that was similar to ODBC and created a rough outline (with requirements) for the JDBC API. This outline was completed on January 1, 1996. During January and February 1996, they worked with industry experts and then the Java licensees to refine and improve the specification. The public review period ran from March to June 1996. After incorporating suggested changes, the beta version of the specification was released for public comment in July 1996.

The final JDBC API specification was released on September 1996. It met with immediate industry endorsement and acceptance.

Sun's responsibility as a PAS submitter

Sun recognizes that it's approval as a JTC1 PAS submitter would carry the responsibility of continuing to develop and evolve Java in the same industry-neutral way as it has in the past. Sun also knows that it can only use the PAS process to submit the mature portions of the Java technologies to JTC1. For example, at the present time Sun has specifications for the Java language, the class file format, the byte codes recognized by the Java Virtual Machine, and the Java APIs. While all specifications are potential candidates for PAS submission, they are at differing levels of maturity and stability with respect to changes. For example, the Java language, the class file format, and the byte code specifications are the most mature and are the likely first candidates for submission. The APIs are still evolving. The Java Core APIs can be considered reasonably stable while some of the more recently introduced Java Standard Extension APIs (like the Java Media API) are in the public review stage. It will be some time before they can be considered ready for submission.

What does Java standardization mean to the industry?

Standardizing Java technologies through JTC1 will guarantee stability and ensure that the technologies that become International Standards will evolve using JTC1's well-defined processes and procedures by which any materially interested party can contribute, monitor, and vote on proposed changes. Sun believes that this the best way to protect the substantial investments being made in Java by industries, governments, and researchers worldwide.

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