SAS® Institute’s Involvement in Current Software Standards
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ABSTRACT
All engineering disciplines involve the establishment of standards and hundreds of groups have been formed to provide standards within the computer software and hardware industries. SAS Institute is actively involved in the standards development process and is committed to supporting standards that provide an important benefit to users, particularly those that allow the SAS System to be portable across different platforms.

SAS Institute has participated in the development of various industry standards, such as the ANSI C, POSIX (IEEE 1003), and SAA standards, and currently is participating in various committees. For instance, the Institute is participating in the Microsoft User Interface committee to ensure awareness of the standards for native interfaces. In addition, the Institute is active on the Software Quality System Registration Committee to establish A Guide to Software Quality System Construction using ISO 9001. Participating on this committee permits SAS Institute to work towards international quality management standards as the guideline is being established.

This paper describes the work groups inside SAS Institute that help us work toward using these standards within software development and how the standards affect the quality of the product. The paper also explores SAS Institute’s commitment to these standards and its strategy for remaining adaptable to new standards.

STANDARDS
Software standards are specifications used to achieve uniformity, conformity, and quality in software development. At the Institute, some standards are used as guidelines while others are strictly enforced. Ultimately, the standards that SAS Institute uses benefit its customers because they enhance portability and quality.

Institute of Electrical and Electronics Engineers Standards
Institute of Electrical and Electronics Engineers (IEEE) software engineering standards are formed from the consensus of professionals in the related fields. Each IEEE software engineering standard is prepared with two goals in mind:
• The standard will conform with all other IEEE software engineering standards.
• The standard will be capable of being used without the need to refer to other IEEE standards.

The Institute has a focal person who ensures that all appropriate software standards are reviewed and balloted upon. The following is a list of standards recently reviewed:
• IEEE Std 982.2, Standard Dictionary of Measures to Produce Reliable Software
• IEEE Std 1002, Standard Taxonomy for Software Engineering Standards (reaffirmation)
• IEEE Std 1008-1987, Software Unit Testing (reaffirmation)
• IEEE Std 1016-1987, Software Design Descriptions (reaffirmation)
• IEEE Std 1028-1988, Software Reviews and Audits (reaffirmation)
• IEEE Std 1042-1987, Software Configuration Management (reaffirmation)
• IEEE Std 1058.1-1987, Software Project Management Plans (reaffirmation)
• IEEE Std 1063-1987, Software User Documentation (reaffirmation)
• Draft IEEE Std 1074.1, Guide for Developing Software Life Cycle Processes
• Draft IEEE Std, A Standard Classification for Software Anomalies
• Draft IEEE Std, Guide for Software Verification and Validation Plans
• Draft IEEE Std 1209, Recommended Practice for the Evaluation and Selection of CASE Tools
• Draft IEEE Std P1219, Standard for Software Maintenance Process
• Draft IEEE Std P1220, Standard for Systems
American National Standards Institute (ANSI) is the United States standards coordinating and approval body. ANSI standards are created by certifying existing standards. ANSI guides the efforts of more than 250 major standards development organizations. ANSI has become the U.S. member body of the International Organization of Standardization (ISO) and the International Electrotechnical Commission (IEC).

The ANSI C standard specifies the form and establishes the interpretation of programs written in the C programming language.

A member of the Institute was active in the ANSI C committee when the standard was being formed. The person wrote parts of the draft and reviewed and voted on drafts. SAS compilers are compliant with the ANSI C standard.

The Institute has built upon the ANSI C standard to develop an in-house standard. Following this standard is mandatory. In-house tools enforce the standard; this helps ensure that the Institute's C code is portable, efficient, and maintainable (most of the SAS System is written in C).

An Institute developer is also an active participant on the ANSI C++ committee. The Institute has released a C++ compiler compliant with the current draft of the ANSI C++ standard.

Software Engineering Institute - Capability Maturity Model

This is an application of process management and quality improvement concepts to software development and maintenance. The Capability Maturity Model (CMM) provides a model-based approach to software process improvement. The CMM has five levels (1-5), with five being the best. Only one organization in the U.S has been assessed as a level five organization.

Although SAS Institute has never been formally assessed, staff members have reviewed the stages of the model and has defined areas where improvement is already underway.

HOST STANDARDS AND INDUSTRY BODIES

SAS Institute has an internal host guideline, the Host Implementation Guide. This guide describes that portion of the SAS System which must be implemented for each machine/operating system environment. Committees exist for each major sub-system (i.e. internal file I/O, external file I/O,
memory management, user interface), meeting bi-weekly to discuss modifications and enhancements to the sub-systems. Each host has a representative on these committees as well as a representative from Quality Assurance and Core development groups.

The user interface committee has a representative from Core, Host and each application group. The committee used external manufacturer standards, such as Microsoft, Motif, Apple, and CUA to help formulate an internal user interface standard. This standard will be utilized starting with Release 6.10 software.

The Institute also works closely with computer manufacturers to establish system standards. These standards enable the SAS System to be portable across different platforms. Portability ensures that the SAS System maintains high quality across platforms. However, if the manufacturer chooses not to follow a standard, the Institute may still port to that platform, depending on the customers' needs.

The following section list groups in which the Institute supports.

Open Systems Groups

- Application Binary Interface (ABI) and Binary Compatibility Standard (BCS) groups are responsible for establishing a single binary standard for multiple platforms. Binary compatibility means that executables for the software will run on multiple vendors' hardware with no change to the software. These standards define the file format of executable files, operating system calls, and shell commands and utilities that must be supported by the operating system.

Currently, the Open Systems Research Development (OSRD) group has three versions: 88k BCS, Intel ABI, and MIPS ABI. SAS Institute is involved with the following committees:

- MIPS ABI Steering, Technical, and Marketing Committee
- Intel ABI Steering, Technical, and Marketing Committee
- HP PRO (HP-PA ABI effort)
- SPARC ABI
- PowerOpen

- Common Open Software Environment (COSE) is a cooperative effort among six industry vendors: IBM®, Hewlett Packard, SunSoft, UNIX System Laboratories, Univel, and The Santa Cruz Operation. These vendors are developing standards in the areas of system management, multimedia, object technology, and other areas to help unify UNIX technology. COSE also is working on standards for messaging services and a common desktop environment based on OSF/Motif. COSE has submitted a proposed standard for multimedia to the Interactive Multimedia Association.

- Independent Software Vendor (ISV) Councils provide software vendors with input into the development of UNIX standards. SAS Institute is a member of the Hewlett Packard, Digital Equipment Corporation, SUN, and IBM Advisory Councils. Some of these groups include:
  - SPARC International Board of Directors
  - SPARC International ISV Council
  - Novell ISV Council

- Open Software Foundation (OSF) is a non-profit research and development organization devoted to open software. The foundation develops specifications and portable software products based on industry standards and selected using an open request-for-technology process. Technology can be received from any organization and is selected based on the criteria of portability, interoperability, and scalability.

- POSIX was established to propose a specification for an operating system interface to provide a base to which a large number of applications can be easily ported.

- X/Open invests business, technical, and marketing resources into the development of a common multivendor application environment based on de facto and international standards. X/Open's goal is to increase the volume of application programs for members' systems and to maximize the return on investments in software development made by users and vendors.

IBM Standards Group

- System Application Architecture (SAA) is a collection of selected software interfaces, conventions, and protocols that provide the framework for the development of consistent products. An element of the SAA is the Common User Access (CUA) User Interface which is a graphical user interface. SAS Institute is compliant with the CUA interface.

- Guide and Share Groups are two IBM mainframe
users' groups. SAS Institute attends their meetings and participates in their requirements sessions.

CONCLUSION

SAS Institute participates in several standards committees for the purpose of evaluating numerous standards. Some of these standards are useful; some are not. The Institute applies standards to its software development when the standard increases portability and quality which benefits the Institute's customers and adds value to its software products.

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