Proprietary Design Information and Fruit Pies

Published in the "Annual Survey on Collaboration and Interoperability" at www.longviewadvisors.com
John Horst, NIST

Like mom's best fruit pie, product design information is made for sharing. Product design information can be consumed by the machine shop, the metrology department, the assembly line, product sales/marketing department, suppliers, the data archiver, or the trash can. Each of these consumers (minus the trash can) must be able to receive all the design information required and correctly decode it, including information on geometry, features, datums, and tolerances.

When you're talking fruit pies, the more different types and variety in the recipes the better. In the case of design information, the more proprietary formats the worse. Proprietary formats are unnecessary and costly, and particularly so as the number of them increases.

Of course, it is necessary to have some format for the data, but when proprietary formats proliferate, a variety of unnecessary costs arise, such as format translation, product training, high maintenance fees, higher product costs generally due to a lack of competition, and critical product delays (remember the Airbus A380 wiring information problem). Furthermore, these costs rise quickly as the number of proprietary formats increase (it's basic combinatorics), and format mismatch can even occur between different versions of the same product (remember the Airbus A380…again).

The enlightened answer is to maintain and implement open and non-proprietary design information standards that are complete, correct, and unambiguous, which satisfy every consuming activity, and that are specified in the purchasing requirements of a critical mass of large users of Computer-Aided Design (CAD) software. The costs of working with proprietary formats are eliminated by quality standards properly implemented and maintained.

Alternative interoperability solutions to standards

Alas, the "standards solution" for design information has only barely achieved adoption in the manufacturing world. Instead, while most end users of CAD software have acknowledged the CAD interoperability problem, their supposed "solution" is to enforce a single supplier "standard" throughout the enterprise. Large end users, e.g. automakers, commonly require that their suppliers provide design info in the automaker's choice of a single proprietary ("native") format. However, their suppliers, who often have several other customers, suffer the high cost of supporting so many native formats. Supplier costs are ultimately passed back to the end user, and the expected savings to the end user turn out to be illusory. Other problems with the single supplier solution are that 1) it hinders enterprise agility in the purchase of products and execution of corporate mergers, 2) it hinders attaining lower product cost through lower supplier software development costs and healthy supplier competition, and 3) it may increase the cost of component integration and maintenance.

CAD-to-CAD translators are also seen to enable interoperability, and they do; however, given that a widely implemented, correct, and complete CAD information standard would eliminate the need for translators, third party supplier-to-supplier (and version-to-version) translation can be seen as a non-value-added activity; in fact, it is sometimes a value-subtracted activity, since translation can often result in a distortion of information.

Choosing either a “single supplier” or “CAD-to-CAD translator” solution and not choosing the open, non-proprietary standards solution appears to be the result of some fundamental misunderstandings. It is believed that the competitive distinction between different design software products is in the information defined and in its format, not in the internal capabilities of the design software. Many argue that, if these distinctions go away (through standard information definitions and formats), competitive advantage is lost.

While it is true that some new product capability might trigger a requirement for new design information definition, the basic elements of design information (e.g., geometry, features, and tolerances), as specified in the relevant American Society of Mechanical Engineers (ASME) and International Organization for Standardization (ISO) standards, are stable. All CAD suppliers must define and output this information. Furthermore, a well-maintained standard will have the support necessary to incorporate new information definitions almost as soon as they emerge.

Not surprisingly, everyone suffers from the proliferation of proprietary CAD formats: end user, tier supplier, software supplier, and the customer, either directly or indirectly.

Design information standards challenges

We’ve referred to “the standards solution,” but many of us know that CAD standards haven’t always worked as planned. Standards development has been slow, end user support is difficult to get and maintain, CAD supplier support seems to be even harder to procure (in part because there are only a few CAD suppliers world-wide), and standards don’t seem to be marketed and “sold” very effectively. Certain “faithful” companies have poured large amounts of money into CAD format standards, while receiving little discernable cost savings in return. The managers in these companies are now reluctant to support standards, given its track record.

Nonetheless, open, non-proprietary CAD information exchange standards, such as STEP (Standard for the Exchange of Product model data), have been a success on several accounts. STEP has been widely implemented in CAD software and provides a rich representation of CAD geometry. It has been particularly valued for longevity storage of information. On the down side, the commonly implemented STEP standards are insufficiently rich in terms of machining features, measurement features, and tolerance information and are costly to implement, since they require intimate knowledge of the EXPRESS information-modeling language and a variety of other STEP-specific technologies. In summary, commonly implemented STEP substantially lags the rich design information representation currently found in proprietary formats, so the cost savings promised by the non-proprietary standard have not been realized.

A renewed call for support of the standards solution

Here’s a simple analogy to inspire us again to support CAD standards. Bring your notebook computer anywhere in the world and you will quickly and cheaply find a wireless Internet connection — all due to the globally-adopted WiFi standards. On the other hand, bring your U.S. cell phone overseas and you will spend frustrating amounts of time and money before you can finally call your friends and colleagues again — mostly due to the absence of globally-adopted cell phone standards.

Here’s a proposal for developing, maintaining, and selling WiFi-quality design information standards, which is in effect a standards development life-cycle.

Gather CAD suppliers and end users together to perform the following tasks

- Choose an appropriate and adequately financed standards-generating organization as a home for the CAD standards development effort
- Define, write, and maintain correct, complete, and unambiguous design information standards
- Encourage implementations of the standards among the entire supplier community worldwide
- Write and maintain good conformance tests to verify the compliance of implementations of the standards
- Define a formal certification program based on the conformance tests
- Choose an appropriate certification organization where the auditor or calibration organization is separate from everyone involved, including those who write the standards and those who are implementing the standards
- Define and implement an effective marketing strategy including
    - Public interoperability demonstrations in the most visible and well-attended technology shows possible
    - Press interactions such as articles, videos, and advertisements
    - Join with organizations (e.g., the trade press and show management companies), who have the necessary expertise, to promote the standards
- Establish appropriate fees for participating suppliers for joint certification and public marketing/advertising efforts, in order to keep the standards organization viable

I particularly stress effective marketing. Typically, those who are gifted enough to write excellent standards, are not often qualified to market effectively what they have written. The effectiveness of the standards, the simplicity and power of certification, the high quality of the conformance tests, and the savings potential to everyone must be communicated by the most articulate and savvy individuals and organizations at the most public of forums for success to be realized.

In spite of their weaknesses, the ISO STEP standards, such as AP203 (editions 1 and 2), are a logical choice, and AP238 and AP219 are designed for downstream to machining and metrology, respectively. Perhaps one of the quasi-standard “lightweight” CAD specifications might also be a candidate for a non-proprietary standard.

Working on standards is not as tasty as mother’s fruit pies; however, potentially enormous savings to end users, tier suppliers, and software vendors should be enticement enough.