often dramatically reduce the runtime requirements of a tool over its life. Such reductions benefit both the tool users—who see the results of each execution more quickly—and all computer users—who see an increase in available computing time.

The last factor in successful long-term support is the development of expert users. Experts increase the availability of help for other users without the need to add more CAD engineers to the staff. Since people differ in the degree of interest they have in a certain tool, the arbitrary assignment of specific users to become experts doesn’t work. Rather, such gurus tend to come forth on their own. At Western Digital, such users are identified and given extra training through more exposure to vendor applications engineers.

**Vendor relationships**

A close relationship between vendor and customer can help the customer get the most out of the tools purchased. For example, keeping a high profile with each vendor is helpful. The customer should take every opportunity for serious dialogue with vendor officers and software developers, including user-group meetings, conference hospitality suites, booths on trade-show floors, and personal visits to vendor facilities. Such opportunities will enable the customer to talk to developers rather than to support people about bug fixes and enhancements, have informed dialogue with higher level management of tool suppliers, learn about and influence planned future products, and establish credibility as a technically competent user whose inputs merit attention.

The customer can establish credibility by taking time to ensure that bug reports and suggestions are both accurate and well-documented.

Another way to enhance vendor-customer relations is to file a non-disclosure agreement with each vendor concerning access to the users’ design data. This procedure ensures that the vendor can move quickly to isolate and repair a bug in customer data.

The customer can serve as a beta site for new products or for new releases of existing tools. This strategy is an excellent way to assure that the new release or tool serves the needs of the local site, as well as building rapport with the tool vendor. However, depending on the state of the beta release, many hours could be wasted trying to apply software that has not been debugged to real problems. Therefore, beta-site decisions must be made carefully, and all possible benefits weighed against the estimated time that will be spent supporting beta-site usage. In general, though, some corporate time can be “written off” for beta-testing because it is time not spent on in-house development. The advantages of being a beta site are that the customer has tools in-house before the competition and has more clout with the vendor.

Frequent customer visits by vendor applications engineers are conducive to learning better (and often undocumented) ways to use existing tools more effectively. In addition, the vendor can be educated as to how the software is being applied.

**The CAD applications engineer**

The people who support the tools must be selected as carefully as the tools themselves. Little has been written about the kind of person required to complement a set of vendor-furnished CAD tools. The CAD engineer typically performs many of the following functions:

- consults with users on how to use the tools;
- provides documentation that describes the use of the generic tools in the specific environment;
- interfaces with the vendor on bugs, problems, requested enhancements, new releases, vendor-supplied documentation, and training;
- installs new software releases;
- prepares “user friendly” front ends and “technology files” for vendor software;
- develops the “glue software” required to combine diverse tools to form an integrated system; and
- manages system hardware.

Candidates for the position need a variety of skills. First, they must be able to apply state-of-the-art software development techniques to portions of the system built in-house and to understand data structures and algorithms used in commercial software. They also need to understand the user view of software, be willing and able to move from one task to another on short notice—usually several times per day—have experience in the application area (CAD engineers working on logic simulation would have experience in logic design; those working on design rule checkers would have experience in chip layout, etc.), and be skilled in working with people, especially in dealing with frustrated users, priority-conscious vendors, and impatient managers.

The situation is somewhat paradoxical: experienced CAD software developers are asked to spend much of their