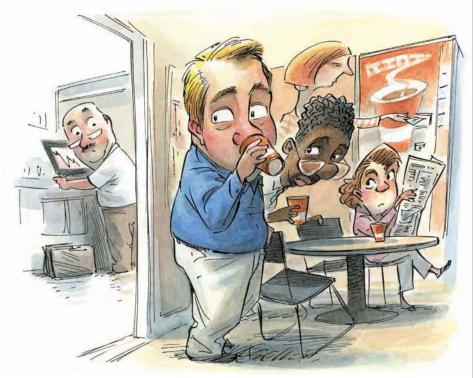# Coffee-break mistake

A number of years ago, I worked as a senior support engineer for a large ATE (automated-test-equipment) system manufacturer. We supplied a large number of test systems to many customers worldwide, all with successful results. One company had five similar machines in its production process, and all initially seemed to be operating well, with good reliability and performance. After a few months, though, problems started to emerge. Our service engineers began to get calls to investigate system crashes. The factory was not local, and getting there required a lengthy journey. By the time the engineer reached the site, the problems had vanished, however, and the systems were working normally.

We swapped out various cards, changed power supplies, and reloaded software—all to no avail. This problem continued intermittently for weeks. One minute the customer was testing boards; the system would then suddenly and inexplicably freeze. Nothing except a reboot would fix the problem. There appeared to be no pattern to the failures. They were not operator-dependent, and they occurred when different tests and even different programs were running.

The customer was concerned over system downtime, blaming our hardware, and we were running out of ideas. Taking drastic measures, we decided to replace the ATE. We selected a demonstration system, fully reworked it so that it was in tiptop condition, and calibrated it to within an ounce of perfection. We loaded the customer's programs, and they performed perfectly under test. Upon delivery of the system, all appeared well.

The next morning, though, we got the dreaded phone call: The new system was behaving exactly the same as the old one. Meanwhile, we had returned one of the customer "rogue" systems to the workshop and could find nothing wrong with it. Reviewing the service sheets and job records revealed little in the way of fixes that I wouldn't have tried under similar circumstances. It was time for a clean sheet of paper.

So, I loaded up the car with all manner of test equipment and headed for the customer site, not knowing what to expect or with an idea of what to try to fix the problem. I decided the best first attack would be to simply sit and watch what happens. The first day revealed nothing out of the ordinary. On the second day, I volunteered to act as the operator to alleviate the tedium and to gain firsthand experience of the fault when and if it ever showed up.

On the third day, around midmorning, the system just froze. Nothing obvious was different, but I now had a clue because the fault recurred about 20 minutes later. The factory had a large work force who took tea and coffee breaks in groups, and large numbers descended on the tea and coffee machines at about the same time in an area adjoining the production floor.

I hooked up the mains analyzer to the incoming supply and discovered the problem. A couple of captured-event waveforms showed that, when all the drinks machines were operating at once, they produced cumulative patterns of noise, rising to well over the ratings for our standard industrial filtering. Our computers simply could not cope with the excessive interference.

It turned out that the drinks vendor had installed its machines soon after we had installed our systems, thus explaining the initial trouble-free period. The drinks machines also had little more than the most basic suppression circuitry, and all of them were wired to the same phase of mains supply as our systems. Changing the wiring on our systems to another phase immediately fixed the problems.EDN

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