Computers

Looking beyond the Melissa virus

The computer virus that struck in late March exposed serious weaknesses in the security of many computer systems. Nicknamed Melissa, this rogue program acted like an automated chain letter, overwhelming electronic-mail service in more than 300 organizations, including government agencies, military bases, and large businesses. What made this particular virus stand out was the extraordinary speed with which it spread throughout the world.

"The Melissa virus represents a new level of sophistication in the progression of computer viruses," says Richard Pethia of Carnegie Mellon University's Software Engineering Institute in Pittsburgh. Pethia was one of several computer security experts who testified at a congressional hearing last month on ways to protect information technology from emerging threats.

The Melissa virus exploited a well-known vulnerability of small computer programs called macros. Word processing software often attaches macros to documents in a way invisible to the typical user. The Melissa virus, posing as a macro, was hidden in a Microsoft Word document, which was distributed by E-mail. Opening the document activated the virus, which would then look for an organizer program called Microsoft Outlook. The virus would mail itself to the first 50 addresses listed in the organizer's E-mail directory.

Because Word and Outlook are widely used, often without sufficient security precautions, the virus spread rapidly. It merely perpetuated itself and forced the suspension of E-mail service at sites that it inundated. A virus designed to destroy data, however, could use the same security loophole to wreak much more havoc.

One encouraging aspect of the Melissa episode was the quick response by several virus-monitoring organizations, which collected information and provided timely, well-publicized warnings. Within a few days, new infections slowed to a trickle.

Response times measured in hours and days, however, may not be fast enough in the future. "Future mutations . . . could easily be much harder to detect, spread even more quickly, and cause significantly more damage," Pethia contends.

Experts estimate that about 30,000 viruses are now in circulation, with 300 new ones created each month. "Users should be sure that their computers are running the most up-to-date virus protection software," warns Michael A. Vatis, director of the Federal Bureau of Investigation's National Infrastructure Protection Center in Washington, D.C.

"The long-term solutions to the problems represented by Melissa will require fundamental changes to the way technology is developed, packaged, and used," Pethia concludes. "It is critical that [computer] system operators and product developers recognize that their systems and products are now operating in hostile environments." —*I.P.*

Developing digital fluency

In a rapidly changing world of destructive computer viruses, balky software products, and highly complex information systems, it helps to know how computers work and to understand the basic technologies required for information processing, communication, and problem solving. In a report to be published next month, a National Research Council panel focuses on how to teach college students—whether in computer science, business, or the humanities—to use information technology effectively.

Titled "Being Fluent with Information Technology," the panel's report suggests that achieving such a goal will require a serious rethinking of the entire college curriculum, not just particular courses and programs. The recommended requirements for fluency in information technology range from having the skill to set up a personal computer to demonstrating a capacity for adapting to new technologies. —*I.P.*

Physics

Electrons hop; current and heat drop

Transistors in today's electronic microchips mobilize electrons by the millions. This heavy traffic gobbles power and heats up components, limiting how small and fast circuits can be.

An alternative type of electronics, proposed 5 years ago (SN: 12/3/94, p. 375), would discard transistors in favor of voltage-sensing units, each eventually to be made from a single molecule. Flipping a bit between 0 and 1 would roust only two electrons, minimizing power use and heat. Units laid side-by-side like dominoes would interact with neighbors via small voltages.

Researchers led by Gregory L. Snider at the University of Notre Dame (Ind.) have now fashioned such a unit and shown that it can make simple computational-logic decisions.

The device, described in the April 9 SCIENCE, covers a square patch of silicon about 2 micrometers on a side. Its four corners contain electrically isolated aluminum islands. The two mobile electrons in the unit stay as far apart as possible, retreating to opposite corners. The device holds a value of 0 or 1 according to which of the two pairs of islands the electrons occupy.

The researchers have created only one unit, but to simulate the action of three surrounding units providing data to it, they apply voltages to three edges of their device. In response to a prescribed combination of inputs, the electrons hop from one pair of corner islands to the other. Assemblies of such switches could act as a general-purpose computer, the developers say.

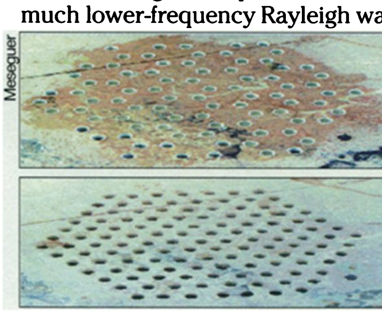
Having demonstrated the technology, the team has recently begun an effort, expected to take decades, to shrink the units to molecular dimensions. At their present size, the units can't compete with transistor-based circuits mainly because they must be chilled to 70 millikelvins to control electron position reliably. Reducing the device to molecular scale is expected to restrict electron mobility and "allow us to operate at more like room temperature," says Notre Dame's Gary H. Bernstein. —*P.W.*

Hole pattern hinders ground ripples

Holes drilled in the ground in an orderly fashion can impede passage of certain surface waves, new research suggests. However, even if huge and widespread, such holes would yield negligible protection against earthquakes, seismologists say.

Francisco Meseguer of the Polytechnic University of Valencia in Spain and his colleagues drilled regularly spaced holes, 1.6 meters deep, in a marble quarry. In the May PHYSICAL REVIEW B, the physicists report that certain vibrational frequencies—resulting from the clink of a steel ball against the marble—sharply weaken as they pass through the hole pattern. The intensity drops to as little as 10 percent of the original, Meseguer estimates. In earlier experiments, he and some of the same colleagues found that arrays of vertical metal bars damp sound waves in air (SN: 10/31/98, p. 284).

Because the pattern attenuated surface vibrations known as Rayleigh waves, the researchers suggest that holes 26 meters across arranged in a pattern over a large area might hinder the much lower-frequency Rayleigh waves caused by earthquakes. However, seismologist Thomas H. Heaton of the California Institute of Technology in Pasadena says that Rayleigh waves cause almost none of the damage from earthquakes. On the other hand, such "clever" hole-pattern barriers might protect buildings from the rumble of railroad cars and heavy equipment, he speculates. —*P.W.*



Meseguer

Both honeycomb (top) and triangular (bottom) hole patterns squelch ground vibrations.