Catching quakes with laptops

October 27 2008

The interactive program built around the BOINC screensaver, designed for classroom activities. Recent earthquakes and sites of major historic earthquakes are indicated; information about these events can be retrieved by clicking on them. Credit: Quake Catcher Network Project

Inside your laptop is a small accelerometer chip, there to protect the delicate moving parts of your hard disk from sudden jolts. It turns out that the same chip is a pretty good earthquake sensor, too -- especially if the signals from lots of them are compared, in order to filter out more mundane sources of laptop vibrations, such as typing.

It's an approach that is starting to gain acceptance. The project Quake Catcher Network (QCN), already has about 1500 laptops connected in a network that has detected several tremors, including a magnitude 5.4 quake in Los Angeles in July. Led by Elizabeth Cochran at the University of California, Riverside, and Jesse Lawrence at Stanford

University, QCN uses the same BOINC platform for volunteer computing that projects like SETI@home rely on.

One of the benefits of this new technology is price: Research-grade earthquake sensors typically cost between $10,000 and $100,000. Of course, they are much more sensitive, and can detect the subtle signals of far-away quakes that laptops will never pick up. But Lawrence notes that, "with many more cheap sensors, instead of guessing where strong motions were felt by interpolating between sensors, we should be able to know where strong motions were felt immediately, because we have sensors there."

Another advantage is that QCN sensors can record the maximum ground shaking. Many high-sensitivity sensors cut short the full extent of the oscillations they are measuring even for moderate earthquakes. Lawrence argues that with enough sensors, eventually "we should have the ability to triangulate earthquakes for earthquake early warning, providing several seconds of warning before the earthquake hits neighboring populated regions."

There is a catch with the QCN sensors, though: getting accurate coordinates for their position. At present, since most laptops do not have GPS, the project relies on coordinates that the users type in. Fortunately, rough coordinates can also be automatically retrieved from network routers that the laptop is connected to, as a backup.

It all started with teenage mutant ninjas

Laptop accelerometers were never meant to be used this way. But in 2005, a benign hacker group called the teenage mutant ninjas figured out how to access the "sudden motion sensor" in Apple computers. A year later, David Griscom at the company Suitable Systems wrote SeisMac as an educational tool for IRIS, a group of U.S. earthquake seismologists.

Cochran had the idea that this approach could be linked with BOINC. Carl Christensen, a distributed computing expert, was recruited to implement QCN in BOINC last year. A first limited release was made in March of this year, and by April the network had already detected its first quake, in Reno, Nevada.

Christensen is now working on integrating stand-alone sensors that attach to desktop machines with USB connections (since desktops don't get bumped around like laptops, they don't have built-in sensors). These USB sensors can be as cheap as $30, and the idea is to have large numbers of them sponsored as educational tools for schools.

Lawrence notes that "the USB accelerometers will provide a stable backbone, without which the ever-changing configuration of laptops would not be quite as reliable. The USB accelerometers can also mount directly to the floor, which means they will have better sensitivity to ground motions."

So this is not just a neat outreach opportunity—it could one day save lives.

Source: International Science Grid