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Rescuing Our Families, Our Neighbors, and Ourselves

Should computer scientists and engineers take on a greater responsibility to help reduce the loss of life and property damage from natural disasters?

"I don't think anybody anticipated the breach of the levees. They did anticipate a serious storm. But these levees got breached, and as a result, much of New Orleans is flooded. And now we are having to deal with it and will."

—President George Bush, on "Good Morning America," ABC Television, Sept. 1, 2005

In the past year, we have seen two natural disasters kill thousands of people and destroy billions of dollars of property. The Indian Ocean tsunami killed perhaps 200,000 people and made over one million homeless. Hurricane Katrina killed more than one thousand people, and the cost to repair New Orleans may be $200 billion.

You might assume that such disasters are the turf of civil engineers, and we computer scientists and engineers should sit on the sidelines. I disagree. I can think of four reasons why IT plays perhaps an even more important role in saving lives and property before and after natural disasters.[1]

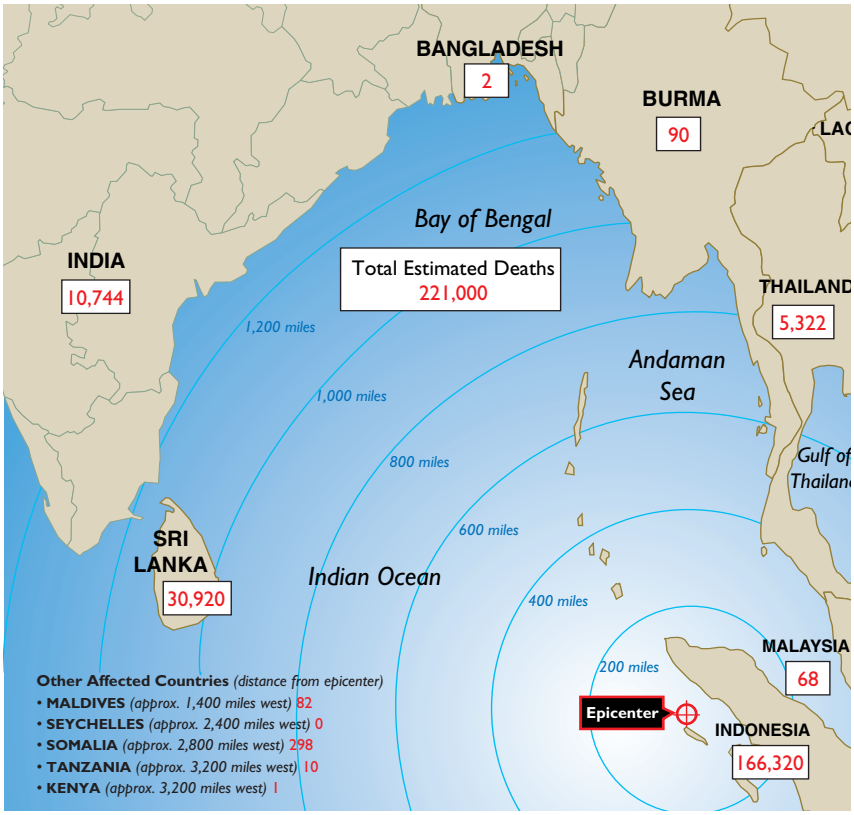
First, after a disaster occurs, telecommunications and the Web are vital to coordinate relief, to find lost family or friends, and help the rest of the world appreciate the magnitude of the disaster. Computer-based sensor networks can also be critical in determining the extent of damage to the environment, the safety of buildings, and so on. And robots help find the injured in situations too dangerous for rescuers as well as survey the extents of the disasters [4].

Second, such sensors can also rapidly detect events shortly after they occur. Had the "tsunameters" been placed in the Indian Ocean as they are in the Pacific, we might have been able to warn surrounding countries before the tsunami hit. Indeed, 40,000 deaths occurred in countries 1,000 miles or more from the Indonesian earthquake.

Third, computer simulation allows us to model the potential impact of natural disasters before they occur. Quoting an article from *Scientific American* in 2001 [2]: "New Orleans is a disaster waiting to happen. The city lies below sea level, in a bowl bordered by levees that fend off Lake Pontchartrain to the north and the Mississippi River to the south and west. And because of a damning confluence of factors, the city is sinking further, putting it at increasing flood risk after even minor storms ... Extensive evacuation would be impossible because the surging water would cut off the few escape routes. Scientists at Louisiana State University, who have modeled

[1] I prefer separating natural disasters from terrorist attacks, for we can use history and computer simulations to assign probabilities of the former, which will be important in deciding how to spend public funds to prevent them. How do we assign probabilities to the latter?

I conclude that scientists and engineers, especially those in IT, must move beyond creating the technology and writing cautionary reports. We must become more involved with our governments if we want to really lessen the impact of such disasters. Perhaps it is our civic duty to do so.



Source: *Washington Post*

Countries over 3,000 miles from the epicenter of the Indonesian earthquake last December were affected by the devastating tsunami that followed. Had sensor networks been placed in the Indian Ocean, many countries may have received advanced warning.

hundreds of possible storm tracks on advanced computers, predict that more than 100,000 people could die." Moreover, it appears that most concrete floodwalls failed in Katrina. Measurements from embedded sensors might have allowed simulations to demonstrate that less severe hurricanes would lead to flooding.

Had these simulations inspired public and private investments to strengthen the levees before Katrina hit, who knows how many lives and how much property could have been saved?

Fourth, computer graphics can help anyone understand the impact of a potential disaster. Unfortunately, human nature is to ignore warnings unless you've seen such a disaster yourself, but our technology can help many believe the warnings by seeing the potential impact to them on a computer screen. We can now go to search engines, type in your address, and view satellite photos of your neighborhood. Imagine a simulation that would allow homeowners in New Orleans to see their neighborhoods after a levee breaks. Or allow San Franciscans to view the possible damage inflicted to their homes after a major quake on the San Andreas Fault.

These are just four examples of the value of IT in natural disasters, but there have been more identified in many workshops, conferences, and publications on the topic[2] (and you can bet there will be even more such gatherings and literature in the future).

Had public and private institutions acted before

[2]For example, the Workshop on Cyberinfrastructure Research for Homeland Security held Feb. 25–27, 2003 in La Jolla, CA; and *Reduction and Predictability of Natural Disasters,* John B. Rundle, Donald L. Turcotte, and William Klein, Editors. The Santa Fe Institute, 1996.

both disasters—by fortifying levees in New Orleans and placing tsunami sensors in the Indian Ocean—as scientific and engineering experts had recommended and reported in magazines and newspapers [1, 3], many lives would have been saved. But no one acted. I conclude that scientists and engineers, especially those in IT, must move beyond creating the technology and writing cautionary reports. We must become more involved with our governments if we want to really lessen the impact of such disasters. Perhaps it is our civic duty to do so.

One avenue would be to join government agencies, especially in leadership positions, but a more radical step would be to run for office. Scientists and engineers bring a skill set—including quantitative risk assessment—that is rare in other professions, yet we have largely ignored politics. For example, the U.S. Congress has seven former scientists (two with Ph.D.s) and 176 former lawyers. In addition, 60% of U.S. Senators have law degrees, but none have a Ph.D. And not one of these 535 legislators is an IT expert. These disasters demonstrate the importance of having the right mix of people at all levels of government, from city councils through regional legislatures to national offices, if we are going to reduce the impact of such events.

Another step is to join or form non-governmental organizations that inform both the public and the elected officials of the real impact and the probabilities of natural disasters. Interactions with government representatives would be mutually beneficial, as we would better understand governmental processes and they would better understand the real risks. If we arm the public with personal, disaster-related data, it is more likely that people will call on government representatives to urge preventive and remedial actions for their neighborhoods.

These are some of the ideas I've identified as opportunities for the IT community in general to adopt a higher profile role in protecting the public from natural disasters. A more concrete suggestion is for ACM to convene a group of experts to assess how IT can be developed and applied to save lives and property affected by natural disasters and to motivate public and private institutions to act before they occur. I would appreciate your thoughts via email on this proposal. If you have special expertise and might be willing to serve, please mention that as well.

Whether or not you agree with me, the question must be what do we learn from these two disasters, for, as George Santayana wrote:

"Those who cannot remember the past are condemned to repeat it." C

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