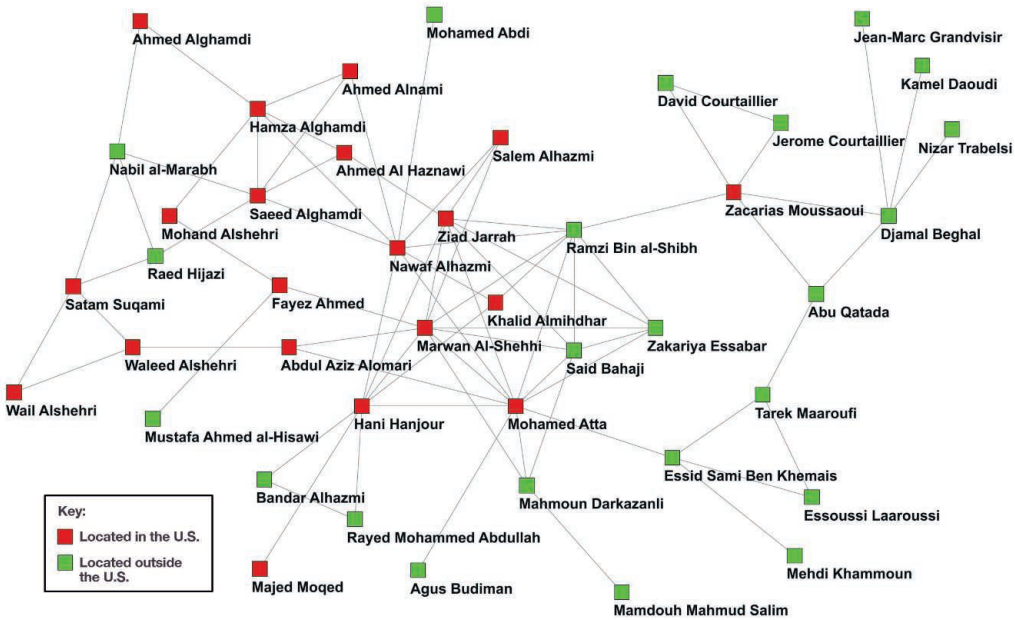

Connect the dots. This network links the attackers of 11 September 2001 and alleged associates.

COMPUTER SCIENCE

Network Science at Center Of Surveillance Dispute

Last week, civil libertarians cried foul when press reports revealed that, in its efforts to ferret out terrorists, the U.S. National Security Agency (NSA) is collecting cell phone records and Internet data from companies such as Verizon, Facebook, and Skype. Some argued that the federal government is spying on its own citizens. From the nature of the data, scientists say it's clear that NSA is performing network analysis, a type of science that aims to identify social groups from the connections among people. And NSA is hardly the only organization doing such work, researchers say. Private companies are already tracing people's social circles.

"I can tell you that this kind of thing is extremely effective," says Alex Pentland, a computational social scientist at the Massachusetts Institute of Technology in Cambridge who has studied phone networks.

Born of the social sciences decades ago, network science blossomed in the 1990s thanks to the confluence of mathematical tools developed by theoretical physicists and huge data sets produced by cell phones, the Internet, and other digital technologies. Network methods have entered the mainstream in fields such as epidemiology, in which researchers use data such as airline networks to help model the spread of disease.

NSA's network analyses likely involve four levels of inquiry, says Brian Uzzi, a sociologist at Northwestern University in Evanston, Illinois. Suppose an analyst works with only phone data. The first step, Uzzi says, would be to map who calls whom—with each person represented by a point or "node" and each person-to-person link represented by a line or "edge"—to create a simple communication network. Next, the analyst would study details of calls—their frequency, duration, and timing—to determine how closely connected each pair of people is. This step breaks the communication network into smaller, overlapping social networks.

The third step would be to study the dynamics of a social network, to see how activity ebbs and wanes and the network evolves. The fourth step would be to try to correlate the dynamics of the network with external events, Uzzi says, such as terrorist bombings in Iraq or Afghanistan. In reality, of course, analysts work with data from many different sources to try to trace a social network as accurately as possible.

Given enough data from electronic and other sources, one can identify a social group, be it an al-Qaeda cell or a classic car club. But the methods have limitations. It's unlikely that NSA is trying decipher the social networks of all 300 million people in the United States, scientists say, as such an effort would yield an impenetrable hair ball.

Instead, NSA is most likely fleshing out the social circles of suspects identified by other means. "If you have the data on everyone, then when you have reason to believe that Mr. X is someone of interest, you can go back and look at his behaviors," says David Lazer, a political scientist at Northeastern University in Boston.

NSA is hardly the only organization tracing social networks. Such work is done by the companies that generate the data, researchers say, and some, such as Twitter, sell their data. Valdis Krebs, a network scientist and the founder of Orgnet LLC in Cleveland, Ohio, says he did work for a phone company that worried its most highly connected subscribers might leave and take their contacts with them. The company hired Krebs to help identify those key customers so that they might receive perks—a task not dissimilar to unmasking the leaders of terrorist networks. "It's the same modeling, but where one group is looking for the nodes to get rid of, the other is looking for the ones to butter up," Krebs says.

Some scientists say that concerns over the NSA program are overblown. "Why do people get upset if the government is handling the data but not if a company is handling the data?" says Alessandro Vespignani, a physicist at Northeastern who, with support from the National Institutes of Health, has helped predict the spread of influenza. Uzzi says the government has its hands full hunting terrorists. "With all that going on, will they come after you and me?" he says. "It just doesn't make any sense."

But some see darker potentialities. Krebs that says his grandparents and parents lived in Latvia and suffered through the brutal repression of the Nazi and Soviet regimes. A modern-day Hitler or Stalin could use network analysis to target political opponents, he says. "People like that get this technology and it's over," he says. "This is the best way to find you and eliminate you." Lazer shares that concern. "It's not the government now, it's the government in 20 years or 40 years that one has to worry about," he says.

Others say that politically, the U.S. government is practically obligated to employ such techniques. If NSA didn't use them and another major terrorist attack occurred, then people would complain that the government hadn't done all it could to prevent the attack, Vespignani says: "We have the tools and we have the information. We have to use them. It's as simple as that." **–ADRIAN CHO**

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