Researchers work to protect, restore vulnerable networks

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Alon Efrat and his collaborators at Columbia University and the Massachusetts Institute of Technology have received NSF funding to determine ways to help telecommunications rebound quickly in the event of an electromagnetic pulse attack or natural disaster.

(PhysOrg.com) -- Alon Efrat, a University of Arizona associate professor of computer science, is working with a team of researchers on a project intended to help prevent a telecommunications meltdown in the event of an attack or natural disaster.

A nuclear weapon launched over the U.S. could create an electromagnetic pulse that would knock out access to power and electronics.

To prepare for this and other potential disasters, Alon Efrat and his colleagues are working on a newly funded research project fueled by the philosophy that telecommunications providers should be aware of system weaknesses and actively work to secure them.

Efrat, a University of Arizona associate professor of computer science, said the multi-institutional project is meant not only to protect networks, but also to help make them more resilient.

"We cannot protect each and every laptop," Efrat said, "but how can we help the system handle any miscommunication cause or restart functionality?"

That is the premise behind "Protecting Networks from Large-Scale Physical Attacks and Disasters," a project that recently earned a $454,000 grant from the National Science Foundation's Computer and Network Systems division.

Efrat, who will be working with Columbia University and Massachusetts Institute of Technology researchers, will receive $151,000 of the funding.

Part of the challenge will be in figuring out where attacks could occur.

The model-based project will involve developing techniques to detect vulnerabilities with the research team also devising plans and mechanisms to strengthen networks against attacks and help them bounce back quickly when unnatural failures occur.

"Looking at the probability of an attack is most challenging," said Gil Zussman, an assistant professor of electrical engineering at Columbia University and principal investigator on the grant.

In addition to studying system weaknesses, the team will evaluate the impact of attacks or disasters - both critically important features of the project, Zussman said.

Other team members include David Hay, a postdoctoral research scientist for Columbia University's electrical engineering department, and Eytan Modiano, an associate professor of aeronautics and astronautics at MIT.

Efrat, who specializes in computational geometry and in developing algorithms, said: "It is an invisible, but a vital world."

To understand the situation, let's talk worst case scenarios.

If an electromagnetic pulse, or EMP, attack were successfully carried out, electronics - cell phones, computer, televisions, fax machines, answering machines, modes of transportation and the like - would immediately cease to operate.

"Almost anything developed after 1980 would stop working," Efrat said, and it could take days to restore such infrastructure.

"We're talking about hospitals not being able to function, homes without electricity, traffic not being able to function. No life-sustainability services," he said. "It would be a long-term problem."

While a substantial amount of research has already been conducted on the resiliency of networks at the local level, the team is focusing, instead, on a broader scale and on effects that cause larger outages.

Specifically, the team will pinpoint networks in certain geographical regions across the nation to study their behaviors.

The issue is timely and of great concern, partially because networks are highly fragile, relying on complex chains and features that include optical fibers, amplifiers, routers and switches, Efrat said.

Additionally, if one failure occurs, it can affect other parts of the system.

Chiefly, the team's concern is with EMP attacks, but the group also hopes that the work will aid providers in the event of natural disasters, such as earthquakes, hurricanes and floods.

"We don't want to maintain YouTube traffic, but energy and power control," Zussman said. "We to to keep the system alive and keep the critical services and applications working."

Provided by University of Arizona