RAINing All Over the World

What do JPL space missions and the Chicago Stock Exchange have in common (other than a certain element of risk)? Well, for one thing, both have benefited from research done by Professor of Computation and Neural Systems and Electrical Engineering Jehoshua (Shuki) Bruck and his colleagues. Back in 1995, Bruck realized that the computer systems that ran spaceborne science missions were expensive because they had to be designed and built from scratch for each new mission. He began thinking about how to construct less-expensive systems using readily available, off-the-shelf components—PCs with commercial operating systems, for instance—that would be at least as reliable as the custom-designed variety.

The result was server-clustering software called RAIN—Reliable Array of Independent Nodes—which prototype use on networked video servers in Bruck’s lab (Fig. 1) proved it to be remarkably resilient to abuse. Individual computers could be unplugged and otherwise interfered with, yet the system would continue to operate. The secret was innovative algorithms developed by Bruck and his graduate students that allowed connections between servers to reroute, instantaneously and undetectably, whenever a machine went down.

As the Internet grew and developed, and personal computers became tools for communication as well as for computation and data storage, Bruck saw that his server-clustering software had commercial applications. In 1998, he patented and licensed RAIN. Then, with three of his grad students, he launched a new company, Rainfinity (in which Caltech is an equity holder) to develop Rainwall, software that lets gateway servers—computers at the interface between an organization’s internal network and the Internet—work cooperatively. Rainwall distributes network traffic evenly among firewall servers (one type of gateway server), thus reducing traffic bottlenecks and increasing the reliability of connections. A second product, Rainfront, also increases firewall availability, but adds Web server load balancing. Rainfinity’s first customer, the Chicago Stock Exchange, has since been joined by many other clients—among them Andersen Consulting (now Accenture), Advanced Micro Devices, Home Shopping Network, and Dresdner Bank Group. The company now has more than 90 employees, and offices in San Jose, London, Munich, and Pasadena.

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Double lines between the server icons (bottom screen) indicated that all network connections are intact.

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fig. 1

fig. 2

fig. 3

RAIN was initially tested and demonstrated on a group of networked servers in Bruck’s lab.