Innovation Research Awards from HP Labs for UC San Diego Faculty

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Amin Vahdat (left) and Geoffrey Voelker

Two computer scientists at the University of California, San Diego's Center for Networked Systems (CNS) are among 60 professors worldwide to receive awards as part of HP's 2009 Innovation Research Program, which is designed to create opportunities for colleges, universities and research institutes around the world to conduct breakthrough collaborative research with HP. Amin Vahdat and Geoffrey Voelker, professors in UC San Diego's Jacobs School of Engineering, were granted awards as part of this year's competitive open call for proposals.

"It is an honor for us to have not one, but two of our professors selected by HP Labs for this program that provides critical support for graduate student researchers in their labs," said Keith Marzullo, chair of the Jacobs School's Computer Science and Engineering (CSE) department, where both faculty members are based. "The projects they are pursuing have the potential to do great public good - from squeezing far more bandwidth at lower cost out of large clusters of servers, to delivering a critical blow to spammers who account for the bulk of Internet-based scams."

CNS Director Vahdat will collaborate with HP Labs on a research initiative focused on interconnecting commodity switches in a fat-tree architecture for clusters consisting of tens of thousands of nodes. "By leveraging strictly commodity switches, we achieve lower cost than existing solutions while simultaneously delivering more bandwidth," said Vahdat, who also holds the SAIC Chair in Engineering in the Jacobs School. "We also expect that our approach will be the only way to deliver full bandwidth for large clusters once 10 GigE switches become commodity at the edge, given the current lack of higher-speed Ethernet alternatives at any cost."

Amin Vahdat, Director, Center for Networked Systems and SAIC Chair of Engineering, Jacobs School

Vahdat's project, "A Scalable, Commodity Data Center Network Architecture", won an HP Labs Innovation Research Award last year. The 2008 award allowed his group to build a hardware-software prototype of a 36-PC scalable data center switch architecture. The 2009 grant will allow the researchers to shift the focus from prototype construction to building better scheduling algorithms for dynamically changing communication patterns in the data center. Vahdat and his graduate student also plan to complete specification, validation and implementation of a Location Discovery Protocol - so switches can automatically discover their location in a hierarchical, multi-rooted topology, based only on communication between pairs of locally connected switches and hosts.

"Our goal with this program is to collaborate with the brightest minds from around the world to tackle the industry's most complex problems and push the frontiers of fundamental science," said Prith Banerjee, senior vice president, Research, HP and director, HP Labs. "UC San Diego has demonstrated outstanding achievement and a vision that will help inspire technological innovation and address the most complex challenges and opportunities facing the industry in the next decade."

Geoff Voelker, who is a member of CNS and co-principal investigator on the National Science Foundation-funded Collaborative Center for Internet Epidemiology and Defenses (CCIED), will collaborate with HP Labs on a

project titled "Understanding and Exploiting Economic Incentives in Internet-based Scams". According to Voelker, the goal is to better understand the Internet's 'underground economy' and ultimately disrupt its activities.

Geoffrey M. Voelker, Associate Professor, Computer Science and Engineering, UCSD Jacobs School

To do so, he said, "we have developed a new technique called 'botnet infiltration' which allows us to measure directly the click-through and conversion rates of Internet spam campaigns in order to get a better understanding of the economics of unsolicited bulk email spam." Voelker, who says a large portion of today's Internet-based crime is fundamentally profit-driven, further explained that "over the last five years the capability of attackers to easily compromise large numbers of Internet hosts has emerged as the backbone of a vibrant criminal economy encompassing spam, phishing, click-fraud, digital denial-of-service (DDoS) extortion and identity theft."

Using messages from 'captured' spam bots, Voelker and co-PI Stefan Savage hope to derive the unique signature of the spammers - who are believed to be relatively few, but who may account for the bulk of spam worldwide. "A small number of organizations likely dominate the market," said Voelker. "Over the next year, our graduate students will help us develop a range of 'fingerprints' to identify different spamming crews while finding ways to undermine their economic models."

The UC San Diego recipients of the HP Labs Innovation Research Awards are affiliated with both CNS and the California Institute for Telecommunications and Information Technology (Calit2), and Voelker is a member of UCSD's Center for Wireless Communications. HP itself is one of eight corporate members in CNS, and is also an industry partner of Calit2.

HP reviewed nearly 300 proposals from more than 140 universities in 29 countries on a range of topics within the eight high-impact research themes at HP Labs - analytics, cloud, content transformation, digital commercial print, immersive interaction, information management, intelligent infrastructure and sustainability. This year 60 projects from 46 universities in 12 countries will receive awards.

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