

IMPACT IMPACT IMPACT IMPACT

Locking Down Cloud Computing

Wireless sensor networks increase flexibility in military and industrial settings, but they also raise the potential for nefarious elements to wreak havoc. Even **Dr. Peng Ning** (right), a good-natured professor of computer science at NC State not given to paranoia, sees threats everywhere. "Someone could pick up a sensor and reprogram it to send false signals. Attackers could use a powerful computer to overwhelm a network of sensors," he says. "Network security is critical."

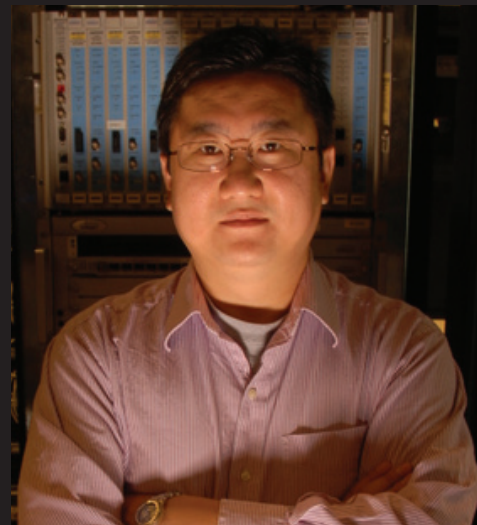
Wireless sensors are deployed, for example, by the military for battlefield surveillance and by a growing number of industries to monitor machinery vibration, fluid flow, and other systems. The minicomputers are smaller than a tin of Altoids, run on batteries, and use radio transceivers. When they're deployed, they relay messages to and from their closest neighbors, with one end of the chain communicating with a central computer.

"Sensors notify people when something in a manufacturing environment has changed, so they can repair it quickly. They could save lives by keeping troops aware of enemy activities."

But here's the problem: The sensors' small size and limited memory make them easy targets, Ning says, so his research team has developed a suite of security algorithms and open-source protection packages. These packages use advanced cryptography to secure a network and provide services across it, and include a minimal amount of code to avoid taxing the sensors' capacity. For example, Ning developed a message-specific puzzle, where certain pieces of data create a pattern, to ensure that only the network operator can program the sensors.

In 2008, NC State launched the **Secure Open Systems Initiative (SOSI)** to find ways to secure open-source software and computer systems, including computing clouds, against malicious attacks. These efforts are attracting considerable federal funding, says Ning, who is SOSI's technical director. Industry collaborators include Red Hat, IBM, Cisco Systems, and several federal agencies.

Ning and **Drs. Xuxian Jiang** and **Mladen Vouk** recently won a \$3 million National Science Foundation grant to develop security solutions for next-generation computing clouds. "Wireless sensor networks are just a small piece of the puzzle," Ning says. "We hope our work will make all open systems and clouds safe for users." ■



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Impact Bytes

Dr. Annie Antón (below), professor, has been named a **2009 Distinguished Scientist** by the **Association for Computing Machinery (ACM)**.



Dr. Tao Xie, associate professor, has received the **Sigma Xi Faculty Research Award**. He is the first NC State Department of Computer Science recipient of this award.

Dr. R. Michael Young, associate professor, has been named a **2010 Glaxo-SmithKline (GSK) Faculty Fellow** by the **Institute for Emerging Issues (IEI)**. He has also been named **Research Director** for 2009 for the **Triangle Game Initiative (TGI)**.

Dr. George Rouskas, professor, has been named an **IEEE Communications Society Distinguished Lecturer** for 2010 and 2011.

Ms. Margaret Heil, associate director for the Computer Science Senior Design Center and lecturer, has been named an **NC State Outstanding Teacher** for 2009-2010.

Nine faculty members: **Drs. Kemafor Anyanwu, Rada Chirkova, Patrick Dreher, Helen Gu, Christopher Healey, Xiaosong Ma, Mladen Vouk, Laurie Williams, and Tao Xie**, received **2009 IBM Faculty Awards** totaling \$267,000.

Co-mentored by **Dr. Nagiza Samatova**, associate professor, the team of **Neil Shah** and **Yekaterina "Katie" Shpanskaya** took second-place for their team research project in the nationwide **Siemens Competition in Math, Science and Technology**.

NC State Research Advances Voice Security Technology

Most people are familiar with security technology that scans a person's handprint or eye for identification purposes. Now, thanks in part to research from North Carolina State University, we are closer to practical technology that can test someone's voice to confirm their identity.

"The big picture is speaker authentication by computer," says **Dr. Robert Rodman**, professor of computer science at NC State and co-author of a new paper on the subject.

"The acoustic parameters of the voice are affected by the shape of the vocal tract, and different people have different vocal tracts," Rodman explains. "This new research will help improve the speed of speech authentication, without sacrificing accuracy."

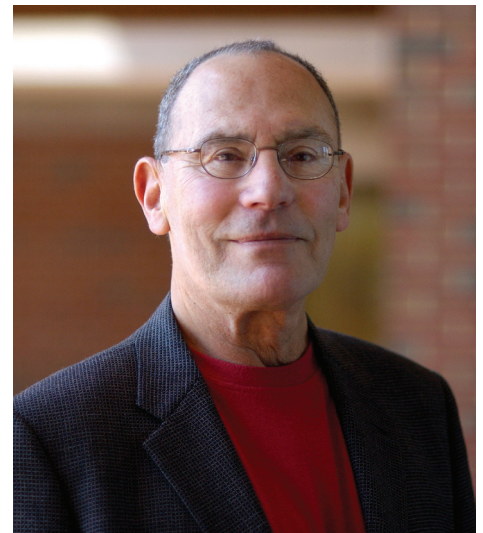
Rodman explains that speech authentication could have a host of applications in this age of heightened security and mobile electronics. "Potential users of this technology include government, financial, health-care and telecommunications industries," Rodman says, "for applications ranging from preventing ID theft and fraud to data protection."

Current computer models that are used to compare acoustic profiles, effectively evaluating whether a speaker is who he says he is, may take several seconds or more to process the information, which is still too long for the technology to gain widespread acceptance. "In order for this technology to gain traction among users," Rodman says, "the response

time needs to improve without increasing the error rate."

To address this problem, Rodman and his fellow researchers modified existing computer models to streamline the authentication process so that it operates more efficiently. "This is part of the evolution of speech authentication software," Rodman says, "and it moves us closer to making this technology a practical, secure tool."

The research was co-authored by NC State's **Rodman** (below); **Rahim Saeidi**, **Tomi Kinnunen** and **Pasi Franti** of the University of Joensuu in Finland; and **Hamid Reza Sadegh Mohammadi** of the Iranian Academic Center for Education, Culture & Research.



The research, "*Joint Frame and Gaussian Selection for Text Independent Speaker Verification*," was presented at the **International Conference on Acoustics, Speech and Signal Processing (ICASSP)** in Dallas, March 14-19. The research was funded in part by the **Centre for International Mobility**. ■

VCL to Provide Infrastructure for Advanced Analytics

The Computer Science Department and NC State are rapidly ramping up their analytics programs and research efforts. VCL (<http://vcl.ncsu.edu>) will be used to host a variety of analytics "clouds" ranging from security, to drug discovery, to climate, to analytics education, to patent mining, to business analytics in general, to analytics needed to quickly detect and analyze biological threats to public health and safety. ■

Forensic Science: Integrating Evidence CSI-style

Crime scene investigators on television make it all look quick and easy, and NC State faculty are doing their best to turn that bit of TV fiction into reality. Researchers in at least six of the University's colleges are using their talents to crack unsolved crimes and make it easier for police, prosecutors, and evidence experts to analyze crime scenes. "Most of us aren't forensic scientists," says **Dr.**



David Hinks, a professor of polymer and color chemistry in the College of Textiles (COT). "We're scientists putting our expertise to work in a forensic setting."

Dr. Ann Ross' expertise, for example, involves revealing information from the bones of slain people. A forensic anthropologist in the College of Humanities and Social Sciences, she examines skeletal remains to determine who they might belong to and how the victims might have died.

In the College of Agriculture and Life Sciences, entomology researcher **Dr. Geoff Balme** deals with bugs instead of bones. He studies the maggots and flies found at crime scenes. Meanwhile, Hinks and COT colleague **Dr. Keith Beck** are after better science to analyze fiber evidence found at crime scenes. They are creating a database of dyes used in various fabrics so law enforcement can link with more certainty a fiber found on

a victim to a fiber found in a suspect's car, home, or clothing. In the College of Management, **Dr. Mitzi Montoya**, Zelnak Professor of Marketing and Innovation Management, wants to make crime scene reconstruction and analysis more accessible to law enforcement.

Team members **Dr. Michael Young** (center in photo), an associate professor

of computer science in the College of Engineering, and **Tim Buie**, an assistant professor in the College of Design, are using video-game technology to trans-

late a 360-degree rendering of a crime scene captured with laser scanning and high-resolution digital photos into a scenario worthy of an Xbox 360 game.

The location of evidence and angles of witnesses and suspects can be plotted precisely, and investigators — even jurors — can "walk through" the scene later to see if eyewitness testimony agrees with the physical evidence.

"Crime scene investigation hasn't evolved much in decades, despite advances in forensic science," Montoya says. "NC State is speeding that evolution by introducing interactive, collaborative elements to take advantage of complementary expertise in high-tech fields." ■

Google DROID Donation to Aid Research/Teaching Efforts

Google has donated 120 **Motorola DROID** smartphones to the department to be used for research and teaching. The equipment donation, valued in excess of \$50,000, is a great example of how NC State partners with industry leaders to develop innovative real-world applications and solutions with cutting-edge technology. ■

Jiang Receives Prestigious NSF CAREER Award

Dr. Xuxian Jiang, an assistant professor of computer science at NC State University, has received a **Faculty Early Career Development (CAREER) Award** from the **National Science Foundation (NSF)**. This award, valued at \$424,166, supports his proposal "Towards Exterminating Stealthy Rootkits – A Systematic Immunization Approach".

Jiang becomes the **20th NSF CAREER Award winner for the department** (18th currently on faculty), one of the highest concentrations of such awards in any computer science department in the nation. ■

Perros Honored as IEEE Fellow for Achievements in Networking



Dr. Harry Perros has been named an IEEE Fellow by the Institute of Electrical and Electronics Engineers (IEEE) for his contributions to performance evaluation modeling of computer networks. He is a Professor of Computer Science, an Alumni Distinguished Graduate Professor, and the Program Coordinator of the MS degree in Computer Networks.

Perros becomes the department's fifth IEEE Fellow, following in the footsteps of **Drs. Donald Bitzer, Wushow "Bill" Chou, Mladen Vouk** and **Munindar Singh**, who were selected in 1982, 1987, 2001, and 2008 respectively. ■

NC State Computer Science

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Director of Graduate Programs -
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Director of Undergraduate Programs -
Dr. Dennis Bahler

**Editor / Director of Development &
External Relations** - Ken Tate

Associate Editor - Tammy Coates

Contributing Writers

Matthew Burns, Tammy Coates,
Nate DeGraff, Matt Shipman,
Ken Tate

Photographers & Graphics

Tammy Coates, Becky Kirkland,
Jessica Tate, Roger Winstead

NC State University Department of Computer Science

Campus Box 8206
Raleigh, NC 27695
Phone: 919-515-2858
Web: www.csc.ncsu.edu

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Computer Science

NC STATE UNIVERSITY

Bitzer Honored for Significant Achievements

Congratulations to **Dr. Donald Bitzer** who was an inaugural 2010 Inductee into the College of Engineering Hall of Fame at the University of Illinois at Urbana-Champaign. Bitzer was recognized as the inventor of the plasma display panel and co-inventor of PLATO, the first computer-based interactive multimedia educational network and home of the first online community. He was also honored at "PLATO@50," a conference held in June 2010 at the Computer History Museum in Mountain View, CA. ■



Gordons Establish Scholarships with a Service Twist

Computer Science alumna **Suzanne Gordon** (B.S. CSC '75, M.S. CSC '80) and her husband, **Ralph** (B.S. CE '72), have recently made a multi-year pledge to establish the **Gordon Family Scholarship Endowment**, which will provide an annual



award to an outstanding undergraduate pursuing a degree in computer science. A similar endowment has been created by the Gordons to benefit undergraduates pursuing a degree in the College of PAMS.

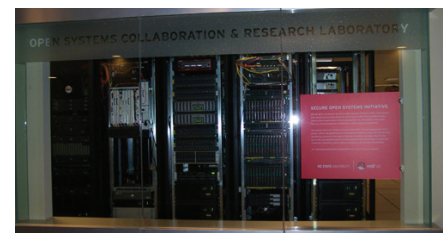
The two endowments will have a combined starting value of \$50,000, and when fully funded should generate \$1,000 each annually for awards. In the interim, as the endowments are maturing, the Gordons have made a commitment to fund annual awards allowing the first scholarships to be awarded starting this fall.

In the spirit of "paying-it-forward," both scholarship awards will require that recipients volunteer one hour per week as a tutor in math or computer skills at the SAS Learning Center at Kentwood, a

partnership program of Communities in Schools, or a similar community program for at-risk children and youth. ■

NetApp's Support Enables NC State's Next Generation Cloud Computing Research

The NC State University Department of Computer Science recently announced that **NetApp**, a Super ePartner with the department, has contributed hardware, software and services valued in excess of \$260,000 to the university to expand the **Virtual Computing Lab (VCL)** and build the next generation of cloud computing environments. NetApp has a dedicated team focused on higher education and this investment in NC State demonstrates its continued commitment to higher education.



"The North Carolina State University Department of Computer Science is pioneering innovative concepts in cloud computing," said Rich Clifton, senior vice president and general manager, Technology Enablement & Solutions Organization, NetApp. "It is great to see our innovative storage systems and data management capabilities enabling breakthroughs in cloud computing research and development at NC State." ■