

CSE Pipeline

MICHIGAN STATE
UNIVERSITY

Department of Computer Science and Engineering | www.cse.msu.edu

RAPIDware Project Awarded Additional \$1.3 Million

On August 14, 2003, a malfunction in a computer alarm system at an Ohio power company precipitated what is possibly the worst blackout in history. Failures cascaded through the power grid in the United States and Canada, plunging an estimated 50 million people in the North American upper Midwest and Northeast into darkness. Estimates of total cost to the United States alone range between \$4 billion and \$10 billion.

This disaster underscores the degree to which business transactions, government operations, and our national defense systems are increasingly dependent on a complex network of interconnected *critical infrastructures*—transportation systems and power grids, financial networks, emergency response systems, and command and control systems.

The U.S. Office of Naval Research (ONR) recently awarded \$1.3 million to the CSE department's Software Engineering and Network Systems Laboratory to continue work on the RAPIDware project, which addresses the need for high-assurance adaptable software to protect critical infrastructures under extreme operating conditions, component failures, and cyber-attack. This award brings funding for the five-year project to \$3.1 million through the ONR Critical Infrastructure Protection (CIP) competition.

"The need for adaptive computing systems is driven primarily by two ongoing revolutions in the computing field," says Philip McKinley, professor of computer science and engineering and the project's principal investigator. "First, *pervasive computing* removes traditional boundaries for how, when, and where humans and computers interact. To accomplish this goal, a computer system must adapt to changes in the environment as it is executing," McKinley says. "Second, *autonomic computing* enables a system to monitor and control its usage of scarce resources with minimal human guidance. This capability enables the system to plan how it should adapt."

Pervasive computing and autonomic computing are priorities for ONR because both are important to national defense and homeland security. Operating conditions in a network-centric battlefield are highly variable, requiring software in mobile devices carried by soldiers to balance conflicting concerns—for instance, the quality of service on

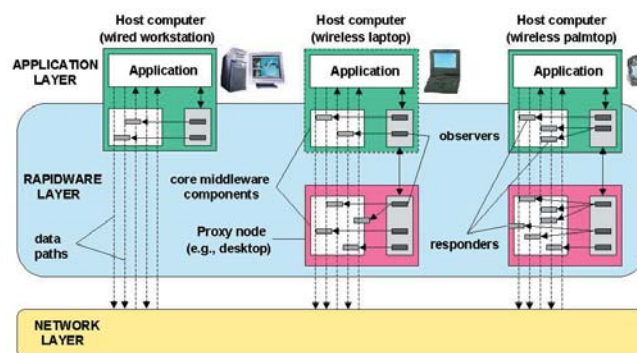
wireless connections, changing security policies, and energy consumption. In addition, an automated response is more predictable and can take significantly less time than a human response, especially under stress. The more human guidance a system needs, the more susceptible the system is to failure due to human error and delay.

The RAPIDware project focuses on designing adaptive *middleware*, which is the layer of services that mediate between an application program and the underlying operating system and network. "The traditional role of middleware is to hide concerns relating to the distribution of resources and differences in computing platforms from applications," explains McKinley. "Thus, middleware is also an ideal place in which to put concerns relating to adaptation, such as monitoring and adjusting quality of service, energy consumption, responses to faults, and security policies."

The project investigates the use of various formal methods to assure that adaptations are safe, including automatic generation and integration of adaptive code from formal specifications, and automated verification of specifications and of generation and integration techniques.

In addition to McKinley, senior project investigators are Betty Cheng, professor; Laura Dillon, professor and interim CSE chair; Sandeep Kulkarni, assistant professor; and Kurt Stirewalt, associate professor. The project also supports 10 graduate research assistants.

Additional information on the RAPIDware project is available at <http://www.cse.msu.edu/rapidware>.▲





Laura Dillon

Message From the Chair – The CSE Vision

My first year as chairperson has already passed by. In some ways it seems like many years have elapsed, yet in most ways it seems like just days have gone by. Where has the time gone? And what have we been doing?

In short, we've spent the past year engaged in strategic visioning, preparing

for an exciting future in computing and information technology, both for the department and for the entire university.

Computing and information technology are revolutionizing every aspect of our world at unprecedented rates. While computing and information technology were once applied to merely a few disciplines, today they have become fully integrated into almost every discipline and hence into every program, department, and college at the university. Entirely new disciplines and new academic programs are emerging as we move forward.

Today, our department stands in a position of both great privilege and great responsibility. We are greatly privileged because we are at the epicenter of these exciting activities. Yet, we realize that this privilege comes with the equally great responsibility of providing vision and leadership for computing and information technology for all of Michigan State University.

As part of our year-long process, we asked ourselves: As a department, where have we been? Where we are now? And where do we need to go?

As a university, what are the strategic opportunities? Who are the computing and information technology leaders on campus? And how do we form partnerships to make things happen?

As a result, we have an exciting new strategic vision for computing and information technology for both the department and the entire university. Among other things, our vision calls for the unification of computing-centric research and instructional activities to ensure that the university is able to anticipate and foster global changes in the landscape of this dynamic field.

Our faculty are already providing leadership across campus through research and teaching in a variety of emerging areas. Faculty from CSE are partnering with faculty from various other departments—history, criminal justice, biology, and philosophy. We are working on the development of innovative curricula and programs. CSE continues to lead the Consortium for CyberSecurity (CCS) in collaboration with the School of Criminal Justice. Additionally, this year we will spearhead a campus-wide workshop to inform the campus community of opportunities presented by the revolution in computing and information technology and to build support for our vision.

Since formulating this vision, we have been engaging our stakeholders both on and off campus in an ongoing dialog. We invite you—as one of our stakeholders—to read our vision statement online at <http://www.cse.msu.edu/Vision2003>. We welcome your comments and suggestions.▲



Von Ehr Receives MSUAA Distinguished Alumni Award

James Von Ehr II (BS '72), of Richardson, Texas, is the recipient of a Distinguished Alumni Award, the highest award bestowed by the MSU Alumni Association. He received the award during the Alumni Grand Awards Ceremony at MSU's Kellogg Hotel and Conference Center on October 14, 2004.

Von Ehr is the founder, chairperson, and chief executive officer of Zyvex Corporation, the first molecular nanotechnology company. He was instrumental in the passage of the 21st Century Nanotechnology Research and Development Act, which authorizes nearly \$3.7 billion for R&D programs for four years; he was present in the Oval Office on December 4 when President George W. Bush signed the bill into law. He also contributed \$3.5 million to establish the NanoTech Institute of The University of Texas at Dallas and endowed the James Von Ehr Distinguished Chair of Science and Technology for Nobel Laureate Alan G. MacDiarmid.

Prior to founding Zyvex, Von Ehr was founder, president, chairman, and CEO of Altsys Corp., the developer of FreeHand and Fontographer (the first PostScript drawing program). He sold the company to Macromedia in 1995.

Digital Evolution Brings Understanding of Ecological Diversity

In finding an answer to “perhaps the greatest unsolved ecological riddle,” evolutionists propose that diversity is a testament to there being more than one way to make a living.

The riddle: Why are some habitats loaded with many more species than others?

The answer: Nature and evolution respect that there’s more than one way of doing things.

“What we’ve learned,” says Charles Ofria, assistant professor of CSE, “is that if there isn’t just one way to succeed, you’ll see diversity.”

An article published in the July 2 issue of *Science* describes how an interdisciplinary team of scientists at MSU, the California Institute of Technology, and Keck Graduate Institute (KGI), with the help of powerful computers, used a kind of artificial life, or ALife, to gain insight into questions of evolution.

Up to a point, organisms that are overachievers at what they do to survive — consume resources — will find there’s a ceiling to their good performance. Once they run low on resources, their ability to dominate loses steam, and other hard-working organisms have a chance to get a foothold in the habitat.

Ofria gives the example of an ambitious organism that eats glucose, a type of sugar. That organism is a glucose-eating machine, and the more it eats, the more it reproduces and dominates. But eventually, there are so many hungry organisms that glucose starts to run out, so the population’s growth slows.

Meanwhile, he says, mutant fructose-eating organisms, which maybe aren’t quite so vociferous, haven’t run out of food. While their greedy neighbors are suffering from glucose famine, they are able to thrive and gain a foothold.

“We show why more than one species can exist in a place,” Ofria says. “We’ve found that in a place where resources are finite, there are limiting effects of productivity.”

The ALife program, called Avida, is basically an artificial petri dish in which organisms not only reproduce, but also perform

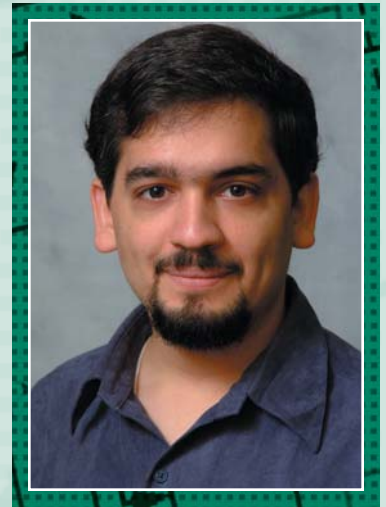
mathematical calculations to obtain rewards. Rather than sugar, their reward is more computer time that they can use for making copies of themselves. The digital organisms come in different “species”—identifiable by the mathematical functions they perform.

The digital bugs evolve at lightning speed, and they leave tracks for scientists to study. “These experiments allow us to look at long-standing questions in ecology, such as why certain environments support more species than others,” says Richard Lenski, MSU Hannah Distinguished Professor of microbial ecology and a co-author. “With Avida, we could look at changes in species diversity across thousands of generations, and see how the ecological relationship between environmental productivity and species diversity could be understood from an evolutionary perspective.” Ofria points out that the evolutionary scenarios can be seen in the real world.

The research seeks to answer questions of evolution that are a piece of the puzzle of understanding ecology. “The better we understand how our world came about, we can begin to understand how to deal with it,” Ofria says. “Diversity is important to understand.”

In addition to Lenski and Ofria, the team consists of Stephanie Chow, graduate student in Computational & Neural Science at Caltech; Claus Wilke, research assistant professor at KGI; and Christoph Adami, professor of applied life sciences at KGI.

The research is funded by the National Science Foundation under its biocomplexity initiative, with additional funding from the MSU Foundation and KGI.▲



Charles Ofria

—Sue Nichols, University Relations

CSE Teams Up with Criminal Justice to Offer Innovative Program

The Department of Computer Science and Engineering and the School of Criminal Justice have teamed up to launch an innovative academic program that combines the two disciplines. In addition to computer science courses, students will take criminal justice courses covering topics like criminology, investigative procedures, cybercrime, identity theft, and computer forensics.

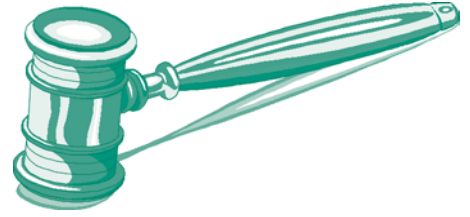
“Our graduates already have the skills needed to detect and stop cybercriminals,” says Laura Dillon, CSE interim chair. “This new program will provide our students with the additional skills required to investigate and build a case that can be prosecuted.”

According to Edmund McGarrell, director of the School of Criminal Justice, “The demand for people with skills that bridge computer science and criminal justice is very large and growing daily. Unfortunately, the supply of such people is almost non-existent. The graduates of this program will be highly sought after by both the private and public sectors.”

Thad Greene, a senior in the program, will be one of the first students to complete a computer science major with a criminal justice cognate. “MSU has provided me with a unique educational experience, including a new computer science course in computer security along

with courses in criminal justice,” says Greene.

“This new program will make me very marketable, providing me with a variety of excellent career opportunities.”



“This program represents one of a number of innovative initiatives in cybersecurity throughout MSU,” says Anthony Wojcik, professor of computer science and engineering and director of MSU’s CyberSecurity Initiative, a team of world-class, interdisciplinary researchers from across the MSU campus working in collaboration with industry and government to lead the state and the country in cybersecurity research. (See <http://ccs.cse.msu.edu> for more information about the MSU Cyber Security Initiative.)

“Cybersecurity, cybercrime, and cyberterrorism are important aspects of homeland security,” says MSU Provost and President Designate Lou Anna K. Simon. “This program not only provides our students with outstanding career opportunities, it also meets the growing needs of our state and our country. Innovative programs like this are core to our land-grant mission.” ▲

Legislative Day Showcases CSE Work



Associate Professor Matt Mutka (center) explains how the haptic remote-controlled robot works during an event held in Lansing, Michigan, to demonstrate to government policy experts and legislators the many research and education applications that depend on the high-speed Internet. At far right is Ning Xi, professor of electrical and computer engineering, co-director of the research project.

High-speed Internet access is the new superhighway and, like the interstate highways, this new superhighway is critically important to Michigan’s economic future. On June 1, 2004, in Lansing, Michigan, Merit Network and Internet2 sponsored “Networking for Michigan’s Future” to showcase research and education applications that depend upon the high-speed Internet.

A joint project between Michigan State University, Michigan Technological University, and the Chinese University of Hong Kong — “Haptic Remote Control of Robots” — was among the research featured at the event. Over the Internet from Lansing, visitors were able to remotely control robots at the three universities.

Matt Mutka, associate professor of computer science and engineering and one of the project directors, explains, “Our research on haptic interfaces will enable users to not just see and hear over the Internet, but also to experience touch. Touch is important in performing many critical activities. Haptic interfaces may one day allow an expert located in a major medical facility to conduct surgeries and examinations in remote locations via the Internet.”

Ning Xi, professor of electrical and computer engineering, co-directs this research with Mutka. ▲

Faculty and Staff News



Joyce Chai, assistant professor, received the prestigious NSF CAREER Award for her project “Learning and Optimization for Robust Multimodal Interpretation in Conversational

Systems.” Multimodal systems allow users to interact with computers through multiple modalities such as speech, gesture, and gaze. This project seeks to improve the robustness of multimodal interpretation through automated knowledge acquisition and probabilistic reasoning.



Cathy Davison (left), secretary to the chairperson and office supervisor, received a 2004 Gloria Stragier Award for Dedicated and Creative Service. She has provided more than 17 years of exemplary service to CSE. Tom Wolff, associate dean for undergraduate studies, presented the award.

Laura Dillon, professor and interim chair of CSE, joined the editorial board of *Transactions on Software Engineering and Methodology (TOSEM)*, one of the family of journals produced by the Association for Computing Machinery (ACM).



Wayne Dyksen, professor, has been appointed associate director of MATRIX: The Center for Humane Arts, Letters, and Social Sciences Online at MSU.

Richard Enbody, associate professor, was in the local news. In the lead story on FOX 47 *News at 10:00* on Thursday, May 7, 2004, he discussed the security of electronic voting. This fall, Enbody joined the MSU College of Law’s Intellectual Property & Communications Law program.

Abdol Esfahanian, associate professor, was recognized for over a decade of service as CSE graduate program director.

Herman Hughes, professor—along with other MSU scientists and engineers—gave tips and advice to Michigan youths about what it takes to be a scientist (*Lansing State Journal*, February 11, 2004).



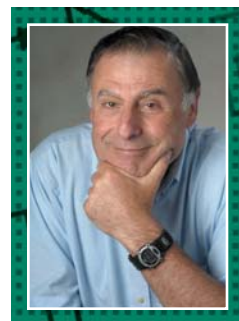
Anil Jain, University Distinguished Professor, was named a 2003 fellow of the Association for Computing Machinery. The ACM Fellows Program recognizes

outstanding ACM members for their achievements in computer science and information technology and for their significant contributions to the mission of the ACM.

He also co-authored *Handbook of Fingerprint Recognition* with Davide Maltoni, Dario Maio, and Salil Prabhakar (Springer 2003), which received the 2003 Professional Scholarly Publishing Award given by the Association of American Publishers.



Charles Owen (left), assistant professor, received a 2004 Withrow Teaching Excellence Award. Owen is an inspiration to his students. By his example and commitment, he makes a difference — a true exemplar of MSU’s motto: “Advancing Knowledge. Transforming Lives.”



George Stockman, professor, was one of several MSU scientists and engineers to engage the next generation at Science Career Day, sponsored by the Woodcreek Magnet Elementary

School. He used a computer game relating to how computers “remember” information in order to illustrate whether computers “think.”

Teresa Isela VanderSloot joined the department this summer as an academic specialist/adviser. She received a BS degree from Grand Valley State University and an MS in administration from Central Michigan University. She has 11 years of experience working in higher education. Previously, she was an academic specialist in the Eli Broad College of Business, a complex director with Residence Life at MSU, and the coordinator of student development with Housing and Residential Life at California Polytechnic State University in San Luis Obispo.

April 2004 saw the birth of the first newsletter of the Autonomous Mental Development (AMD) Technical Committee of the IEEE Neural Networks Society. Chaired by **Juyang Weng**, professor, the newly created AMD Technical Committee consists of leading researchers in artificial intelligence, neuroscience, psychology, robotics, and other related fields.▲

Kevin Ohl Receives First CSE Distinguished Alumnus Award

Kevin Ohl was the first recipient of the new CSE Distinguished Alumnus Award, which was presented at the College of Engineering Awards Banquet on May 8, 2004. This annual award recognizes an alumnus of the CSE department who has distinguished himself/herself as a leader through professional contributions, public service, and personal accomplishments.

Ohl is an executive with Crowe Chizek and Company LLC, a top ten accounting and consulting firm, and a partner with Crowe Group LLP. He joined the firm after earning his BS in computer science in 1978 and his MBA in accounting in 1981, both at MSU. He is a registered CPA in the State of Illinois.

Throughout his career, he has provided a variety of services to Crowe Chizek clients, including strategic planning, technology planning, and technology implementation services; he has helped set standards for software development and implementation of IT systems. Today, he leads Crowe Chizek's efforts related to state and local government technology consulting in the state of Illinois.

Ohl has also been involved with both professional and community groups. He has presented at various conferences and served on technology advisory boards. His community activities include providing fundraising leadership for United Way and serving as auction chairperson for public television station WNIT. He has also been active in youth sports coaching.

He was heavily involved with the computer science department even before becoming an active alumnus. He served in a number of roles as an undergraduate, starting as a teaching assistant during his sophomore year and eventually becoming a course administrator for the entry-level computer science courses.

He still works closely with the CSE department. He is the founder and sponsor—through Crowe Chizek—of CSE's semiannual graduation breakfast



Laura Dillon (left), CSE interim chair, presents Kevin Ohl with the first CSE Distinguished Alumnus Award.

(see article on page 7). He also serves on the CSE department's strategic partner council and is a member of the College of Engineering alumni board.

He and his wife, Sue, are Hannah Society members. He has spearheaded the creation of two endowed scholarship funds for MSU CSE students—the Crowe Chizek MSU Alumni Endowed Scholarship Fund and the Emerson and Dorothy Ohl Scholarship Fund. In addition, he makes a financial contribution to the CSE department for each graduate that joins Crowe Chizek.

"An inspiring speaker, tireless advocate, and sagacious counselor, Kevin has become a treasured friend to all of us in CSE—faculty, staff, and students alike—who have come to know him," says Laura Dillon, professor and interim chair of computer science and engineering. "He is CSE's most engaged alumnus."

Ohl's family includes daughter Alison, and son Nicholas; father Emerson; and siblings Jennifer, Dana, Lynnea, Tracey, Cameron, and Colin.▲

Record Attendance at the Spring Graduation Breakfast

The tradition of the CSE graduation reception continued this past year, thanks to the generosity of Crowe Chizek and Company LLC. This event, which celebrates the achievements of graduating students, has been a highlight of every graduation weekend since fall semester 1996. Attendance at the spring reception reached an all-time high of 150 computer science graduates, family members, CSE faculty, and friends. The event included a breakfast at the Kellogg Center, a presentation of the graduates, and talks by several notable speakers.

Graduating senior Bobby Joe Glover gave an inspiring talk about achieving one's goals in spite of unforeseen obstacles and periods of self-doubt. He shared highlights of his experiences as an undergraduate student — heartwarming lessons in succeeding through perseverance and hard work.

Graduate student Anoop Namboodiri spoke of the excellent education that he received in CSE. He recounted how he once astounded a Microsoft recruiter by giving a better solution to a problem than the one recruiter himself had figured out. Namboodiri confided that similar problems had been covered in the algorithms course taught by Associate Professor Abdol Esfahanian.

Kevin Ohl, senior executive with Crowe Chizek, was the keynote speaker. From the perspective of a successful alumnus, he urged graduates to set high goals, hold themselves and others to high ethical standards, become lifelong learners, and stay connected with CSE at MSU.

In addition to the talks, graduating senior Shailesh Saini was recognized for outstanding academic achievement, outstanding service, and devotion to CSE.

In her closing comments, CSE Interim Chair Laura Dillon recognized Jane Evorian, academic specialist, for outstanding counseling, nurturing, and professional development of the accomplished men and women who graduated later that day. Evorian, who relocated to California this summer, will be missed.▲



Keynote speaker Kevin Ohl urged graduates to be all that they can be and to stay connected with MSU.



Graduate student Anoop Namboodiri spoke of the excellent education he received in CSE.

Student News

The MSU Student Chapter of the Association for Computing Machinery won the 2003-2004 ACM Student Chapter Excellence Award for Outstanding Chapter Website (<http://www.acm.msu.edu>). **Maciej Skierkowski**, an undergraduate student in CSE and “Webmaster Extraordinaire,” was responsible for creating and maintaining this labor of love, with much input, cajoling, and harassment from the MSU Chapter’s 55 student members.

“Non-linear Manifold Learning for Data Stream,” by **Martin H.C. Law**, **Nan Zhang**, and **Anil Jain**, was named the Best Student Paper at the 2004 SIAM International Conference on Data Mining (SDM) in Orlando. Law and Zhang are PhD students; Jain is a professor in CSE.

“On Quality-of-Service and Energy Consumption Tradeoffs in FEC-Encoded Wireless Audio Streaming,” by **Zhinan Zhou**, **Philip McKinley**, and **Masoud Sadjadi**, won the Best Student Paper award at the 12th IEEE International Workshop on Quality of Service. Zhou and Sadjadi are PhD students; McKinley is a professor in CSE.▲

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