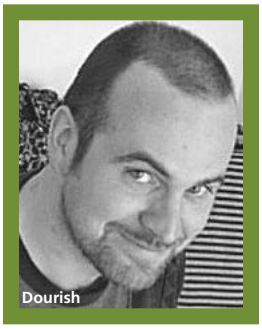
ISR*Connector*

INSTITUTE FOR SOFTWARE RESEARCH / UNIVERSITY OF CALIFORNIA, IRVINE

HOT RESEARCH

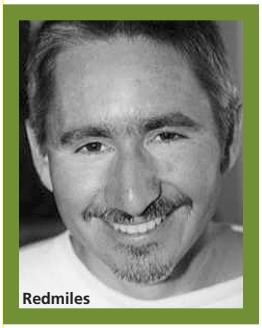
ISR Leads the Way with Research on Web Security and Privacy

Web security is a thorny problem, but of critical importance given our shrinking world and terrorist threats. ISR researchers are actively seeking practical, real world solutions to computing security and privacy problems. Solutions must consider system isues, human and organizational issues, as well as technical matters. ISR's enduring research strengths in all these areas promise leading edge yet practical results.


Dourish

Profs. **Paul Dourish** and **David Redmiles** are working on one such far-reaching research project emphasizing effective security. They draw a distinction between *theoretical security* and *effective security*, best illustrated by examples drawn from their research:

- A research group designing a system for mobile code needed a security solution. A highly qualified academic security expert designed and implemented an elegant scheme based on SPKI/SDSI in which the system servers would determine transaction rights based on cryptographically secure certificates exchanged over an SSL RPC infrastructure. However, in actual use, this resulted in a performance reduction of 5-10X. As a result, in day-to-day use, everyone simply turned it off, rendering the system less secure than it had been in the first place.
- A research laboratory used S/Key one-time pads to allow terminal access through a firewall host. Researchers would periodically use private passwords and local client programs to generate themselves new one-time password pads. However, the system was soon discontinued when it became clear that people could not tell whether their connections were secure enough to make it safe to generate the new pads.
- Norton's Anti-Virus software offers an option to check incoming email for viruses before you download it to your computer. The actual mechanism for doing this is not directly disclosed. When this option is turned on, the user's login and password are sent to a Norton server, which downloads the user's email and reads it, checking for viruses, before sending it on to the user. Inserting Norton's own servers as an intermediary makes great technical sense, allowing Norton to respond rapidly to new virus attacks. However, users are typically shocked to learn that their password and their email are being shared with Norton; it damages their trust in the system and in the software.


Redmiles

The goal of the Dourish/Redmiles research is to provide new software that improves not only theoretical but also effective security by allowing the user to constantly assess and adjust the amount of security needed to get individual tasks accomplished. Their novel approach combines and incorporates visualization and event monitoring technologies into user-friendly everyday practice. ISR researchers have been studying and applying these technologies for many years.

Visualization is an approach based on creating rich visual representations of information. In doing so, it capitalizes on human visual and perceptual skills, our ability to recognize patterns and to process large amounts of visual information with little cognitive

RESEARCH BRIEFS

Walt Scacchi and ISR colleague **Les Gasser** (U. Illinois, Urbana-Champaign) have received an NSF Information Technology Research (ITR) grant for $750,000. The three-year study on the organizational dynamics of open source software system quality will examine problems, bugs, failures, and repairs. This is Scacchi's second ITR award.

Alfred Kobsa gave the keynote presentation at the 7th ERCIM Workshop in Paris recently (October, 2002); his talk was entitled, "Universal Access and Privacy" — *http://www.ics.uci.edu/~kobsa/talks/talks.htm*

Gloria Mark, Alfred Kobsa and **Victor Gonzales** presented a paper at the Fifth International Conference on Information Visualization, London, July 2002; "Do Four Eyes See Better than Two? Collaborative versus Individual Discovery in Data Visualization Systems" — *http://www.ics.uci.edu/~kobsa/papers/2002-IV02-kobsa.pdf*

From ISR Computer Game Researchers:

Walt Scacchi was recently named Associate Director for Research in the Cal(IT)^2 Laboratory for Computer Game Culture and Technology. ISR is a partner in the multi-campus State-funded California Institute for Telecommunications and Information Technology—Cal(IT)^2 . The Game Lab involves an interdisciplinary team of faculty and students from UCI, including the Arts, Computer Science, and Engineering Schools.

Just for fun: Announcing the official release of the "Problems and Programmers" card game: *http://www.problemsandprogrammers.com*

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DID YOU KNOW?

ISR is the only organized research unit (ORU) within the University of California (UC) system focused on software research.

NSF Awards ISR $1.8 million for Distributed Software Development Research

The National Science Foundation has awarded $1.8 M to a team of ISR researchers. The five-year Information Technology Research (ITR) grant, entitled "An Integrated Social and Technical Approach to the Development of Distributed, Inter-organizational Applications," includes four industry partners: the Advanced Power and Energy Program (APEP) Consortia; NASA's Jet Propulsion Laboratory (JPL); Boeing; and SRI's Center for Technology in Learning (SRI-CTL). In a nutshell, ISR researchers seek new ways for distributed multi-organization teams to build and evolve software for use by distributed inter-organizational systems.

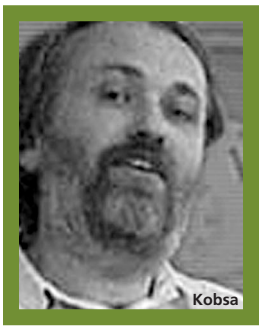
Today, software applications commonly span worldwide company business units, multiple companies, various regulatory agencies, and consumers, involving thousands of interacting computers. Application development for these complex interactions needs a whole new set of supporting methods and technologies. ISR is tackling this challenge with an interdisciplinary and far-reaching research agenda. The ultimate goal is to transition new knowledge and technology into widespread practice.

The ISR ITR research recognizes the multidimensional nature of distributed software development in today's world. Therefore, both social and technological concerns will be of equal importance in this research project. From the social perspective, these concerns involve organizational settings where migratory work is common, applications and work context change on a regular basis, and tradeoffs between information sharing and privacy concerns are continuously made. From the technological perspective, novel approaches are needed to overcome inter-organizational challenges. The emergence of new, highly adaptive software architectures and event-based technologies, as well as fresh applications of enhanced coordination and awareness technologies, are highly promising long-term solutions.

The first step in this research is to understand how distributed software development needs are changing. To that end, we have turned to our external collaborators, who will not only serve as a source of real-world problems, but will also work directly with us in developing strategies and solutions, and serving as test-beds for early evaluation of new technologies. ISR researchers are currently defining research agendas with our collaborators.

effort. For example, we find it much easier to pick out a white object in a sea of black than to pick out an even number in a field of odd numbers. Dourish and Redmiles are creating visual representations of the dynamic security state of software systems and infrastructures, providing users with a continually-available peripheral display of the context in which they are working.

Event monitoring and routing architectures are a basis for scalable, loosely coupled distributed software systems. This loose coupling is an appropriate model for the many different distributed components that make up a system's security configuration, including end-point software systems, routers, network protocol handlers, and more.


Kobsa

Prof. **Alfred Kobsa** and his research team also consider the human and system issues while investigating technical opportunities. Three projects explore several aspects of electronic privacy.

- Personalized web sites collect large amounts of personal information to be able to cater to each individual user's needs. This research project examines and documents privacy requirements for personalized web systems stemming from national and international privacy regulations.
- Distance electronic collaborators need policies for information distribution that are sensitive to individual privacy preferences. A software tool that recognizes conflicts between demands for group awareness information and privacy preferences, and helps workgroups negotiate a compromise, is the solution sought by this research project.
- A third project explores ways to keep web site users anonymous while fully preserving personalized interactions with them. Advanced privacy safeguards are the goal of this research, in that both users as well as the user modeling system that maintains personal data remain anonymous. This approach is expected to lead to more user trust in anonymity, which in turn will lead to more extensive and frank interaction, more and better user data, and to better personalization.

As the Internet expands and we move into an era dominated by distributed applications and "Web services," information system security and privacy concerns will continue to impede user-friendly practical applications. While progress in the foundations of theoretical security is impressive, ISR is tackling a much broader picture in the real world of people, technology, and organizations.

For more information on these and related ISR research projects, see *http://www.isr.uci.edu/research-privacy-security.html* and *http://www.isr.uci.edu/research.html*

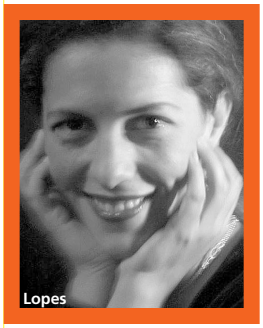
DID YOU KNOW?

ISR researchers have garnered a total of 4 NSF Information and Technology Research grants.

FOCUS ON FACULTY

Meet Crista Lopes, "the Mother of AOP"

Cristina ("Crista") Videira Lopes (*http://www.isr.uci.edu/~lopes/*) is an Assistant Professor of Information and Computer Science at UC Irvine. Prior to joining the ICS Faculty this year, she was a member of the Research Staff at the Xerox Palo Alto Research Center (PARC) (*http://www.parc.com*). Crista was a founder of the group that developed Aspect-Oriented Programming (AOP) and AspectJ (*http://aspectj.org*); for that reason she is known as "the mother" of AOP. Her Ph.D. thesis on programming language support for distributed systems was the first AOP-related thesis, and she co-wrote the seminal AOP paper published at ECOOP'97 (*ftp://ftp.ccs.neu.edu/pub/people/crista/publications/ecoop97/index.html*). For a number of years, she acted as one of the main evangelists for AOP technology, giving invited talks and organizing workshops at academic and industry conferences. More recently, she has also been working in Ubiquitous Computing with a focus in


Lopes

communication mechanisms that are pervasive, secure, and intuitive for humans to perceive and interact with. Though with diverse interests, her research is always related to languages and communication systems. Lopes joined ISR in Sept. 2002. She can be reached at lopes@ics.uci.edu, (949) 824-1525.

ISR Internship at JPL Applies ISR Technologies to Space Missions

No strangers to practical applications of their studies, ISR graduate students often seek work opportunities during their school years that further their research projects, hone their skills, and apply their knowledge in the real world, while earning income for school expenses.

Georgas

Exemplifying this trend, **John Georgas** spent the past summer as an intern working closely with scientists at NASA's Jet Propulsion Laboratory in Pasadena. Georgas, whose advisor is ISR Director **Richard N. Taylor**, is a third year doctoral student in Information and Computer Science (emphasis on adaptable software architectures) at UCI.

Working with two different JPL groups, Georgas adapted and applied several ISR architecture technologies. JPL used these technologies to support their software development efforts. The internship projects verified the generality of the ISR technologies and the ease with which they can be adapted to the needs of a demanding organization.

In one project, Georgas integrated ISR's extensible software architecture language xADL 2.0 into the software development framework used by JPL's Mission Data System (MDS) software engineers. The MDS group models and supports space mission software. To accommodate these applications, extensions to xADL 2.0 schemas were created and associated tools (Apigen and Archstudio 3.0) were enhanced, such that component structure and software architecture interfaces would be visible and useable by the MDS system architects. In addition, the MDS group's need to keep existing software engineering capabilities was accommodated. For example, MDS uses code generators to lighten the load of code development and enforce a degree of consistency between the architectural model and the actual software system implementation. Integrating ISR tools with MDS code generators and similar tools enhanced overall useability for the JPL software engineers, and enabled their use of advanced software architectural concepts and analytical techniques.

In a second project, xADL 2.0 and Archstudio tools (including the Critic framework) were used to model elements of a space mission from beginning to end and from multiple perspectives. Georgas worked with the Consultative Committee for Space Data Systems (CCSDS) group on this project. JPL is a liaison member of CCSDS, an international consortium of space agencies cooperating to develop worldwide, standardized space data systems. Whether it be an international or national effort, planning and implementing a space mission is complex. Missions include diverse elements such as software control, custom designed hardware, multiple organizations, and scientific goals. Many of these elements are tangible (e.g., hardware and spacecraft), but others are less tangible: organizational collaborations, funding sources, or centers of expertise. Many of the tangible elements had been modeled, but a more globally representative and comprehensive model was needed. Using adapted ISR technologies, Georgas and the JPL/CCSDS team clarified the dependencies and relationships among and between both the tangible and non-tangible elements of the model. Two major benefits accrued to the new model: (1) a common base of interaction, coordination, and communication between the people working on varied aspects of a space mission; and (2) the creation of a standard, unified model and development environment for the design and implementation of space missions.

Future collaborations between the JPL MDS group and ISR are planned to expand these applications. The ongoing relationship between John Georgas and JPL exemplifies just one of the many benefits of ISR-industry internships. For industry, hiring an ISR intern can serve to:

- Invigorate your staff with fresh ideas and perspectives on company problems and issues.
- Enhance your knowledge base with advanced technological and academic software skills.
- Build relationships with interns and their faculty advisor(s), thereby gaining direct access to current research and applied expertise.
- Enable projects that otherwise wouldn't be resourced in house.
- Create an ambassador (your intern) who will convey positive information about the interning company to ISR and campus colleagues.
- Link to leading edge technologies, providing IP opportunities.
- Demonstrate your support for education.

Georgas can be reached at jgeorgas@ics.uci.edu.

For help in hiring an ISR student intern, please contact Susan J. Knight at sknight@uci.edu, +1-949-824-5927.

MESSAGE FROM THE DIRECTOR

Taylor

Why a newsletter? ISR strives to keep you, our colleagues and partners, informed about our research activities. With multiple research agendas evolving rapidly and simultaneously in a dynamic technological environment, there is always something new going on at ISR. Based on valuable input from our External Advisory Committee, we thought a newsletter made sense to fill the communication gap between Annual Research Forums and to supplement our web site. Unlike the web site, in which news items rotate over time and the news is not all in one place, the newsletter will at once deliver all the latest developments at ISR in a form you can quickly reference. For your convenience, we'll provide the newsletter in electronic and paper form, the latter mailed automatically to our partners and sponsors. If you would like to be added to our mailing list, please email your contact information to brodbeck@uci.edu.

In addition to faculty, student, and event news, each ISR *Connector* will give you a more in-depth look at selected ISR research projects and people. Please let us know if you have any suggestions for newsletter content and how we're doing at meeting our goal of keeping you informed.

Richard N. Taylor
Professor and Director

ISR STUDENT NEWSBRIEFS

Madhu Reddy (P. Dourish, advisor) has been awarded the distinguished Diane E. Forsythe Award for the year's best paper at the intersection of medical informatics and social sciences. This award, conferred by the American Medical Informatics Association (AMIA), is drawn from all journal and conference papers published by AMIA. The paper is titled "Asking questions: Information Needs in a Surgical Intensive Care Unit." Reddy expects to complete his Ph.D. in Spring 2003.

Eric Dashofy (R. Taylor, advisor) recently received the prestigious National ARCS scholarship for 2002-2004. This non-profit organization is dedicated to providing scholarships to academically outstanding U.S. citizens studying to complete their degrees in science, medicine, and engineering.

Danyel Fisher (P. Dourish, advisor) is currently working by invitation at IBM Research in Cambridge, MA, following up on interest in his research on incorporating temporal and social aspects of working activities into the user experience (see UCI-ISR Tech Report 02-2).

Mark Bergman (G. Mark, advisor) presented a poster at the 10th International Symposium on the Foundations of Software Engineering (FSE-10) Student Research Forum in November, titled "Complex Requirements Analysis: Modeling the New Millennium Process." He expects to complete his Ph.D. in May 2003.

Marlon Vieira (D Richardson, advisor) presented a poster at the 17th IEEE International Conference on Automated Software Engineering (ASE) in September. The poster on "Analyzing Dependencies in Large Component-Based Systems" was co-authored by Richardson. Vieira expects to complete his Ph.D. in April 2003.

Marcio Dias (D. Richardson, advisor) also presented a poster at the 17th ASE conference. The poster, titled "Identifying Cause and Effect Relations between Events in Concurrent Event-Based Components", was co-authored by Richardson. Dias expects to complete his Ph.D. in Summer 2003.

For more information on students: *http://www.isr.uci.edu/people.html*

WANT TO GET INVOLVED?

Sponsoring ISR has many benefits. It enables your company to form closer ties with our faculty and students, puts you on the fast track to our leading edge research, and gives you first crack at our experimental software tools. Choose from five levels of sponsorship:

Support Level	*Annual Contribution*	*Contribution goes to:*
Friend	$10,000	ISR's general research fund
Affiliate—Research	$30,000	A designated ISR research area
Affiliate—Visiting	$40,000	Host Faculty's research area
Affiliate—Grad Student	$60,000	Graduate Student fellowship
Partner	$100,000 or more	Large-scale research project

For more information about ISR Sponsorship, contact:

Dr. Susan J. Knight
sknight@uci.edu
(949) 824-5927

ISR Welcomes Fujitsu Ltd., Japan, as a 2002-3 Visiting Affiliate Sponsor

Visiting us from Japan this year is Tadahiro Uehara, a Research Scientist with Fujitsu's Project-A XML Application Technology Team. The specially appointed Team, which reports directly to Fujitsu's President, has members drawn from three of 13 Fujitsu divisions. The Team is based in Fujitsu's Kawasaki Research & Manufacturing Facilities south of Tokyo. Tadahiro has worked on XML technologies, EJB technologies, and Object-Oriented methodologies. His research interests are in dynamically changed software architecture, especially in software architecture in the integration of web services. He will be working closely with his faculty host, Richard N. Taylor, during his visit from mid-September 2002 through mid-September 2003. He can be reached at tadahiro@ics.uci.edu, (949) 824-4121.

ISR ALUMNI NEWSBRIEFS

Erin Bradner, Ph.D. 2001, (Gloria Mark, advisor) is now working at Autodesk in the Bay area as Senior Usability Engineer.

Owen O'Malley, Ph.D. 1996, (Debra J. Richardson, advisor) is now a Computer Scientist at NASA Ames Research Center in the Silicon Valley.

ISR Partners with NASA/Ames on Collaborative Software Engineering Tools

ISR is very pleased to have NASA/Ames as a Partner-level sponsor. As full collaborators in a major research project (funding in excess of $100,000), ISR and Ames researchers are working together to generate a joint understanding of collaborative software engineering tools.

Principal Investigators **David Redmiles** (ISR/UCI) and **John Penix** (NASA/Ames), with help from ISR's Technical Relations Director, **Debra A. Brodbeck**, convened a workshop at Ames in July to brainstorm the topic. Experts in the field from several organizations were invited to participate. The workshop identified a number of problems associated with distributed collaborative work and posed potential solutions for each. A few examples show the breadth of issues addressed and conclusions reached:

- Event-based architectures present an effective solution to the problem of uneven awareness among distributed colleagues.
- Current collaborative technologies need to be enhanced to reduce the risk of collaborative project failure due to uneven communication across complex collaborative groups.
- Ad hoc communications are not currently supported by commercial tools; novel collaborative technologies are needed to capture these kinds of interactions.

- Event notification servers may be helpful to integrate diverse applications across teams that use different infrastructures and software systems.

For more information on the August 14, 2002, Workshop on Collaborative Software Engineering Tools see *http://www.isr.uci.edu/events/NASA-Workshop/*.

Our Partnership with NASA/Ames involves multiple ongoing interactions with ISR faculty and students.

Annual ISR Research Forum Spurs Collaborations and Maximizes ROI

This year's Annual Research Forum, held June 18, 2002, has been hailed by software industry leaders, technical practitioners, and researchers as exceeding its ambitious goals. The afternoon sessions included a nice mix of panel discussions, audience participation, and a refreshing change-of-pace keynote presentation. Panel speakers addressed topics such as current research trends in event-based and publish/subscribe computer architectures, mobile and collaborative technologies, P2P networking, and next-generation HTTP. Lively discussions resulted from panel interactions, furthering research and technological agendas.

Keynote speaker Dresselhaus

ISR EVENTS SCHEDULE — 2003

Mark your calendars now!

Friday, January 17, 2003
Distinguished Speaker: Gregory D. Abowd
College of Computing, Georgia Institute of Technology
"Challenges in Applications Research for Ubiquitous Computing"
2:00-3:30 p.m. UCI Student Center, Monarch Bay A

Friday, February 7, 2003
Distinguished Speaker: Mary Jean Harrold
College of Computing, Georgia Institute of Technology
"Testing and Analysis of Next Generation Software"
2:00-3:30 p.m. McDonnell Douglas Auditorium

Friday, May 16, 2003
Distinguished Speaker: Carlo Ghezzi
Dept. of Electronics and Information, Politecnico di Milano
"Binding in the Age of Network Programming: New Challenges for an Old Concept"
2:00-3:30 p.m. UCI Student Center, Monarch Bay A

Friday, June 6, 2003
Distinguished Speaker: Richard Kemmerer
Dept. of Computer Science, U. California, Santa Barbara
"Designing a Web of Highly-Configurable Intrusion Detection Sensors"
2:00-3:30 p.m. UCI Student Center, Monarch Bay A

Tuesday, June 17, 2003
Second Annual ISR Research Forum
Keynote speaker:
Dr. Alfred Z. Spector, Vice President of Services & Software, IBM Research Division
1:30-7:00 p.m. McDonnell Douglas Auditorium
(Wondering what you missed at last year's Forum? See story, left)

John Koelsch of Cameron Health, who also teaches software courses for UCI Extension, was glad he came: "Thanks for including me! I saved all my questions for the reception and much enjoyed the resultant discussions with panelists, students and the keynote speaker." John says he'll be applying what he learned to competitive business strategy and to maximize the ROI on interactions with an industrial design firm his firm had previously engaged.

Bill Dresselhaus, renowned design guru, had plenty to say on new ways to conceive and apply software and other kinds of product design. ISR's Director, Richard Taylor, described why he asked Bill to be our keynote speaker: "I thought Bill would expand participants' minds about what software design is all about and get them thinking of new and exciting techniques for application in their day-to-day tasks." Participants overwhelmingly agreed, as exemplified by **Eric Dashofy**, UCI software graduate student. Eric commented, "Bill Dresselhaus' keynote, focusing on design in general rather than specific issues of software, was especially interesting. As someone whose research area is in software architecture—essentially designing software out of independent components, his points on visualization as a facilitator for promoting better design were well taken. While software isn't visualizable in the same way that mechanical devices are, I have certainly put visualization a few notches up on my priority list."

Dashofy

Attendees appreciated the Forum as a source of fresh ideas. Said one, "I've spent my career in the trenches of software development and fairly removed from the research side of things. So, it was interesting to see the activities going on in your pro-

gram. Events like this ISR Forum, that focus on software technologies and bring academia and industry together, are beneficial. The speakers did an excellent job! I particularly enjoyed the keynote speaker's presentation. Kudos to you and your colleagues for hosting this event."

Many participants saved questions for the reception, which drew the majority of the conference attendees. In addition to interactions between participants and students presenting posters and demos, many one-on-one conversations around the buffet table at the University Club fostered new relationships and strengthened old ones. Faculty and industry participant reports indicate that many research and business problems were discussed and ongoing collaboration meetings were scheduled. The posters and demos, which included participants from UC Santa Cruz in addition to UCI/ISR graduate students, held attendee interest well into the evening. Interactions between the student presenters and industry attendees were mutually beneficial, by all accounts. Eric Dashofy summarized the student's perspective: "Talking to some of the visiting industrial practitioners was a great way to enable two-way information exchange. Personally, I was able to learn about several specific problems facing the 'real-world' software industry today, which has helped to focus my research, but I was also able to introduce some new approaches to the practitioners that will hopefully offer some advantages over the solutions they were currently working with."

For more detailed information about the June 18 program, including presentation slides and poster abstracts, please go to *http://www.isr.uci.edu/events/Research-Forum-2002/program.html.*

If you missed this stimulating and productive exchange of cutting-edge ideas and business solutions, be sure you don't miss next year's Forum, which will build on this year's successes. **Mark your calendar:** Tuesday, June 17, 2003—ISR Annual Research Forum at UCI.

SPECIAL THANKS

The UCI Institute for Software Research is generously supported by:

The Aerospace Corporation
Fujitsu Ltd.
NASA Ames Research Center

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