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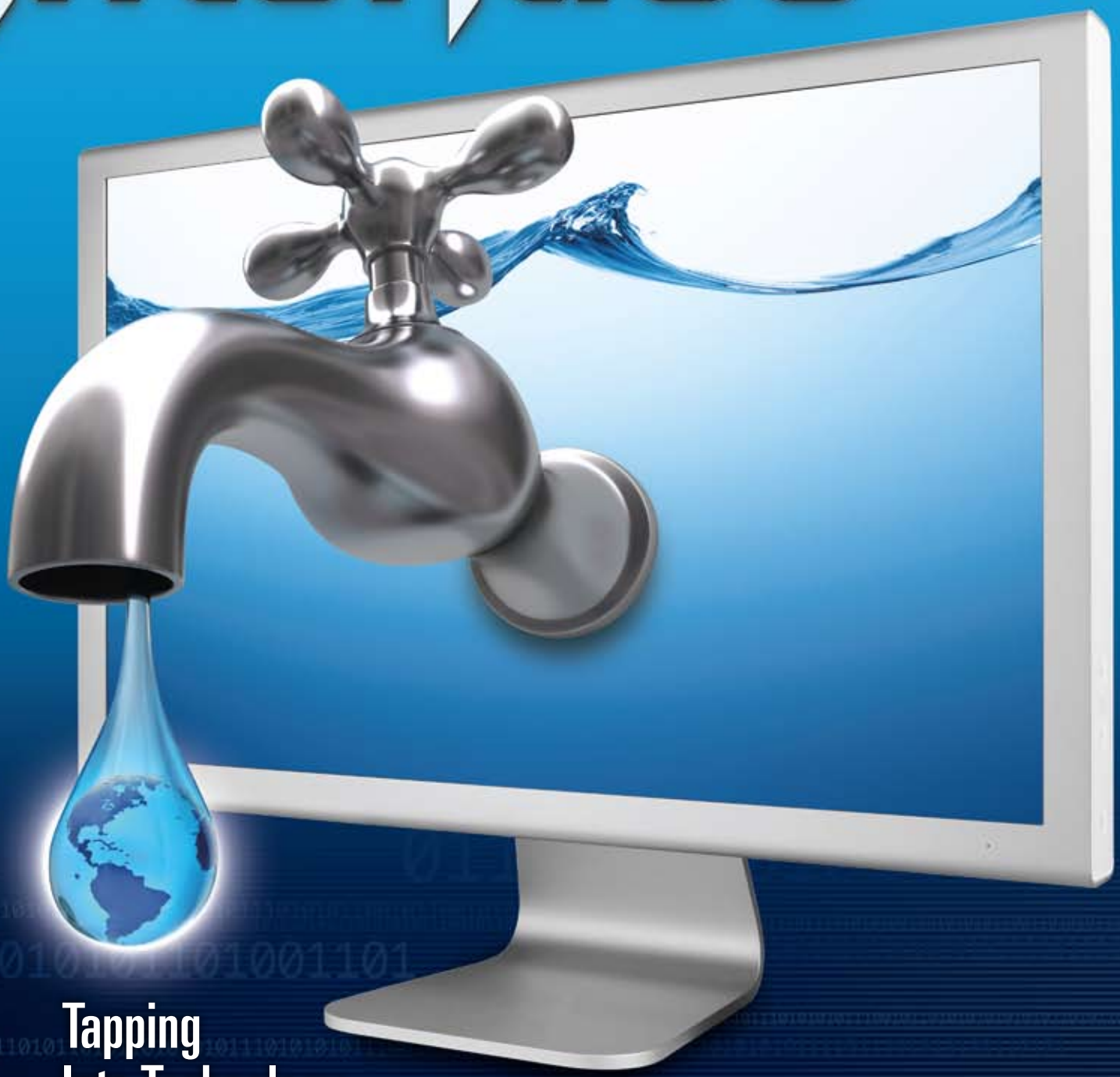

Tapping Into Technology

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Thirsting for ANSWERS

by Anna Lynn Spitzer

Like a pebble that forms concentric rings when dropped into a pond, water itself generates a profound ripple effect. A product of nature, it cascades into often-contentious issues of supply and demand, contamination and regulation.

From the California Delta to the Colorado River, from bustling cities to squalid slums, from amber waves of grain to arid Sub-Saharan wheat fields, the need for water connects all living things while cruelly dividing the "haves" from the "have-nots."

Water's accessibility and affordability have created a false sense of entitlement for many. Turn on the tap or the garden hose or the irrigation system, and out it pours.

But water arrives without a guarantee. More than one billion people in the world – one in six – who lack access to safe drinking water can attest to that. Eighty-eight percent of all disease is caused by unsafe drinking water, inadequate sanitation and poor hygiene. And water-related diseases kill more children age 5 and younger than any other cause; every six seconds a child dies due to lack of clean water.

"The $4.60 I spent for a gallon of gas a few weeks ago would buy you eight tons of water delivered to your house; that's how cheap water is. That shouldn't last. We should be charging twice as much."

Water crises are not the exclusive domain of third-world countries, either. Global warming, aging infrastructures, industrial toxins and unchecked population growth threaten water supplies in even the most sophisticated locales.

Scientists are hoping their work can avert the looming catastrophe. "The sustained availability of adequate clean water will increasingly depend on advances made by water professionals," says Bill Cooper, UC Irvine professor of civil and environmental engineering, and director of the university's Urban Water Research Center.

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IT's All in the Process

The Irvine Desalter Project's Potable Treatment Facility, a partnership between the Irvine Ranch Water District and the Orange County Water District, reinforces the clout of information technology. The spotless structure removes salt and carbon, and disinfects 5 million gallons of well water a day, producing enough clean water for 50,000 people a year.

Yet, not a single employee is anywhere to be seen, either inside the building, where 434 membranes remove salt in 62 pressurized vessels through reverse osmosis, or outside, where pre- and post-treatment, and decarbonation occur. The entire operation is controlled remotely by a powerful SCADA (Supervisory Control and Data Acquisition) system that runs the plant, collects and analyzes information, and sends alerts when human intervention is required.

Top: UCI's Bill Cooper (left) gets an inside look at the system from IRWD engineer Steve Malloy. Center: Gauges monitor the automated process. Bottom: Reverse osmosis in 62 pressurized vessels removes salt.

"IT is increasingly showing that there are different ways to take complex information and simplify it, model it and make it useful. It's really an interactive process."

Oladele Ogunseitan tumbles ground-up cell phones in acidic solutions. By measuring the chemicals that have leached into the water, he can identify which are the worst culprits in various conditions.

More and more, those advances rely on information technology. Experts agree that ready access to data is vital to maintaining water quality and increasing the odds of its sustainability.

Sensing Sources

High above the earth, NASA and NOAA satellites circle the planet. Onboard sensor arrays receive and record signals emitted by clouds and objects on the ground, such as foliage and soil. This electromagnetic, near real-time information is relayed to receivers, where it can be accessed by hydrometeorologists like Soroosh Sorooshian, Bisher Imam, Kuo-lin Hsu and Rafael L. Bras.

The four researchers are affiliated with UCI's Center for Hydrometeorology and Remote Sensing (CHRS), a Calit2 partner. The center specializes in using remote-sensing information and computer models to improve understanding of the land-surface hydrologic process.

Sorooshian, distinguished professor of civil and environmental engineering, and director of CHRS, compares the remote sensors to MRIs used in diagnostic medicine. "The doctor can see what's happening on the surface, but there are other things he won't know until he gets in there. An MRI penetrates and gives the doctor information in three dimensions." In the same way, he explains, remote sensors pick up signals

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Diego Rosso checks the aeration efficiency of his oxygen diffuser. The faster oxygen dissolves into the water, the more efficient a treatment process is.

along the electromagnetic spectrum that the human eye cannot discern.

Remote sensing aids Bras' research efforts to determine how deforestation affects the exchange of energy and water between the atmosphere and the Earth's surface. The new dean of engineering, who came to UCI as a distinguished professor in September from MIT, has studied the Amazon extensively. "It's a question of understanding what impacts result from the massive land changes related to deforestation, and understanding changes on the energy balance, the water supply and the viability of the forest itself," he explains.

He credits remote sensors for providing accuracy and depth of information to his research. "[Before sensors] we depended on point observations that were few and far between, mostly from accessible populated regions," he says. "Now we have unprecedented observations of the whole earth because satellites allow us to look where we couldn't look before."

Researchers are also combining

Picturing the Perfect Storm

Satellite weather data is now showing on the big screen. Bisher Imam (pictured)and Kuo-lin Hsu are collaborating with Calit2 HIPerWall project manager Steve Jenks and his research team to develop animation software that turns high-resolution satellite data into a pictorial on the 200-million-pixel visualization wall. Their first animation debuted this summer: a 64-million-pixel depiction of Cyclone Gonu, which battered the coast of Iran and Oman last year. Each of the 240 frames in the animation is about 15 megabytes of data compiled from hourly rainfall measured during the event.

"We want to see how visualization can help us dig deeper into the datasets we have," says Imam, whose goal is to have HIPerWall software visualize data on the fly instead of relying on pre-made animation. "Somebody who wanted to do a rainfall analysis could just plug the data into the program and get images immediately," he says.

remote data with information from other sources – for example, giant snow pillows that continuously measure the weight of the snowpack in the Sierra Nevada. Their goal is to develop models that can interpret the satellite signals and improve hydrologic predictions – where will water originate, what path will it take and how much will ultimately find its way into aquifers and reservoirs?

Sorooshian focuses on surface hydrology, mainly rainfall-runoff modeling. The mathematical modeling tools he and his research team developed are used by hydrologic services worldwide for flood forecasting.

Experts agree that flooding will continue to worsen as wetlands are drained for farming, and new highways, housing and shopping centers are built on river flood plains.

In addition, many scientists view climate change as a catalyst that increases the occurrence and severity of storms and droughts, which in combination can increase the likelihood of flooding.

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"Engineers used to think only in terms of dollars. Now we have a new paradigm. Instead of dollars, let's use a different currency - carbon emissions."

Recycling a Valuable Resource

Orange County, California is home to more than 3 million thirsty people. It is also home to the world's largest and most sophisticated wastewater recycling facility.

The Groundwater Replenishment System, in operation since January 2008, takes highly treated sewer water that would otherwise be dumped into the ocean and purifies it. Using a state-of-the-art, three-step process that includes microfiltration, reverse osmosis and ultraviolet light with hydrogen peroxide disinfection, the system produces 70 million gallons a day of potable water that exceeds all state and federal drinking water standards – enough to meet the needs of 500,000 people.

This innovative approach to producing a new source of water could safeguard the county from the effects of drought or supply cutbacks. It also significantly reduces the amount of sewage pumped into the ocean.

Approximately half of the treated water is injected into the county's seawater barrier. The barrier, an underground ridge of water formed by injection wells along the county's coast, prevents seawater from seeping into and contaminating the underground aquifers.

"The water they make is so pure, they actually have to add lime back into it or it would dissolve the pipes."

The remaining water is piped to percolation ponds in Anaheim, where it joins rain water, snow melt and water from the Santa Ana River in Kraemer Basin, a reservoir that filters the water through clay, sand and rock to the deep aquifers of the groundwater basin.

"The water they make is so pure, they actually have to add lime back into it or it would dissolve the pipes," says UCI's Bill Cooper. "There's no odor, no salt; in fact it's higher quality than the groundwater and cleaner by far than most bottled water or natural water you'll find."

From an environmental perspective, the method is a winner, too. According to Diego Rosso, who studies the carbon footprint left by water treatment processes, it consumes approximately 1/5 of the energy required by desalinization of seawater. Rosso and Cooper recently received a three-year, $800,000 grant to investigate further optimizing the procedure by reducing energy consumption at each step of the process.

There are cost savings, too. Groundwater replenishment produces better-quality-than-bottled water

The system is monitored around the clock with a high-tech process control program. Photo: Orange County Water District.

for $476 per acre-foot, while imported water costs the county $530 per acre-foot and desalinated water costs range from $800 to $2,000 for the same amount.

"Orange County pioneered this technology and we have the most advanced plant in the world," Rosso says.

The Orange County Water District and the Orange County Sanitation District, partners in the effort, were recipients this year of the Stockholm Industry Water Award, which recognizes outstanding contributions to sustainable development in water. The award was established in 2000 by the Stockholm Water Foundation in collaboration with the Royal Swedish Academy of Engineering Sciences and the World Business Council for Sustainable Development.

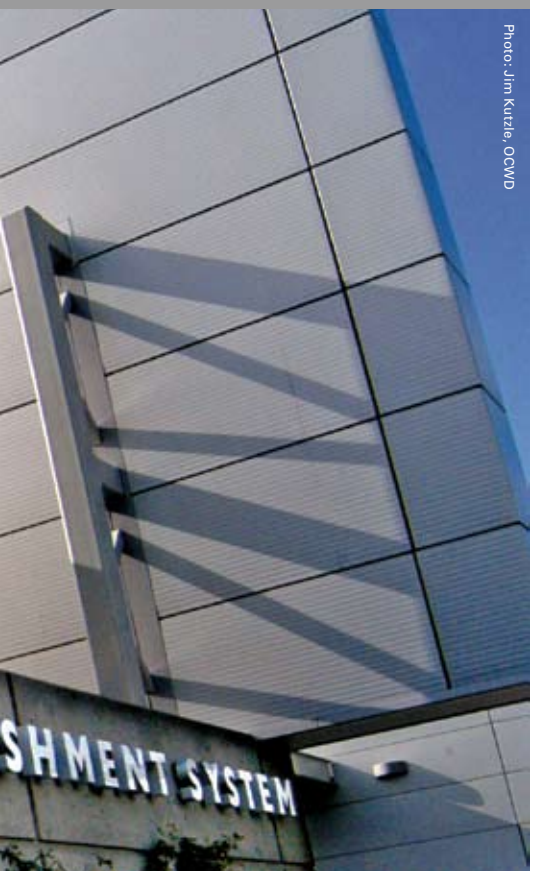

Photo: Jim Kutzle, OCWD

Rainfall observation traditionally has relied on ground gauges and radar systems, but the limitations of those systems hamper the flow of data. "If a thunderstorm produces a flood but there are no gauges in that location, the storm is not even observed," Sorooshian says. "And radar has its own limitations; it can't penetrate mountains or tall structures, so you can't get good measurements. The alternative is to look from space."

But how do you use this constant flow of data to increase understanding? "We're working on merging the information we get from the satellites with the information we get from gauges. Each of them has different characteristics," Imam explains.

Forecasting Supply

A project called "Califorecast" mathematically combines once-daily microwave data from satellite sensors with hourly, real-time data from snowpack ground gauges. With that information, researchers devise a current-condition report and a six-month water-supply forecast for various sites around the state.

"We are focusing our modeling studies on California, but whatever techniques we develop can be implemented globally," Imam says.

The center is making satellite precipitation data accessible to users worldwide through a combination data-access and visualization tool researchers call G-WADI. In cooperation with UNESCO's International Hydrologic Programme, the Calit2 researchers developed a site that characterizes global precipitation by depicting satellite data in 250-meter x 250-meter pixels. The high-resolution precipitation information and estimates can be retrieved from any desktop or laptop computer. *(http://hydis.eng.uci.edu/gwadi/)*

Click on a specific country, city, political region or watershed and the site accesses rainfall data in three-hour, six-hour or daily increments during the most-recent 72-hour period, as well as monthly averages. Moreover, clicking an individual pixel on the map yields the value of rainfall from a 100-kilometer-square area, making available longitude, latitude, average elevation, distribution of aridity and land type. According to Imam, future applications will include cloud-tracking algorithms that will speed rainfall prediction.

The site garnered international recognition last year for UCI, winning the prestigious Great Man-Made River Prize from UNESCO; CHRS researchers shared the honors with the University of Arizona. The award recognizes outstanding achievement in water-resource research and has only been awarded two other times: in 2001 and 2005; last year was the first time U.S. institutions were recognized.

"The Earth is 70 percent oceans and we could not really observe what was happening in the oceans before. When you think of what we've achieved from remote sensing ... it's truly a revolution in the way Earth science and hydrology can be done."

Running Dry

One-third of the water used by 25 million Southern Californians is transported from the Sacramento-San Joaquin Delta, over the Tehachapi Mountains, through the 444-mile-long California Aqueduct. Another third flows to the Southland from the Colorado River, and the rest is obtained from local sources.

The delta, which also irrigates hundreds of thousands of acres of Central Valley farmland, is on "the brink of disaster," according to U.S. Sen. Dianne Feinstein. Rising sea levels threaten the freshwater estuary; a levee break could disrupt delivery for up to two years; and a large earthquake could destroy the system entirely. In addition, the delta smelt,

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Experts predict that a catastrophic water shortage could be a greater threat to mankind than high food prices and depleted energy reserves.

a tiny fish that makes its home in the 16,000 square miles of wetland and open water, is a federal- and state-designated threatened species, a distinction that is reducing the amount of water pumped from the area.

The Colorado River system has problems of its own. A report issued by the Scripps Institution of Oceanography last February cautioned that human demand, natural phenomena and man-made climate change are creating a deficit of almost 1 million acre-feet of water per year from the system, an amount that could supply 8 million people. In March 2007, Lake Mead was at 46 percent of capacity – approximately 118 feet below normal. The report warned of a 50 percent chance it could dry up completely by 2021 if consumers don't change their behaviors.

"When this water was allocated to seven Western states in the 1920s – Arizona, Colorado, Nevada, New Mexico, Utah, Wyoming, and California – it was based on high flow rates. Now it's oversubscribed," says Cooper. "If [all of

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a view from ABOVE

Look, up in the sky: it's a bird, it's a plane, it's . . . HATI

When the Hyperspectral Airborne Tactical Instrument took a test flight recently over the Santa Margarita Ecological Reserve near San Diego, researchers from several organizations, including the Calit2-affiliated Center for Hydrometeorology and Remote Sensing, were on the ground, doing their part to help test and calibrate the airplane-mounted high-resolution imaging device.

HATI uses technology first developed for NASA's Earth Observing Satellite sensors. It allows scientists to obtain incredibly detailed views of trees, vegetation, soil, moisture and other ground data undetectable to the human eye.

All objects possess a unique spectral identification – similar to a fingerprint – created as they reflect solar radiation at various wavelengths. Only a small portion of the wavelength spectrum is visible to the human eye, but hyperspectral imaging can measure reflected light at hundreds of wavelengths beyond the eye's reach.

In fact, a hyperspectral sensor can measure 20 times as much information as a standard sensor – enough to differentiate between healthy and dry vegetation or detect the amount of moisture in soil.

"There are zillions of pieces of information in these bands that we cannot see," says CHRS's Soroosh Sorooshian.

Because Northrop Grumman seeks to make existing sensor technology smaller, more economical and customizable, the test project requires scientists to determine whether they can get the information they need from the equipment.

"The more precise our information is about what's on the ground, the more accurate our forecasts can be."

"We're looking at how we can build very low-cost, rapid turnaround spacecraft that will actually serve weather and climate needs," said Brian Baldauf, who works in environmental systems at Northrop Grumman's Space Technology division. "We want to integrate ground-sensing capabilities with space sensors and that's why it's exciting to work with UCI."

Before the flight, Calit2 researchers joined their colleagues to identify specific areas from which they wanted information. While the test flight was gathering massive amounts of data from the reserve, researchers on the ground were taking their own spectral measurements of the same areas to see if the datasets would match. "We dug trenches to get an idea about soil moisture, we looked at areas with burn and with no burn, and we looked for areas of thick vegetation," says Bisher Imam. The researchers are now analyzing the data sets to see if they contain the right information.

The project is ongoing and no conclusions have been reached, but the ultimate goal for researchers is to identify trends. The more scientists know about an area, the better their meteorological predictions. "In each area that the same amount of rain falls, different amounts are going into the water supply, depending on all the conditions in that area," Imam explains. "The more precise our information is about what's on the ground, the more accurate our forecasts can be."

Other partners in the project include NASA's Ames Research Center, Cal State San Diego and the Scripps Institution at UCSD.

Above: Researchers take to the field at the Santa Margarita Ecological Reserve. Below: Kuo-lin Hsu (left) and Jialun Li measure soil moisture in the burn area.

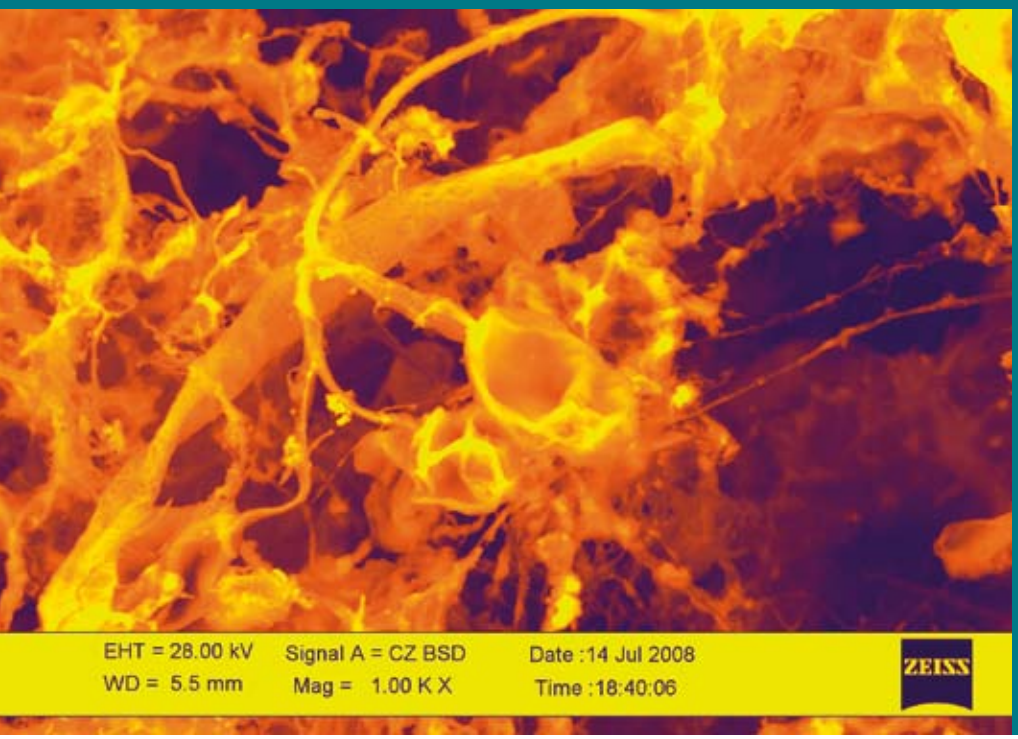
Water Under the Microscope

Enhancing understanding of water treatment and quality is the goal of a partnership between the Irvine Ranch Water District and Calit2.

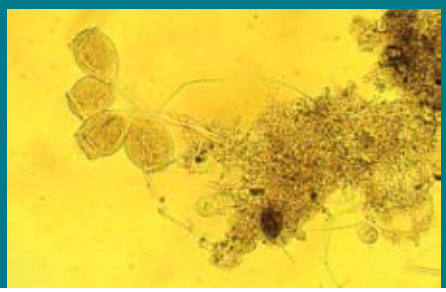
Funded by a $10,000 seed grant from the Urban Water Research Center, scientist Jian-Guo Zheng uses an environmental scanning electron microscope in Calit2's Zeiss Center of Excellence to study sludge and effluents in different stages of water treatment.

Water district scientists analyze the sludge on a daily basis with optical microscopes and x-ray fluorescence. But Zheng says the SEM goes much further. Besides offering higher resolution and three-dimensional imaging, the Zeiss equipment provides higher spatial resolution that allows the composition of the sludge in the water to be analyzed.

"They (IRWD) can count the number of organisms in the water and see how they move, but we can observe much smaller details of the organism and analyze what is inside them to see what compounds (in the water) they're eating and what they are composed of," he explains.



Micrographs – photos taken with the scanning electron microscope –capture a detailed view of sludge samples.



How does a shrinking commodity stretch to meet the needs of all constituents?

the subscribers] took all of their water at the same time, they'd be taking out more than is going in. That's scary."

There is another problem with importing water: as it journeys through the aqueducts, it consumes the largest single chunk of California's available electricity.

Treating water so consumers can use it gobbles up energy, too. In research funded by the California Energy Commission, Diego Rosso, assistant professor of civil and environmental engineering, seeks to reduce the carbon footprint of water and wastewater treatment processes. He compares the energy consumed and the amount of greenhouse gas emitted when different approaches are used.

"We are really scarce in water resources and it requires very energy-intensive processes to reclaim water from wastewater or out of seawater. We are trying to evaluate different scenarios to provide decision-makers with something tangible, so they'll know the carbon footprint of their decisions."

Sometimes the results are surprising. Improving the quality of a lagoon or wetland so it discharges cleaner water sounds like a good idea, when in some cases, the improvement process could release more carbon dioxide into the atmosphere than using a different process to clean the water downstream.

"Engineers used to think only in terms of dollars," he says. "Now we have a new paradigm. Instead of dollars, let's use a different currency – carbon emissions."

Controlling Contaminants

Then there's the third source of Southern California's supply: groundwater.

Purification systems keep disease-causing organisms at bay, but industrial toxins, lead, pharmaceutical compounds and pesticides from agricultural runoff are polluting rivers and streams, finding their way into the water supply and the oceans.

Oladele Ogunseitan, UCI professor of public health, is finding ways to eliminate them.

A new $1.62 million multi-campus University of California Green Materials Program that Ogunseitan directs seeks to develop nontoxic alternatives to everyday products, such as electronics, plastics and pesticides.

Until new materials are developed and implemented, however, the toxins from today's products leach into the groundwater when they are discarded. Ogunseitan is trying to determine whether there are acceptable levels for these toxins that don't impair human health and if so, what those levels are for each chemical.

Researchers use certain micro-organisms as sensors. Hemoglobin, a protein in human blood that readily attaches to lead, resembles proteins that are also present in these micro-organisms. Because the bacteria's responses to lead in water are similar to those of humans, researchers can determine how much lead is potentially dangerous to people. "We try to simulate how things really are so we can improve the standards," Ogunseitan says.

His research also focuses on learning where contaminants in runoff originate and how best to keep them out of the groundwater. A recent project used GIS maps of an Orange County city to identify the location of 600 storm drains. By measuring the types and levels of pollutants flowing into the drains, the research team was able to test 10 different filters on different contaminants, determining the most effective way to remove each.

Some pollutants do make their way into the open ocean, potentially affecting water quality at one or more of California's 400 beaches. Stanley Grant, professor and chair of chemical engineering and materials science, uses sensors to measure temperature,

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Bill Cooper talks with actress and guest of honor Jane Seymour at the Urban Water Research Center banquet in September.

Creating Global Dialogue

International Conference on Water Scarcity, Global Changes, and Groundwater Management Responses

For five days this December, scientists, engineers, water managers, policy makers, public health experts, lawyers and economists from around the world will gather at UC Irvine in an attempt to address the many complex issues swirling around the world's water supply.

Approximately 400 attendees are expected at the "International Conference on Water Scarcity, Global Changes, and Groundwater Management Responses," a joint effort sponsored by UNESCO (the United Nations Educational, Scientific and Cultural Organization), UCI and the U.S. Geological Survey.

Organizers hope the December 1-5 conference will:

- Serve as a forum for the presentation of innovative technologies and technical tools;
- Facilitate communication among key players, leading to improved management of water availability and quality;
- Allow participants to exchange ideas about ways to help the public understand the issues and contribute to solutions;
- Establish mechanisms to encourage international cooperation and shared experiences among universities, engineering firms and others; and
- Produce a follow-up policy proposal and action plan.

Bill Cooper, director of UCI's Urban Water Research Center, is one of three co-chairs of the conference. "Solving these massive problems will take a major effort by developed countries to assist developing countries in finding appropriate ways to address the deficiencies," he says.

"Our goal is to link people from different disciplines and countries. By bringing everyone together, we hope to initiate meaningful dialogue and to affect change in water and water resources management."

www.waterunifies.com

Water policy expert David Feldman believes IT can help make data more understandable.

salinity and turbidity in water at local beaches, correlating that data to changes in water quality. His research team determined that changes in water quality can be indicated by changes in the sensor data. This near-real-time detection ability allows authorities to post warnings or close beaches much more quickly than they otherwise could.

Paying the Price

Investment bank Goldman Sachs held a "Top Five Risks" conference in London last June. A panel of international experts discussing resource scarcity predicted that a catastrophic water shortage could be an even bigger threat to mankind this century than soaring food prices and the depletion of energy reserves.

"Our work is an interface between science and engineering - between the land and the atmosphere . . . It has no boundaries and no borders."

Nicholas Stern, author and former chief economist of the World Bank, said governments have been slow to accept the reality that usable water is running out. "Water is not a renewable resource. People have been mining it without restraint because it has not been priced properly," he said.

UCI's Cooper concurs. "The $4.60 I spent for a gallon of gas a few weeks ago would buy you eight tons of water delivered to your house; that's how cheap water is. That shouldn't last. We should be charging twice as much."

Americans are prodigious consumers. The average American uses 100 to 176 gallons of water at home each day, while the average African family uses five gallons a day.

After California Gov. Arnold Schwarzenegger declared a statewide drought in June, Los Angeles implemented restrictions for residents watering their lawns, hosing down paved surfaces and washing their cars. There is already discussion of government-mandated rationing next year if conditions don't improve.

Add to that the ongoing battles – intensified when water is scarce – between agriculture and urbanization, Northern California and Southern, the environment and industrialization. About 75 percent of California's water is used for agriculture, while 90 percent of its population lives in cities. Likewise, about 2/3 of California's rainfall occurs in the north, while 2/3 of its population lives in the more arid south.

How does a shrinking commodity stretch to meet the needs of all constituents?

Enabling Reform

UCI political scientist and water policy expert David Feldman studies the ways in which communities and jurisdictions deal with conflicts over water use and allocation. "If we're going to sustainably manage the resource, we've got to figure out a way to meet the needs of the environment at the same time we meet human demand," he states.

"You have to involve the public – lots of stakeholder groups. There has to be a lot of negotiation, a lot of bargaining and a lot of compromise. It can't be done top-down; it has to be done bottom-up."

Feldman sees information technology as a means to that end, both in educating policy-makers

and in obtaining public cooperation. "Water policy increasingly relies on very accurate ways of depicting information to decision-makers at all levels," he says. "Ways of graphically presenting information, layering it and mapping it are very important.

A report he recently co-authored for NOAA's Climate Change Science Program examines how water managers use graphically-depicted climate models to make better decisions in such areas as abating flood hazards and ensuring public supply.

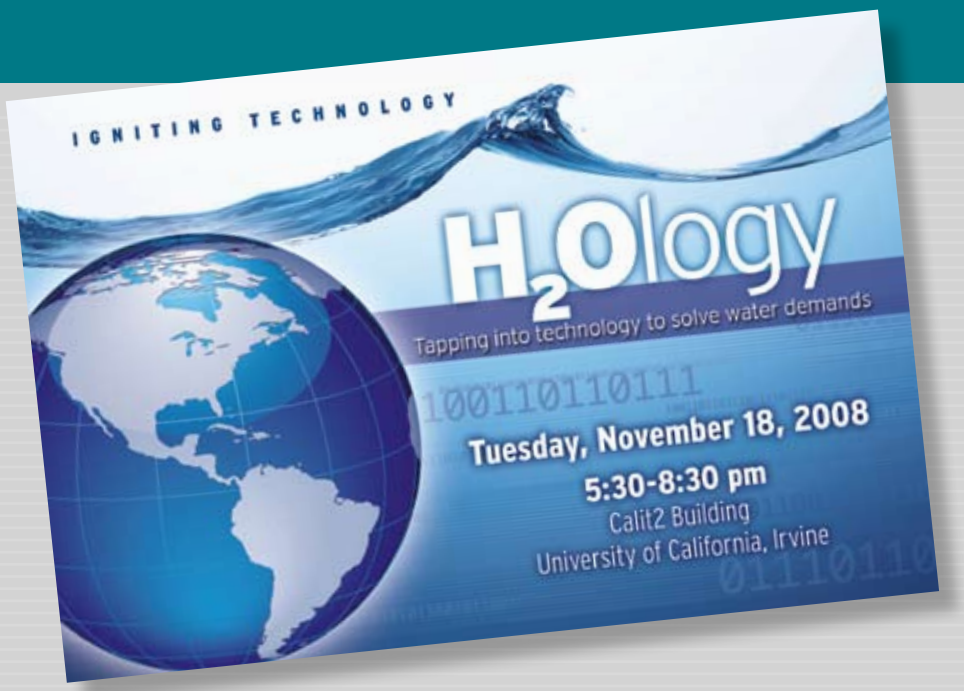
He advocates engaging the public in the same way. One approach is to develop platforms on which students, homeowners and community groups could participate in behavior-and-consequence-type games based on real information.

"It would be really useful for schools and communities to look at these things modeled out in such a way that they can generate scenarios, in essence create their own endings. The challenge is to get people to become more cognizant of where their water comes from, how it gets to their communities and the pressures upon the resource."

Cooper envisions public seminars utilizing the power of high-resolution visualization walls like HIPerWall. "You could show people the big picture of how water works," he says. "Creating interactive dialogue with the public helps get their buy-in."

Drawing on a seemingly endless supply of energy, Cooper works tirelessly to raise awareness of the complex issues surrounding the pure liquid that's earned the nickname "the new oil." He networks day and night with public agencies, water researchers, politicians, citizens and anyone else willing to lend an ear.

"The statistics are just horrible," he says. "To think that a billion people around the world don't have access to clean water …" he shakes his head in disbelief, "and we take it for granted, at $2 per thousand gallons. That is appalling in this day and age."



Register: www.regonline.com/h2ology

Everyone needs clean water and it's often taken for granted. We generally don't consider where it comes from, how it gets to us or what it costs. California's governor declared a statewide drought recently and there is discussion of mandated rationing if conditions don't improve. Calit2@UCI researchers are working to avert the looming crisis. Join us Tuesday, November 18, 2008 to discover how they are tapping into technology to solve our water demands.

Igniting Technology is sponsored by Knobbe Martens Olson & Bear LLP in partnership with the University of California, Irvine division of the California Institute for Telecommunications and Information Technology.

Making Data accessible

by Anna Lynn Spitzer

Data collected through scientific inquiry and published in scholarly journals have always been available to others – if one knew where to look and had lots of time to search.

Today, more and more information is readily available to a diverse audience in online databases, aiding timely understanding and facilitating decision-making.

CalSWIM

UCI faculty members Crista Lopes and Stan Grant are developing CalSWIM, a Wiki-type Web platform that provides everyone from theoretical scientists to swimmers and surfers access to shared water data.

The California Sustainable Watershed/Wetland Information Manager is designed both as a public forum and as a Web location, a place where professionals can publish and obtain data, as well as discuss different interpretations. Anyone can view pages, but publishing privileges require registration.

Contributors can upload images, Word documents, PDF files and Excel spreadsheets. They can also post blogs, view data in linked and continuously updated databases, and create maps, tables and charts.

Lopes, an informatics associate

Above: Betty Olson peers into a denaturing gradient gel electrophoresis tank, where bacteria are separated into groups to determine the specific byproducts produced by each. She will post her results in an online database.

Stan Grant and Crista Lopes designed CalSWIM for laypeople as well as professionals.

(http://nile.ics.uci.edu/xwiki/bin/view/Main/)

professor, and Grant, professor and chair of chemical engineering and materials science, began collaborating four years ago. The project was initially a traditional Web page, created to make water quality information from Newport Bay available to the public.

It didn't take Lopes long to realize the site would be more effective with an open infrastructure that allowed access to professionals and volunteers alike, and offered advanced content-management features and up-to-date information.

"There are all these ad hoc groups of people that share information, usually by email or face-to-face. There is a need to share both the full-blown databases and also smaller pieces of information," she says.

CalSWIM's creators hope the site will attract volunteers as well as professionals.

A current statewide effort to investigate harmful algal blooms that release neurotoxins in the coastal ocean includes an army of volunteers collecting water samples. "Now, they can immediately upload their pictures to the site and automatically alert everyone to look at them," Grant says.

The algal bloom project also evaluates data collected by sensors. "The idea is to leverage all of these different activities that might otherwise end up in a report on a shelf," he says.

Because the site hosts scientific information, security is essential. Anonymity is taboo and contributors can be sure their data are safe. "This is not Wikipedia," says Lopes, who is building security features into the site. "These are important data that sometimes need to be access-controlled."

Wastewater Treatment

Betty Olson is using advances in information technology to improve access to water-quality data for wastewater-treatment managers.

The civil and environmental engineering professor developed a molecular methodology for tracking the sources of fecal waste in water, becoming interested in process control along the way. "So many processes in wastewater treatment are biological," she says. "We have much better techniques to measure than we ever had before; it really advances the field, more so than we've seen in 150 years."

These results can streamline processes, saving energy or reducing carbon footprints, but only if they are accessible. Olson is creating an online database that will display results from molecular and biological process experiments in a graphical user interface, presenting data as graphical icons and visual indicators instead of text. The database will interact with databases at wastewater treatment facilities, an advance she hopes will lead to process improvements.

"My hope is that we're going to be able to take this information and put it into different types of interfaces so that people running the treatment plants will be able to pull it up, put it alongside the physical and chemical properties they measure and [improve their efficiency].

"This allows us to take technologies that right now are in the university and make them usable everyday tools for people."

Also, she adds, hundreds of millions of dollars are spent on monitoring the quality of water and most of the data never sees the light of day. "All that information goes someplace and no one ever uses it. Making these data available is a step forward."

Experiencing EUREKA!

For the fourth consecutive summer, a group of undergraduates immersed itself in Calit2 research projects, providing valuable contributions and gaining hands-on skills. The Summer Undergraduate Research Fellowship in Information Technology (SURF-IT), co-sponsored by Calit2 and UCI's Undergraduate Research Opportunities Program, gave the students a unique opportunity to work alongside faculty mentors, post-doctoral researchers and graduate students from different disciplines. For many, SURF-IT was an inaugural dive into research – providing encouragement and exploration that will shape future academic and career plans. Here, each student shares his or her unique perspective:

Andrew Zaldivar,
Psychology - Cognitive Sciences
Firefox Environmental Sustainability Toolkit

My mentor and I developed a prototype of Firefox Environmental Sustainability Toolkit (FEST), a system that connects popular online services to existing databases containing relevant environmental information and subtly displays that information onto these online services. I had limited experience with Web development coming into SURF-IT. I was concerned that in 10 weeks I would not be able to make good progress. However, with the help of my mentor and the rest of the people in the lab, and with hard work and perseverance, I not only acquired various Web development

techniques at an accelerated pace, but also managed to get a prototype of FEST up and running. There were times when I would get stuck on a particular problem for days until I would suddenly find the solution and move on to the next problem, only to repeat this vicious cycle. This is part of what makes research an experience like no other.

Robert Simpson, Computer Science
Human Mediated Networking

The interdisciplinary nature of the SURF-IT program helped me realize the broad scope of applications possible for computer science and information technology. I hadn't thought about potential ways that computer skills could be put to use beyond the obvious paths of software or hardware engineering for computer systems. Furthermore, by actually using my skills to build solutions to interdisciplinary problems, I have been given an opportunity to develop them beyond those available in the classroom. I think that the opportunity to do research in a field I find interesting will be greatly rewarding and I will be looking more closely at graduate school.

Calit2's Stu Ross and division director G.P. Li (back row, center) join the SURF-IT scholars after their final presentations.

Howard Wong, Computer Engineering
Parallelization of the Telemedicine Benchmark for the Xbox 360 Architecture

The significance of this project is to recognize the parallel programmability on the Xbox 360 with the Telemedicine Benchmark programs. Currently, not too many people take a good look at the old program codes for multi-core optimization. By investigating, I have gained insight into how someone would parallelize sequential code as well as measure the possible benefits for particular programs. I found that reading through and improving old code is no light job. I only managed to revise one program out of a suite I had selected. I will continue working on the project since there is still much to be done. SURF-IT's interdisciplinary focus has shed new light on clearer applications for the technology we are developing. I realized how valuable it is to think beyond my own research and that working towards a common goal may be more useful.

Ilya Sukharnikov,
Computer Science & Engineering
HIPerWall Large-Scale Animation

This project provides a way to display enormous amounts of information in an animation that had not before been possible. I was solely responsible for figuring out a way to play extremely high-definition movies on the HIPerWall and writing a program that enables playback. Also, I wrote the control program that enables the user to start and pause the movie, and adjust the playback speed. Playing an animation that is 10 times the size of current high-definition is a challenge because computers can't handle that much information at reasonable speed. When I got my program to work and actually saw the animation instead of still images, I realized how significant the impact of this project would be. It opened the possibilities for many disciplines to use this tool to view a lot of information in new ways and I experienced first-hand how my research efforts can be used in fields that go beyond computer science.

Dean Bottino, Studio Art
Designing Computer Games that Foster Ethical Behavior in Grades 1 & 2

My role was to develop the character designs and play elements for an educational computer game, and to put together a simple interactive demonstration of the first level. I will continue to work with my mentor to further develop the game and character designs, and to help recruit voice actors and programmers to take it into the beta stage. Overall, the SURF-IT experience has cemented my plans to pursue a career in the game industry, and this project is helping me get the experience I need to work in such an environment, as well as an opportunity to develop my portfolio.

(continued, page 18)

Michael Riccobono, Engineering
Human Mediated Networking

Even though I am an engineering student with very little knowledge in IT, I was able to contribute towards all the projects in my lab. This taught me that an interdisciplinary approach not only offers a unique point of view, but can contribute to the core material as well. My role in the project was to create a computer simulation to test the feasibility of the system. I first created a mathematical model, then a virtual city with people. When I first graphed all my data, I was very surprised at how good it looked. I was not expecting my simulation to produce such a detailed and accurate representation of sensor-sharing so quickly. Due to SURF-IT, research does not feel half as mysterious anymore, and I think am better prepared for the rigors of graduate school.

Lauren Lewis, Computer Science
FanFiction University

I was certainly not expecting to spend so much time in the lab! It was good for me to experience though, as it has prepared me for future employment, and has given me a good taste of what can be accomplished in such large blocks of time. I was the main coder and designer for FanfictionUniversity.com. I learned Ruby on Rails, CSS and other coding languages in order to accomplish this effectively. I also provided site content, such as columns on writing style and "FAQ" documents. The summer culminated with writing a paper for possible publication on the legality of fanfiction and the information contained within. I feel that SURF-IT gave the project a great home among other similarly interdisciplinary projects, and allowed for more points of reference for my work on the site.

Jordan Sinclair, Informatics
Computational Metaphor Identification in Political Blogs

I was in charge of designing the visualization and interface for computational metaphor analysis. My mentor had a lot of important and valuable data that was almost incomprehensible in its initial form; I developed an interface to visualize the data in a way that made it understandable and interesting. I gained a lot of experience by applying all sorts of concepts that I have learned from my coursework here. This application has not only boosted my confidence in my own abilities, but has also taught me the importance of many previously dubious lessons. Interestingly, there was a point where my team was skeptical about whether or not the project would actually be a success. After putting some real data into the visualization, we saw the information in a different way that engendered a new meaning for it. This was very exciting and it emphasized the importance of the project.

Zohrab Basmajian, Computer Science & Engineering
Annotation, Retrieval, Synchronization and Presentation of Lecture Documents

I designed and implemented a new Web-based architecture system to synchronize videos and presentations. I learned lots of new technologies and how to apply them to real-world projects. For example, I learned how to use Google Web Toolkit to develop Web applications, design a database in Oracle and design a new xml schema using DTD. It was fun and challenging. After my graduation, I plan to enter industry as a software engineer, and thanks to my SURF-IT research experience, I am confident that it is the right career choice and I will enjoy the work.

Ask the TIPSter

TIPS (Taking IP to Startup) is a service offered by Calit2 to help guide faculty and students through the process of moving their research to the business marketplace. In this issue, guest TIPSters Cynthia Bemis and Sandy Guzman, who lead an OCTANe initiative called "OCTANe Next" for younger entrepreneurs, answer questions about ways to expand indispensable business networks.

Networking for "Nexters"

You've heard it before: "It's all about who you know." As a Nexter (someone 18 – 29), it can be tough to build your network and know how to truly leverage it. Here, we'll take a look at how you can start networking today, expand who you know, and more importantly, who knows you.

I'm not comfortable approaching someone I don't know at a business event…I don't feel like I have very much to talk about.

First, your opportunities to network are everywhere – not just at business events! Practice talking about your job or skills with people you meet on a plane, at a cocktail party, in a supermarket line, at a sporting event, or anywhere else! Ask the person about his or her job. Listen closely and with interest. When asked what you do, respond sincerely with your current job title and responsibilities. If you're in the market for something new, clearly state what you are looking for and what role you could fill. Your response should be around 15 seconds, but try to avoid a "canned" elevator pitch… it's a conversation, not a speech.

It's hard for me to join in conversations…any tips?

When talking in groups or at a table, don't hog the conversation, and don't say just anything for the sake of speaking. Give yourself a goal of saying one really smart, relevant thing. This will make you much more memorable than half an hour of semi-conscious small talk. Tip: read the newspaper daily so you can chime in on current events (yes, even the sports section!).

What will make a person remember me later?

To be memorable, think about the three "I"s: image, impression and impact. Do you have a distinct image? Maybe you're the guy with the brightly colored shirt, or the girl with the interesting piece of jewelry. Sometimes, just being well-groomed (or the eternal "jeans and T-shirt" wearer) can be enough. To make a memorable impression, skip the "So, what do you do?" question. If you're speaking to a more experienced professional, try a question like "What significant changes have you seen take place in your industry over the years?" This allows the person to reminisce about the good old days, and sets the stage for a great conversation. Remember that people generally talk more than they listen, and it's human nature that we like to talk about ourselves. If you show interest and are fully "there" in the conversation, you'll likely make a positive impact.

I met some great people at a networking event…now what?

The key to great networking is the follow-up. When you get home from an event, go through the business cards you collected and make notes about each person you met. Next, take time to send everyone an e-mail letting them know you're glad you met them. Refer to something they said or to a common interest you discussed with them, and be sure to mention ways to work together in the near future. If your conversation included an action (i.e. Bill knows the HR director at the company you want to work for), make sure you put in a clear request for action, and thank Bill for his time.

OCTANe Next

The goal of OCTANe Next is to help students and young professionals integrate early and effectively into the OC business community. Membership is free. Learn more at www.octaneoc.org. TIPS has open office hours 1-5 p.m. every Thursday in the Calit2 Building, suite 4100.

ON LOCATION

Sensors and data analysis enable next-generation connections

by Anna Lynn Spitzer

When Alexander Graham Bell uttered the famous directive "Mr. Watson, come here," into his new invention in 1876, he couldn't have fathomed the technology explosion he was unleashing.

The October 1 signing of a memorandum of understanding between the Irvine division of Calit2 and the Media Development Authority (MDA) of Singapore marked the start of a collaboration on long-term synergistic research in Experiential Media Systems. UCI's Vice Chancellor for Research Susan Bryant shakes hands with MDA's Deputy Chief Executive Officer Michael Yap after executing the agreement. Professor Ramesh Jain and RAdm (NS) Lui Tuck Yew, Singapore Senior Minister of State for Education, and Information, Communications and the Arts witnessed the ceremony.

Telecommunications would evolve from wall phones to portables, from cellular to VoIP, from conference calls to teleconferencing. And now, there's Environment-to-Environment (E2E).

The next-generation telepresence system is under development by Calit2 academic affiliate Ramesh Jain, Donald Bren Professor of Information and Computer Sciences, and his research team. E2E uses sensors and complex data analysis to allow people in far-flung locations to interact with each other in new and unprecedented ways.

Free to Move About

Current teleconferencing equipment requires participants to face a camera and stay within range of a microphone. Jain's system will free people to move around their environments without losing audio or video connection with colleagues in remote locations.

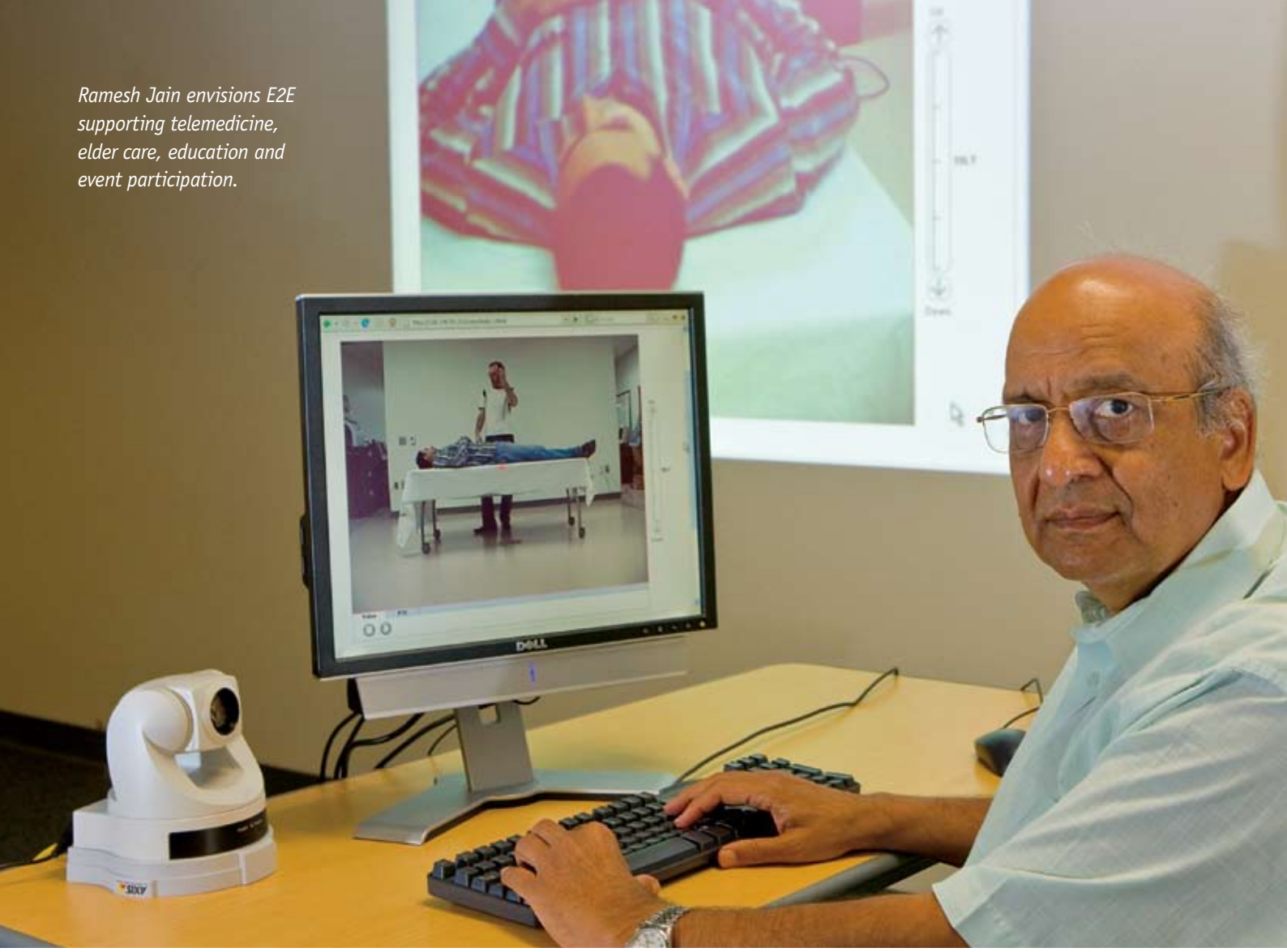
"We're trying to get [people] away from dependency on their devices. Phones, computers, cameras – all of our current communication actions depend on being connected to these," he says.

E2E employs a variety of built-in sensors – video cameras, microphones, RFID tags and heat sensors, among others – that track movement in an environment. The sensor data is analyzed, interpreted and converted into a virtual rendering that serves as a user interface.

Meanwhile, in the connected environment(s), participants see the activity from the first environment in two formats. On their computer monitors, they see the actual video feed, and in a smaller window that can be enlarged if necessary, the corresponding real-time virtual version. By clicking on a specific avatar in the virtual depiction, the user instructs the system's sensors to zero in on the matching subjects in the actual environment. "The software switches automatically to the camera [and/or microphone] that gives the best view of what you want to see or hear," Jain explains.

Unlimited Interactions

The system has numerous real-world applications. Doctors in remote locations can visit a patient's home or hospital room from hundreds of miles away, conferring and making recommendations. Family or caregivers can communicate with and monitor the elderly. Students can participate in lab experiments even if their schools don't have the necessary equipment. And long-distance colleagues can collaborate on product design.



Ramesh Jain envisions E2E supporting telemedicine, elder care, education and event participation.

The system enables users to gain additional information about the people or objects in the room by clicking on their avatars, which will launch a text box or video. Click on an object in a laboratory: the text box offers an explanation of its function. Click on a patient's head as he sits in the emergency room: his MRI appears.

Another feature allows users to view objects from different angles, as though they're walking through the environment.

"The devices and the underlying design architecture should play a supporting role," Jain says. "Users should be able to interact in their natural settings and let the system find the most appropriate input and output devices to support communication."

Jain plans to have a prototype ready sometime next winter. Later phases will incorporate additional features, like projectors that can beam images anywhere in the room, eliminating the need for cumbersome computer monitors.

Partnership Plans

Jain's proof-of-concept is being built and tested in the UCI Experiential Systems Laboratory in the Calit2 Building. He and three students spent the summer in Singapore, helping the National University of Singapore and a government office to outfit a sister lab there that will connect to the UCI lab. The partners have submitted a request for funding that will allow them to conduct joint research using the connected labs as a beta model.

He concedes there will be "enormous" privacy issues inherent in the finished product, but says society will find a way to accept them. "Privacy issues keep arising as society progresses," he shrugs, listing credit card transactions and online purchasing as examples. "If you start worrying about that too early, you're never going to build anything. I believe in first building things and then relying on society to decide the best ways to use them."

Ultimately, Jain would like to see E2E available for consumer use, connecting families with each other, and with a variety of cultural and educational institutions. Future plans include advancing E2E towards what Jain calls "event-ware," a system that will make it easy for interested parties to participate in a variety of events, regardless of location.

"In a few years, we want to have a system where it will not matter *where* this event is going on; you'll just know that there is something (occurring) on a particular topic and it's an open meeting. You should be able to search the Internet, find out what the meeting is, connect to it and participate in it," he says.

FUNDING NOTES

by Stuart Ross

This list comprises recent awards made to Calit2 research affiliates. The institute is interested in helping faculty secure grants for IT-based interdisciplinary research. Contact stuross@uci.edu for details.

Developing a Presence in Telemedicine

With three recent grants in hand, Calit2 is fast becoming an important player in telemedicine – the use of IT connections to overcome physical barriers separating patients from needed medical specialists. Rural residents, the disabled, prisoners and others are often unable to visit medical specialists, but some combination of networks, sensors, cameras and video screens could provide enough information exchange to allow for diagnosis and prescription of treatment. Under a grant from the California Consumer Protection Foundation, Calit2 will provide technical expertise and evaluation services as part of a program that includes the UCI Medical Center and Access OC. In the second project, funded by the Verizon Foundation, Calit2 will assist in operating a system that allows physicians at a Santa Ana community clinic operated by Share Our Selves to consult with UCIMC specialists. A third grant, from the UC Discovery program, established a postdoctoral fellowship in telemedicine for UCI grad **Paul Marc**, who is working under the mentorship of Irvine division director **G.P. Li** and UCIMC's designated leader for telemedicine, **Dr. Ira T. Lott**. Meanwhile, Calit2 engineers led by **Mark Bachman** are developing a package system that can accommodate a wide variety of sensors, protocols and connections.

Virtual Worlds, Real Users

World of Warcraft is a game, *Second Life* is a simulation, and *DinoQuest* is an educational tool, but all are examples of a broader phenomenon – what Calit2's **Walt Scacchi** calls "decentralized virtual activity systems." Each engages multiple real users in virtual worlds and all of them – as well as other systems used in government and business – are growing in commercial importance. Scacchi and a team of five ICS researchers just received a $3 million award from the National Science Foundation to study the issues and problems common to all these systems. They will spend three years examining the virtual-world activities of five real-life organizations: The Aerospace

Corp., Avaya Labs, the Discovery Science Center, Northrop Grumman and Unimodal Inc. Specifically, the researchers will examine six areas: the blending of real and virtual elements, the development of standardized practices, the ways work relationships are created and sustained, the balance between open and proprietary software, the balance between privacy and mutual awareness, and methods for avoiding or controlling malicious behaviors.

Filtering Malicious Internet Traffic

Athina Markopoulou has been awarded $400,000 – her second NSF grant in less than a year – to study better ways to filter malicious traffic on the Internet. Spam, viruses, worms, Trojan horses, etc. cause billions of dollars in damage every year. One of the most important tools against attacks is IP filtering – blocking traffic at the network level, based only on a combination of fields in the IP header. Other methods – from lawsuits to anti-virus programs on desktops – are helpful too, but filtering has the practical advantage of being readily deployable in routers that govern large amounts of traffic. Filtering programs must be more than just checklists of individual addresses to block because

that uses precious router memory; on the other hand, merely blocking large ranges of addresses ends up obstructing good traffic as well as bad. Markopoulou seeks to achieve an optimal trade-off. She and a collaborator at UC Riverside will devise algorithms to detect and predict the sources of malicious traffic, and evaluate their severity. The scientific advance in this work is how it self-adjusts by recognizing which attack sources are related in address groups and timeframes.

Using IT for Firefighter Safety

Building on Calit2's previous success in developing IT for emergency management, **Sharad Mehrotra** has won a two-year, $1 million award from the Federal Emergency Management Agency

to develop IT systems for firefighter safety. That safety depends on having the right information at the right time: the location of the other firefighters, the floor plan of the building, the presence of hazardous materials. The team will develop new data collection, data fusion and analysis/visualization systems for firefighters. The data-collection process ensures that data from many different sensors (including audio and video) can be obtained and transmitted to outside command centers. This requires network nodes and sensors that are both robust and sensitive, powerful and portable. The data-fusion component is where the real advances will be made – in software that can derive data and meaning from multiple sources and coordinate those streams in real time. The researchers will also provide programming for smart display boards on site and at HQ that can present the data in visual form on overlays of maps and diagrams.

Global Changes, Local Impacts

Even the best global models of an impending rise in sea level can't predict what will happen to a particular coastal neighborhood, because that requires knowledge of local variables. Models that can incorporate those variables to generate alternate scenarios are needed by local governments and property owners. The NSF recently funded **Brett Sanders** to collaborate on the problem with Calit2. He will use the three-year, $290,000 grant to create new simulation models that can be uniquely tailored to specific coastal areas. Employing Newport Beach as a case study, Sanders and his team will combine the physics of water flow and wave motions with local data, including soil types, storm drains, street slopes, building orientations and tide patterns. The models will be based on tools already used by most local governments, such as aerial photography and GIS overlays, enabling other cities to use their own data. Researchers will advance

the process, however, by developing new computer representations of the data, enabling rapid calculation of multiple scenarios. The researchers will also hold workshops to disseminate the techniques to representatives of other Southern California coastal communities.

[Bits and Bytes]

by Shellie Nazarenus

Adventures in New Music

On October 25 the Calit2 auditorium at UCI will be transformed into a virtual concert hall, connecting live performers with colleagues at UCSD. "Multiplicities: An Inter-Arts Telematic Performance" features pianist Myra Melford, trombonist Michael Dessen and dancer Oguri in the Irvine building collaborating simultaneously in real time with Mark Dresser on bass and painter Nancy Ostrovsky performing in San Diego. The free concert takes advantage of advanced Internet technologies and features original compositions. "I think that telematic technologies will have the kind of impact in the 21st century that audio and video recording technologies had in the 20th," says Dessen, UCI assistant professor of music. "From a social standpoint, we're still coming to terms with the full implications of recording technology, well over a century after it was invented. Telematics will have an equally profound impact on how communities evolve and how we understand the relationship between culture and place."

Rooftop Sensing

A new project moved into an unusual location in the Calit2 building. A wind lidar, a box-like sensor that uses a laser beam to measure the vertical profile of the wind, was installed on the rooftop this summer. By detecting particles in the air, the equipment measures 10 height profiles from 40 to 200 meters each second. The software can also produce 3D mapping of the wind, and since the location even has an Internet connection, researchers can track their data from remote locations. The project is gathering information as part of a larger atmospheric research study headed up by Carl A. Friehe, professor in the UCI departments of mechanical engineering and Earth system science. The research focuses on atmospheric turbulence in the boundary layer over the Earth's surface, with an emphasis on geophysical turbulence.

Accolades for Emergency Response Efforts

Project ResCUE's lead software engineer Jay Lickfett has been recognized by the California Emergency Services Association with its Platinum Award. The award is presented to an individual for outstanding service in the emergency management field. Lickfett is the principal designer of the Disaster Web Portal and was nominated for the award by Jacob Green, from the City of Ontario Police Department's Administrative Services Bureau. Green worked closely with the Calit2 team on developing the portal, and the City of Ontario was the first municipal agency to implement the software that allows emergency responders to provide the public with real-time information in a crisis. The system was put to the test last year when a large fire broke out in the city. Residents used the portal's interactive features to track the fire's progress, learn which streets were closed, monitor mandatory evacuations and locate relief shelters. "I think the award will give our whole team the satisfaction of knowing that we are succeeding in our work, and it motivates us to continue our efforts," says Lickfett, who is receiving the award in October during the CESA annual conference in Palm Springs.

New UCOP VP Pays a Visit

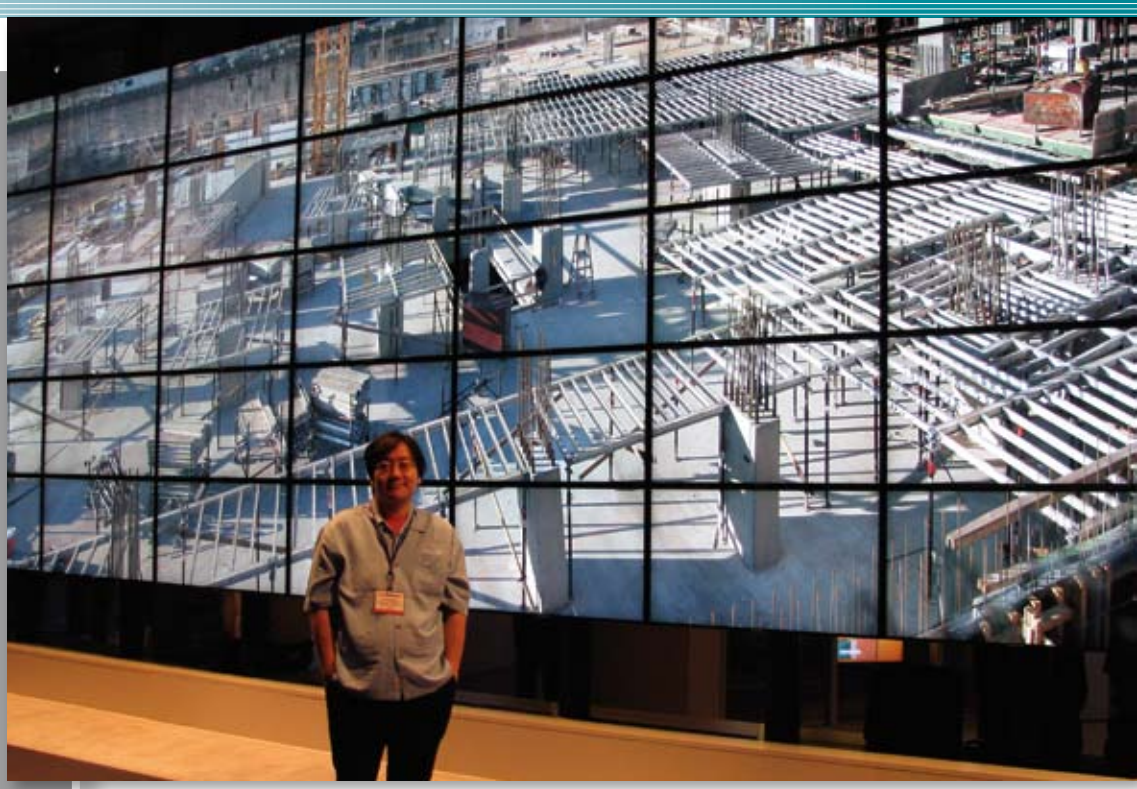
After fewer than four months on the job, the newly appointed University of California vice president for research and graduate studies made stops at both divisions of Calit2. Steven Beckwith, who filled the recently created position, serves as the senior system-wide research officer responsible for UC's long-term graduate education planning, outreach and recruitment. He will also promote ties with industry, state and federal government, and develop and promote university positions on research policy issues. During his UCI visit, Beckwith took a building tour and saw several project demonstrations, including the Zeiss lab (pictured). Calit2 and its three sister California Institutes for Science and Innovation are under the new leader's purview.

Sound an Alarm, Test the Technology

Alarms sounded and buildings emptied in what appeared to be a routine fire drill for occupants of UCI's Calit2 Building and neighboring Bren Hall. But the afternoon exercise in September turned out to be a well-orchestrated disaster simulation. Calit2 researchers tested their new SAFIRE (Situational Awareness for Firefighters) data communications system, which is funded by a $1 million FEMA grant. While the buildings were evacuated, the project team tracked the progress and safety of four role-playing firefighters searching for a pretend victim who had come into contact with toxic material. The firefighters wore sensors that recorded temperature, heart rate, acceleration, light, humidity and location. Researchers also deployed two portable, self-contained optical/acoustic sensors that relayed video and sound over Wi-Fi. Cameras and sensors in the two "smart" buildings registered their own data, and all of the information was relayed to a makeshift command center outside the two buildings that was outfitted with an early prototype of the team's Fire Incident Command Board.

IT Happened in Vegas

A descendent of HIPerWall – Calit2@UCI's 200-million-pixel, high-resolution display wall – traveled to Las Vegas during the summer to make an appearance at InfoComm 2008. The HIPerWall software was displayed in the Samsung booth at the show, on a wall built of 40 monitors with 46-inch screens. The wall simultaneously displayed four different data sets in high resolution, drawing notice from many of the 30,000-plus people who attended the three-day AV and information technology showcase. The Calit2 HIPerWall team, including postdoctoral researcher Sung-Jin Kim (pictured), was on hand to answer questions about the technology.



The Body Bionic

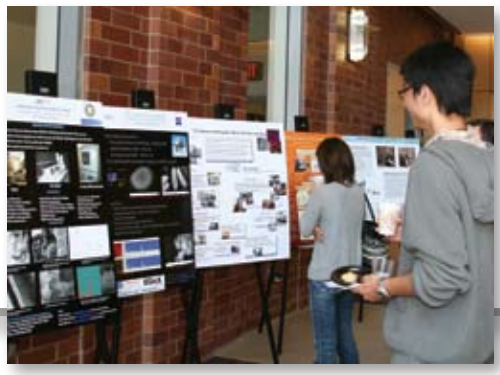
Next-generation embedded, wearable and prosthetic devices were showcased in the most recent Igniting Technology event in the Calit2 Building. "The Bionic Human" featured four UC Irvine researchers who are working on innovative technologies that combine biology and electronics, as well as a venture capitalist who discussed the biomedical device space. The panel presentation series, sponsored by intellectual property law firm Knobbe Martens, showcases research projects that are nearing commercialization. Presenters and local companies demonstrated their work during a post-presentation networking session, giving attendees a hands-on opportunity to learn more.

Voyage for Cleaner Energy

British polar explorer and environmental leader Robert Swan brought his Voyage for Cleaner Energy, a worldwide lecture series and sailing expedition, to Calit2 in May. The event was hosted by UCI's Center for Unconventional Security Affairs, in conjunction with Calit2's Green-IT research initiative. The voyage, which set sail from San Francisco in April, aims to increase awareness about environmental issues related to climate change and inspire young people to lead the way in implementing practical, viable solutions. Swan shared his lifelong commitment to preserving Antarctica with an overflow crowd in the Calit2 Building auditorium. During the next five years, Swan and his crew will journey around the world to the largest emitters of greenhouse gases, talking to audiences in the U.S., Russia, Europe, China and India about their roles as leaders in achieving sustainability. As a moving symbol of its global mission, the expedition's sailing vessel is powered solely by renewable energy.

Stimulating New Collaborations

Indicative of Calit2's multidisciplinary approach, a workshop held in June engaged an auditorium of researchers from a wide range of fields. "LifeChips, Stem Cells and Cancer" featured a dozen presenters from three prominent UCI research programs: UCI's LifeChips, the Sue and Bill Gross Stem Cell Research Center and the Chao Family Comprehensive Cancer Center. The workshop gave scientists from life sciences, physical sciences, medicine, computer science and engineering an opportunity to learn about their peers' research and discuss potential future collaborations. The event marked the successful second-year conclusion of the LifeChips graduate program, which in 2006 was awarded nearly $2.9 million for five years by the National Science Foundation. LifeChips combines interdisciplinary practices to produce small-scale technologies that benefit human health.



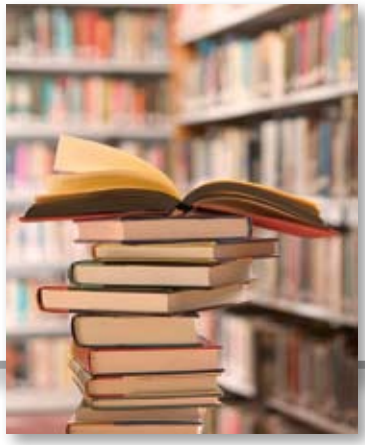
A Daily Dose of Calit2

Now there is a new way to learn more about Calit2 activities. Calit2.Life was launched mid-summer as an experiment in institutional lifecasting. The new blog-like site is a venue for insights and observations about the institute's everyday events at UC Irvine and UC San Diego. The behind-the-scenes contributions come from faculty and student affiliates as well as the staff at both divisions.

"We wanted to offer a different type of Web experience that allows many more voices to be heard than a traditional Web site can offer," says Larry Smarr, Calit2 director. The site accepts postings in a variety of formats, including texting from a Web-enabled cell phone, emailing or logging into the site's content management system from a laptop or desktop. Readers are encouraged to leave comments in response to posts that interest them.

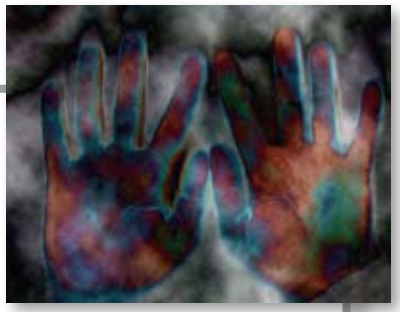
A Presenting Challenge

Whether it's a patent, a paper, a book, an installation, a talk, a design, a performance or a poster, academics have numerous ways of presenting their research. The 4th annual Calit2 Interdisciplinary Graduate Student Forum took a look at the choices scholars face, with a particular emphasis on how interdisciplinary collaborations may require novel approaches. Faculty and senior graduate students offered their insights into the challenges they faced when moving around and across disciplinary boundaries while preserving their own research methodologies. This year's forum included panel discussions followed by small group breakout sessions, where participants received advice and feedback on their research projects.



Green from Every Angle

Responding to heightened awareness of environmental issues, Calit2 is bringing together researchers with an interest in the subject to identify new collaborations in the burgeoning field of Green IT. An initial roundtable workshop was held in May under the direction of UCI informatics professor Bill Tomlinson. More than two dozen faculty from diverse disciplines and vast environmental and technology interests took five minutes each to share their research and where it is headed. As a result, three team clusters were identified based on campus research strengths. Each team will continue to meet to identify funding and project possibilities. To get involved, e-mail wmt@uci.edu.



All Hands to the Auditorium

Assisted by state-of-the-art Calit2 buildings on their respective campuses, UCI and UCSD researchers and staff came face-to-face through the power of a high-definition gigabit-per-second optical network experiment. The institute's director, Larry Smarr, led the virtual all-hands meeting in June. In the past, the two campuses took turns hosting the annual meeting. But in an effort to reduce travel time and expense, and to capitalize on the dedicated bandwidth between the two facilities, attendees only had to journey to their respective auditoriums for the meeting experience, which included updates by the division directors and presentations from researchers at both divisions who are leading parallel project areas.

Global Interest

Calit2@UCI continues to draw visitors from different sectors – including industry, academia and foreign governments. Some come to see a specific lab or research project, while others are being introduced to an overview of the institute. The outreach activities have proven to be a good way to develop research partnerships, contracts and donations. A sampling of guests from the past few months includes the president and CEO of Canon, USA; a delegation from Disneyland; Keck Graduate Institute scholars; attendees of the 3rd annual Frontiers in Biomedical Devices conference; and dignitaries from Iran (pictured), Korea, China, Singapore, Canada, Taiwan and Sweden.

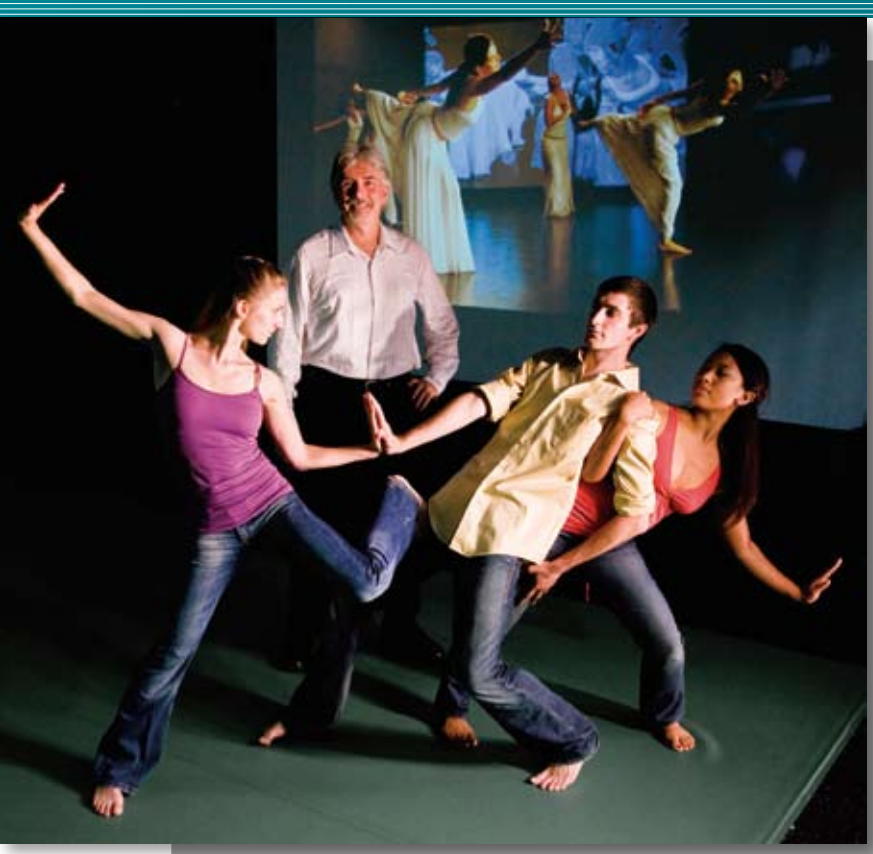


Photo: G. Gallardo

A New Lease on Research

A little bit of funding and a lot of hard work is transforming a lab on the second floor of the Calit2 Building. Under the direction of UCI assistant professor John Crawford, the eMedia Studio has been redesigned as "a distributed arts collaboratory, where artistic inquiry meets technology innovation." With support from Calit2 and the Claire Trevor School of the Arts, the eMedia Studio is a site for creating real-world environments, augmented by computer and communications technology, to explore embodied interaction in dance, theater, music and visual arts. Crawford received a 2008 Investigator Innovation Grant from the Council on Research Computing and Libraries (CORCL) to support initial development of the interactive Dance-IT network, which will tie together a series of specially designed and equipped media kiosks installed in locations around the world.

HASTAC in Motion

A mixture of lightning talks, demonstrations, performances, open labs and keynote speakers marked the second annual HASTAC (Humanities, Arts, Sciences, Technology Advanced Collaboratory) conference held at the Calit2 Building. "Techno Travels/Telemobility" explored the multiple ways in which place, movement, borders and identities are being renegotiated and remapped by new locative technologies.

While the three-day event took place at UCI and UCLA, participants along the Southern California high-speed corridor joined in virtual sessions, demonstrating the pervasive power of the tele-technologies themselves. Calit2 UCSD researcher Lev Manovich was among the presenters to demonstrate how new tools such as the HIPerWall offer an interconnected, collaborative space for research, teaching and presentation.

Cultures of Virtual Worlds

The rapidly increasing popularity of virtual worlds such as Second Life is creating new types of social networks and interactions. To better understand the cultures of these virtual worlds, researchers, developers and online residents came together last spring in a two-day conference at Calit2. Organized by Tom Boellstorff, UCI associate professor of anthropology, and Maria Bezaitis, director of Intel's People and Practices Research Group, the event included 30 presentations, including several moderated panels, creating a lot of dialogue and audience participation. According to the organizers, "Research in this field is at a preliminary stage where much of the most important work involves crafting new kinds of questions rather than providing definitive answers."

The California Institute for Telecommunications and Information Technology is a two-campus multidisciplinary research institute. In collaboration with its sister institute at UC San Diego, Calit2@UCI develops innovative projects that integrate university expertise with industry experience. The result: IT-based solutions that benefit society and ignite economic development.

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CARTKids

A new project at Calit2 has researchers going 'round and 'round.

David Reinkensmeyer, professor of mechanical and aerospace engineering, and Ph.D. candidate Laura Marchal are building a motorized wheelchair that uses robotic-assistance techniques and a smart-control algorithm to teach children with severe motor and cognitive disabilities to steer it.

A robotic joystick mounted on the wheelchair guides the user's hand as s/he controls the chair's direction. As the child steers the chair along an oval track, a camera sends data to a computer mounted on the back of the wheelchair, which relays it to the robot assistant, allowing it to continuously sense the child's performance. As the child's skill level rises, the robot reduces its steering assistance.

Current protocol requires the therapist or caregiver to walk next to the wheelchair, guiding the child's hand as s/he begins the learning process. Reinkensmeyer and Marchal believe the "smart" wheelchair will be more economical, more efficient – and more fun – than that.