CS@ILLINOIS ALUMNI MAGAZINE
SUMMER 2011

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University of Illinois at Urbana-Champaign

the future of the internet: what's next ?

ALSO IN THIS ISSUE:

PLATO: The World's First Online Community 18
Novel Computing Helps Spot Autism 31
Healthcare IT Research 34
Bridge Doctors and Grid Security 51

College of Engineering

computer science
is no more about computers
than astronomy
is about telescopes.

Edsger W. Dijkstra

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University of Illinois at Urbana-Champaign

CS@ILLINOIS ALUMNI MAGAZINE

SUMMER 2011

2	Letter from the Head
3	The Evolution of Social Networks
4	Alumni News
13	Did You Know?
14	**The Future of the Internet: What's Next?**
18	**PLATO: The World's First Online Community**
26	In the Lab
31	**Novel Computing Helps Spot Autism**
34	**Healthcare IT Research**
42	In the Classroom
51	**Bridge Doctors and Grid Security**
56	Students
63	Awards
64	New Faces
66	In Memory
71	The Last Word

> "I came to Illinois in early 2010, and have been overwhelmed with the sheer scale of the technical landscape here."

Welcome to CLICK!—our new magazine for the Department of Computer Science at the University of Illinois at Urbana-Champaign. We plan to use CLICK! to offer our friends and alumni a fresh and regular look at some of the cutting-edge accomplishments of our faculty and students.

The last year has been an enormously active one for Computer Science. We launched SHARPS, a new national center focused on the security aspects of strategic healthcare IT. And INARC, another new national center, launched to focus on the information management challenges of complex, mobile, self-forming, rapidly changing networks. New projects in social media, in secure Web browsing, in secure virtualization, in future Internet architectures, showed compelling results. We also celebrated the 50th anniversary of PLATO, the revolutionary Illinois computer learning system that pioneered concepts ranging from online communities to multiplayer games.

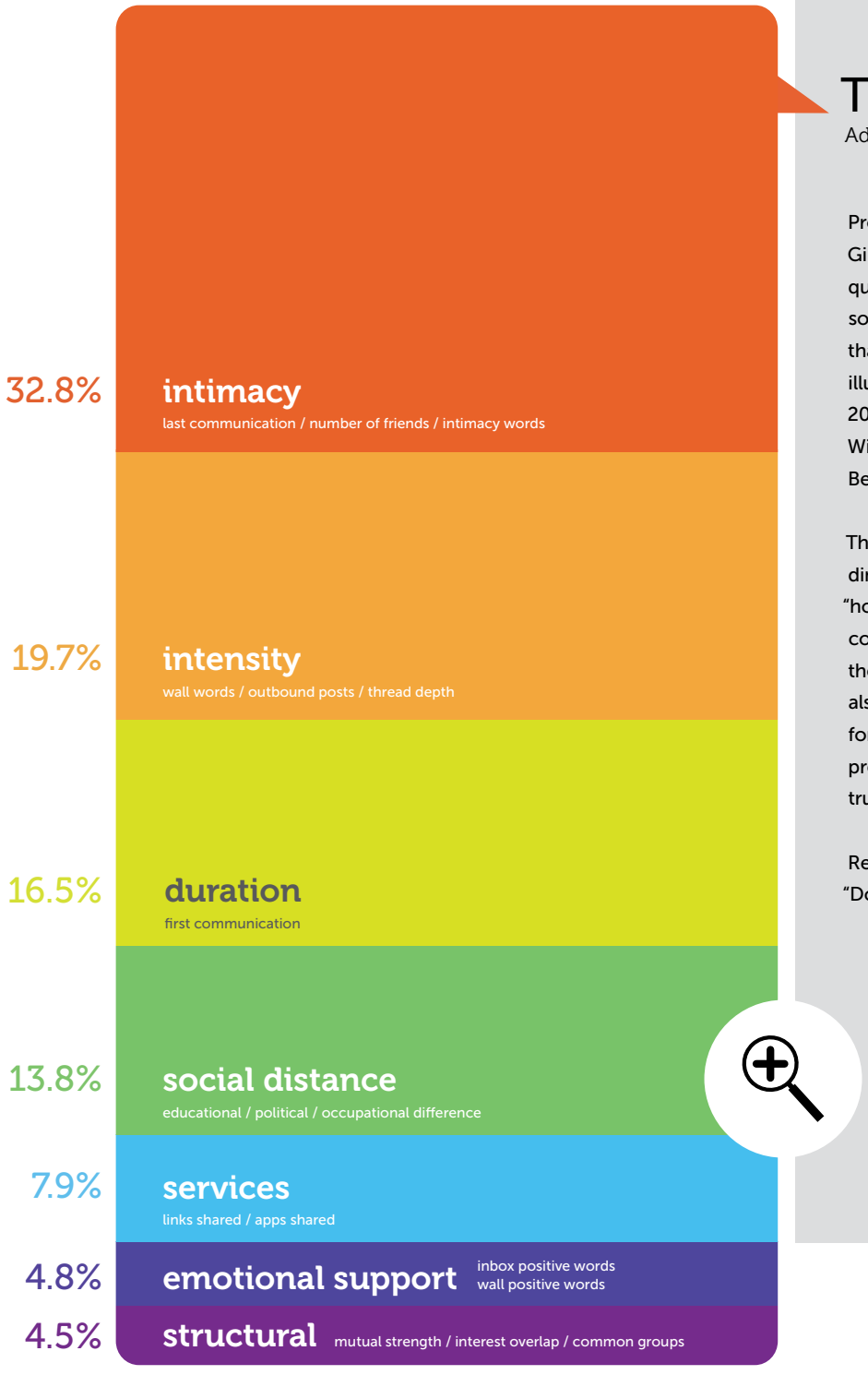
In the classroom, we moved mobile platforms into our entry-level programming courses, so that our students can learn that design in resource-poor/connectivity-rich ecosystems like smartphones is a very different beast. And summer school programs in strength areas such as data science and parallelism brought diverse teams of students to Siebel Center to share a deep, immersive experience working with our top faculty and graduate students.

Speaking of "deep and immersive experiences," I've had the privilege of being head of CS for just about one year as I write this. I came to Illinois in early 2010, and have been overwhelmed with the sheer scale of the technical landscape here. I should probably note, by way of full disclosure, that both of my graduate advisers got their doctorates here. (Even worse, *their* advisers got their doctorates here.) Seems there was something inevitable about me ending up at Illinois.

I hope you have as much fun reading CLICK! as we had in creating it. Stay tuned for future editions.

Rob A. Rutenbar, Head

the evolution of **social networks**



Tie Strength

Adj. $R^2 = 0.534$ MAE = 0.0994

Professor Karrie Karahalios and alumnus Eric Gilbert (Ph.D. 2010) explored methods for quantifying the strength of relationships in social networks. The research team discovered that tie strength depended on the factors illustrated here. Their results appeared at CHI 2009 in a paper entitled "Predicting Tie Strength With Social Media." Their work received the Best Paper Award at the conference.

The predictive power of the seven tie strength dimensions are presented here as part of the "how strong?" model. A dimension's weight is computed by summing the absolute values of the coefficients belonging to it. The diagram also lists the top three predictive variables for each dimension. On average, the model predicts tie strength within one-tenth of its true value on a continuous 0–1 scale.

Read more about their work on page 29, "Do You Really Have 324 Friends?"

BRUNO Virlet:

iphone genius

BY JOSH HOLAT, CS FRESHMAN

Few people can say they've written an iPhone application that's both made it to the top of the charts in iTunes as well as appeared in Apple's "What's Hot" section. If you're looking for someone who has, look no further than alumnus Bruno Virlet (M.S. 2010).

Virlet is the creator of the application Genius Scan, "a portable scanner in your pocket." Genius Scan combines a simple interface and quick processing that allows it to, as Virlet puts it, "satisfy the most common-use cases." What makes Genius Scan special other than its focus on simplicity and speed is that it also takes care of cropping and correcting the perspective of any documents the user snaps with their iPhone camera. It can then be converted into a PDF and sent to anyone.

Genius Scan almost eliminates the need for a scanner altogether, and can even eliminate the ubiquitous stack of receipts and business cards that inevitably have to be carried back from business trips.

"It's quite convenient when you have to email signed documents and have no scanner at hand," said Virlet.

Another aspect driving the popularity of Genius Scan is that its applications reach all sorts of different people. Virlet has received feedback from professionals ranging from lawyers to social workers. The app review site AppPicker.com gave Genius Scan five stars and declared, "Next time you plan to hit the road don't forget to download a copy of Genius Scan to make life easier for yourself and your accounting department."

However, to Virlet and his roommate Guillaume Gigaud, Genius Scan was simply a way to test the iPhone App market in their free time while earning master's degrees in computer science and electrical and computer engineering, respectively.

"Of course, what I was studying [parallel compilers under Professor David Padua] definitely helped me: all my research and most classes here focus on going faster and we worked a lot on making Genius Scan run fast." Looking at their success, it seems like that was a good concept to have learned.

Following their recent graduation, Virlet works for Amazon in Seattle while Guillaume is working for a software company in France. They both plan to continue development of Genius Scan by adding more features to satisfy the large amount of feature requests they receive.

ROBERT Horst:

robotic knee

BY MEGAN KELLY, COORDINATED SCIENCES LABORATORY

While Robert Horst was in high school, he suffered a knee injury that required three surgeries to fix. He endured a long healing process, and the primitive rehabilitation technology used frustrated him. So he decided to do something about it.

Horst, who received his M.S.E.E. in 1978 and Ph.D. in computer science in 1991 from the University of Illinois, envisioned a company that developed sophisticated, robotic medical devices and therapies to help patients with musculoskeletal and neuromuscular deficiencies. After working more than 30 years in computer design, he decided it was time to make his vision a reality.

"The idea to create a robotic device was always in the back of my mind, and I eventually got the opportunity to do it," he said.

Horst cofounded Tibion Bionic Technologies with Kern Bhugra in 2002, and immediately began creating and marketing the PK100 Bionic Leg Orthosis, a powered, assistive leg device that enhances knee rehabilitation therapy.

The PK100 is a battery-powered device with sensors to detect what the person is doing. It reacts to those sensors and acts as an amplifier for the person's muscle movement.

"That's important, especially in stroke rehab, because recent research in neuroplasticity has shown that the neural pathways can be retrained, but it requires the patient to be actively involved," Horst said. "With our device, they can walk with a much more normal gait, and when they do that, they're retraining the neural pathways to produce the right muscle forces."

The product also shows promise for people recovering from traumatic brain injuries and incomplete spinal cord injuries; patients with Parkinson's disease and MS; and those with mobility problems due to total knee replacement surgery or arthritis.

THOMAS M. Siebel:

corporate citizen

Thomas M. Siebel (M.S. 1983, computer science) was honored with the Woodrow Wilson Award for Corporate Citizenship from the Woodrow Wilson International Center for Scholars of the Smithsonian Institution. At the same event, the Honorable Condoleezza Rice, former Secretary of State, received the Woodrow Wilson Award for Public Service.

"These two leaders personify the attributes we seek to honor at the Woodrow Wilson Center," said Lee H. Hamilton, president and director of the Woodrow Wilson Center. "Their contributions have been numerous and significant, and it gives me great pleasure that the Board of Trustees has chosen to recognize such worthy honorees."

In addition to his success in business, Siebel has also been a generous humanitarian. He is the founder and chairman of two philanthropic foundations: The Siebel Foundation and The Meth Project Foundation. The Siebel Foundation was established in 1996 to support projects and organizations that improve the quality of life, environment, and education of the community, including programs advancing research and education and serving the homeless and underprivileged.

LINDA Mills:

distinguished service

Alumna Linda A. Mills, corporate vice president and president of Northrop Grumman Corporation's Information Systems Sector, received the Alumni Award for Distinguished Service from the College of Engineering in recognition of her outstanding leadership and management in providing critical, large-scale information technology services to military, government, and corporate clients.

Mills received her Master of Science in computer science from the University of Illinois in 1973.

"The University of Illinois continues to be a leader in innovation—introducing students like me to emerging technologies and cutting-edge projects," said Mills. "I learned about discipline, how to solve big, complex problems, and the practical application of engineering, lessons that have been essential to my success at Northrop Grumman."

During her 30-year career, Mills has held numerous positions and led varied programs of increasing scope and responsibility to become one of the top female executives in the nation. In her current position at Northrop Grumman's Information Systems, a leading global provider of advanced solutions for defense, intelligence, civil agency, and commercial customers, she is responsible for a business unit that generates $8.5 billion in revenue annually, employs more than 24,000 people, and maintains offices in 50 states and 18 countries.

MARY JANE Irwin:

acm-w athena lecturer

The Association for Computing Machinery's Council on Women in Computing (ACM-W; http://women.acm.org/) has named University of Illinois computer science alumna Mary Jane Irwin (now of The Pennsylvania State University) as the 2010–2011 Athena Lecturer for her outstanding research contributions to computer-aided design, computer arithmetic, and computer architecture. Irwin designed novel computer structures that are used in laptops to vastly improve the performance of image and speech applications. The award, which celebrates women researchers who have made fundamental contributions to computer science, includes a $10,000 honorarium, which is provided by Google Inc.

Irwin's landmark contribution is the design of the first architecture for Discrete Wavelet Transform, a process that decomposes a signal into a set of basic functions. This advance provides optimal performance for signal processing and image compression used in computer-aided design. To address bottlenecks in hardware design progress resulting from poor design tools, Irwin developed a new addition algorithm, known as ELM, which offers superior energy and performance characteristics that are now found in many computers.

KENICHI

Miura:

vector ideas recognized

Kenichi Miura (M.S. 1971, Ph.D. 1973, computer science) is the 2009 winner of the IEEE Computer Society's prestigious Seymour Cray Computer Engineering Award.

Miura, a professor in NII's Information Systems Architecture Science Research Division, is also director of the Center for Grid Research and Development and a Fellow of Fujitsu Laboratories Ltd. He was cited for leading the groundbreaking development of the Fujitsu vector processors, hardware, and software. Miura was recognized for his unique contributions to the field of computer engineering by bringing a strong background in numerical algorithms and applications to the task of designing systems that deliver high performance on real scientific applications.

The 1983 introduction of the Fujitsu VP-100/200 Vector Processing Systems was a major milestone in the history of supercomputer design. Miura made seminal contributions to the Fujitsu supercomputer design, showing how effective vectorizing compilers could exploit architectural features. He was the first to vectorize Monte Carlo radiation transport using the techniques, something that has profoundly affected important applications such as computational crash analysis for automobile safety design. The ease of program development and the delivered performance caused a significant reexamination of supercomputer research, performance, and approaches, influencing the worldwide market for high-performance computing technologies. The resulting designs and products were, at the time, the fastest machines in the world, largely based on Miura's work.

DAVID

Stolarsky:

swim the web

Alumnus David Stolarsky won the $20k OpenNI Grand Challenge with his gesture-based Swimbrowser for the Kinect.

Stolarsky received his B.S. in computer science in 2008. While a student, David was the brains behind the Wallfall interactive video wall display and other interactive projects. David is currently a creative engineer at Ars Electronica Futurelab in Austria, where he has created realtime distributed graphics systems, artistically rendered geospatial data, and created a multitouch floor with 2D LiDAR.

The Swimbrowser uses gestures to "swim" through the Web on the Kinect. It enables users to click links, zoom, pan, scroll, open tabs and menus, and more.

The OpenNI organization is an industry-led, not-for-profit organization formed to certify and promote the compatibility and interoperability of Natural Interaction (NI) devices, applications, and middleware.

RICHARD T. Cheng:

outstanding leadership

Alumnus Richard T. Cheng (Ph.D. 1971), founder and president of ECI Systems, received the Alumni Award for Distinguished Service from the College of Engineering in recognition for his pioneering and outstanding leadership in education and in business.

After graduating from Illinois with one of the first graduate degrees from the Department of Computer Science, Richard T. Cheng went on to found several computer science programs—at the University of Wisconsin–Whitewater, Hunter College, the Rochester Institute of Technology, and Old Dominion University. In 1981, during his time at Old Dominion, he began serving as a consultant to the Kingdom of Saudi Arabia, assisting with the establishment of the College of Computer Science and Engineering at King Saud University. Until 1991, he advised the Saudi government about the nation's computer network system.

He retired from his career in academia in 1985 to concentrate full time on running ECI, a highly successful, award-winning company he founded in 1980 with a former graduate student as his first employee. The company focused on research and development in computing in native foreign languages, including Chinese. Because of this expertise, ECI successfully competed in 1983 for a multimillion-dollar contract for the United States Information Agency's worldwide computer network. ECI grew into a leading integrated systems provider for the U.S. military and government, with annual sales of over $50 million, more than 500 employees, and 32 offices around the world. In 2002, Cheng retired, and ECI went through several mergers.

Cheng has made several endowments to support computer science, including the Richard T. Cheng Endowed Fellowship in the Department of Computer Science at Illinois. He has also been active in the Chinese American community, having founded the Organization of Chinese Americans, Eastern Virginia Chapter, and has become a member of the Committee of 100, an organization that seeks stronger relations between the United States and China.

DAV Zimak:

google buys fflick

In January, Google acquired Fflick, cofounded by alumnus Dav Zimak.

Fflick runs a sentiment analysis engine that recommends movies to users based upon their and their friends' Twitter feeds. The site lets you judge movies based upon tweets from all users, filter movies to see just those that you or your friends have tweeted about, and share your movies on Twitter. Fflick also allows users to buy movie tickets and add films to their Instant Queue if they are Netflix users.

The recommendations engine currently uses its sentiment machine for movies alone, but the model is potentially expandable to other verticals, a goal the founders laid out when first introducing fflick.

In an article about the acquisition, GigaOM suggests, "Using technology like Fflick's, Google could improve content discovery on the site, perhaps making the videos it surfaces more relevant to users. Google could also extend video recommendations based on social data to its Google TV products, enabling viewers to not only find content suggested by friends, but to get a good idea of how good a show is based on Twitter sentiment analysis."

JEFF Holden:

groupon buys pelago

In April, Groupon acquired alumnus Jeff Holden's Pelago. The iFund-backed Pelago was most famous for its Whrrl product, which is a Foursquare-like LBS services app that allows people to check into places.

Pelago CEO and former Amazon executive Jeff Holden will be now be overseeing product development at Groupon and members of the Pelago team will be taking on roles in "Grouponnovations."

"Many people think of Groupon as one thing: the inventor of the daily deal," said Holden in a post on the Pelago blog. "But as it often is in such cases, there is an amazing vision behind the company that goes far beyond what is visible on the surface today.

"Whrrl's mission has always been to increase the possibility of adventure in our daily real-world lives, and to that end, we invented an idea economy... It turns out that Groupon has a very similar mission, except they approached it by creating a new kind of deal economy...

"What made this a no-brainer was Groupon's massive adoption and meteoric growth. The opportunity to take the collective brain power and technology of our two companies and point them at a phenomenon already at huge scale is virtually impossible to refuse."

Groupon CEO Andrew Mason wrote, "We've always liked CEO Jeff Holden, the Whrrl team, and the technology they've developed. Their obsession with real-world serendipitous discovery, or Anti-Search, is core to Groupon's mission. It's about discovering what you didn't know you didn't know, right in your own backyard. Jeff intimately gets consumer buying behavior and the importance of a great user experience, and his team is this awesome combination of data-driven creatives...the people who create smart products that are really fun to use."

ALEX Miller:

strange loops

The Strange Loop Conference, run by software developer and Illinois computer science alumnus Alex Miller (B.S. 1996), has been described as a "who's who of interesting people doing applied computer science."

Miller was inspired to start this conference by his uncle Al, who battled a rare kidney disease for most of his life. "Al had an amazing vision of what must be done and he convinced [others] to take ownership of something they didn't even know they could do. It struck me like a thunderbolt. I don't want to just create a conference, I want to inspire and support others to create their own communities and events," said Miller.

In addition to creating the Strange Loop Conference, Miller currently works for Revelytix, creating federated data integration products using semantic web technologies. "I spend the bulk of my time right now working specifically on the SPARQL-SQL query planner. I also run the Lambda Lounge user group for the study of functional and dynamic languages and the Clojure Lunch Cljub in St. Louis. Also, I like nachos," said Miller. He has fond memories of the University, like living at Townsend Hall and spending time at Record Service, Garcia's, and the Courier Café.

The content of the conference is influenced by the creator's interest, such as emerging languages, alternative data storage, the use of "big data" and machine learning to build the next wave of web apps, concurrency, scalability, web, and mobile. The Strange Loop Conference also has a "Strange Passions" track, where attendees may submit a 10-minute, non-technical talk, which is selected by vote; the crowd favorites win a Strange Loop Klein bottle. Last year's "Strange Passions" talks included topics like astronomy, neurons, options trading, and building houses in Mexico.

ACM International Collegiate Programming Competition world finals

Illinois students have qualified for the world finals 9 of the last 10 years.

For the sixth year in a row, a team of Illinois computer science students will head to the ACM ICPC world finals.

The grueling competition pits the Illinois team against ten mind-bending, real-world programming problems, with only five hours to solve as many as possible.

The event is the most elite collegiate programming competition in the world, comprising just 100 teams from across the globe.

Problems range from designing an instant translation device to helping commuters get to work faster through mass transit systems.

2010 team from the University of Illinois

The 2011 team is sponsored by Palantir, which employs several former Illinois programming team world finalists. CS alumni John Carrino, Steve Downing, and Jeff Tamer reminisced about their time on an ICPC world finalist team.

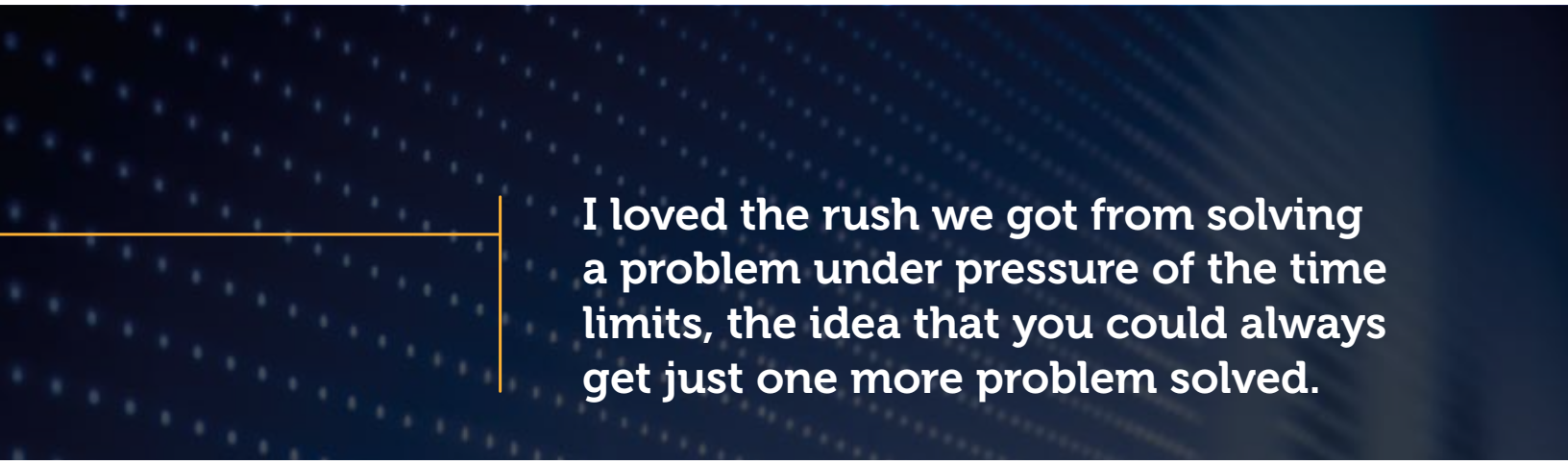
JOHN
Carrino:

I was introduced to programming by Jeff while in high school. Soon, Jeff and I began working with Steve on a programming team to compete in ACSL (American Computer Science League). After two successful seasons with Jeff and Steve, I matriculated to the University of Illinois to study computer science, which is where I discovered ACM. I devoted many days and nights to ACM, working on projects for SigGraph and SigOps and serving as chair of SigOps as well as secretary during my junior year. ACM is an amazing organization because of the experience you will get from working on various projects and for the people you will meet and work with. They will pass along knowledge that cannot be taught in a classroom and many will become excellent resources as you begin and further your career.

My experience with ICPC was irreplaceable, and I was fortunate to be reunited with Jeff and Steve, my programming team from high school. Prior to my entrance into ICPC, Steve and Jeff had already completed one season and had traveled to Prague. In 2005 when Jeff and Steve invited me to join their team I jumped at the idea. We were about to compete in regionals when our star, Jeff, fell extremely ill. We still placed second which solidified our spot in worlds, in Shanghai.

We decided to extend our trip to Shanghai from one week to three weeks, travelling around China the two weeks prior to worlds. Our adventure through China was fabulous and after two weeks of travelling, we met Jeff in Shanghai. We had tailored suits made and prepared for the competition. Fortunately, Jeff was in better health so we were confident and our performance was stellar thanks to him. We answered five questions, which was more than any other U.S. team. While we placed 17th in Shanghai, we were #1 in the States. It was an amazing ending to an amazing trip and experience.

Even though after graduation we all went our separate ways, two years later we all ended up in Silicon Valley, and then four years later, at Palantir. Since we've put the team back together, we have been tackling a lot of the hard problems Palantir has to deal with every day and loving it!



I loved the rush we got from solving a problem under pressure of the time limits, the idea that you could always get just one more problem solved.

STEVE Downing:

I've been drawn to programming for as long as I can remember, but growing up with Jeff definitely accelerated my interest and learning. As a kid, I felt like programming was the most productive thing I could do. My enthusiasm for programming continued to grow in high school where there was a critical mass of people drawn to the same thing. There was always a sense of competitive motivation. We challenged each other, but helped and learned from each other at the same time.

When it came time for college, UIUC was a natural choice, and Jeff recruited me to join ACM in 2003. I loved the rush we got from solving a problem under pressure of the time limits, the idea that you could always get just one more problem solved. In 2004 we had the opportunity to travel to Prague to compete, and we met finalists from all over the world. We placed second in the Java Challenge, and were able to go home with some bragging rights. We were also lucky enough to travel in Eastern Europe. Overall it was an amazing opportunity.

In fall 2004, we convinced John to join our team, and we rocked regionals. Despite a software glitch, we made it into the top 2, and went on to place as the top U.S. team at the world finals in Shanghai that year. Another amazing year in ACM, and another amazing travel experience.

JEFF Tamer:

I can't remember an age when I wasn't interested in coding. My dad was (and still is) a programmer, so it was a natural path for me to take growing up. I met Steve in third grade, and he quickly became interested in computers and programming as well. When we went to high school and met John, it didn't take long before he was learning to code with us, too. The three of us remained good friends throughout high school, college, and beyond.

In the fall of 2003, Steve and I learned about the ACM-ICPC competition, and in 2004 we went to the world finals in Prague. It was my first time in Europe, and it was a great experience getting to meet brilliant CS students from all over the world. We struggled a bit during the main competition, but we finished second place in the supplemental Java AI Challenge that year. Steve and I managed to recruit John onto our team the following year, and the three of us made it to the world finals yet again (but just barely, due to a bug in the judging code at regionals). In Shanghai we were thrilled to be able to complete 5 out of 10 questions, finishing in first place in the U.S. The three of us made a really fantastic team due to good communication and being able to play off each other's strengths.

did you know?

In 1987

when the smallest computers took up an entire desktop, and long before the Internet and mobile computing changed the way we live and work—Apple sponsored a contest at a dozen universities across the country to design the personal computer of the year 2000.

A team of Illinois CS Ph.D. students took on the challenge. The Illinois team included computer science Ph.D. students Steven Skiena, Arch Robison, and Bartlett Mel, and electrical engineering Ph.D. students Luke Young and Kurt Thearling; the team was advised by Stephen Wolfram.

The rules were simple: describe the computer's purpose, predict the technologies that will be available at that time, and show how to use them. The Illinois team's vision was chosen as the winning entry from more than 1,000 proposals.

Here are some of the team's predictions for how a tablet would look and function:

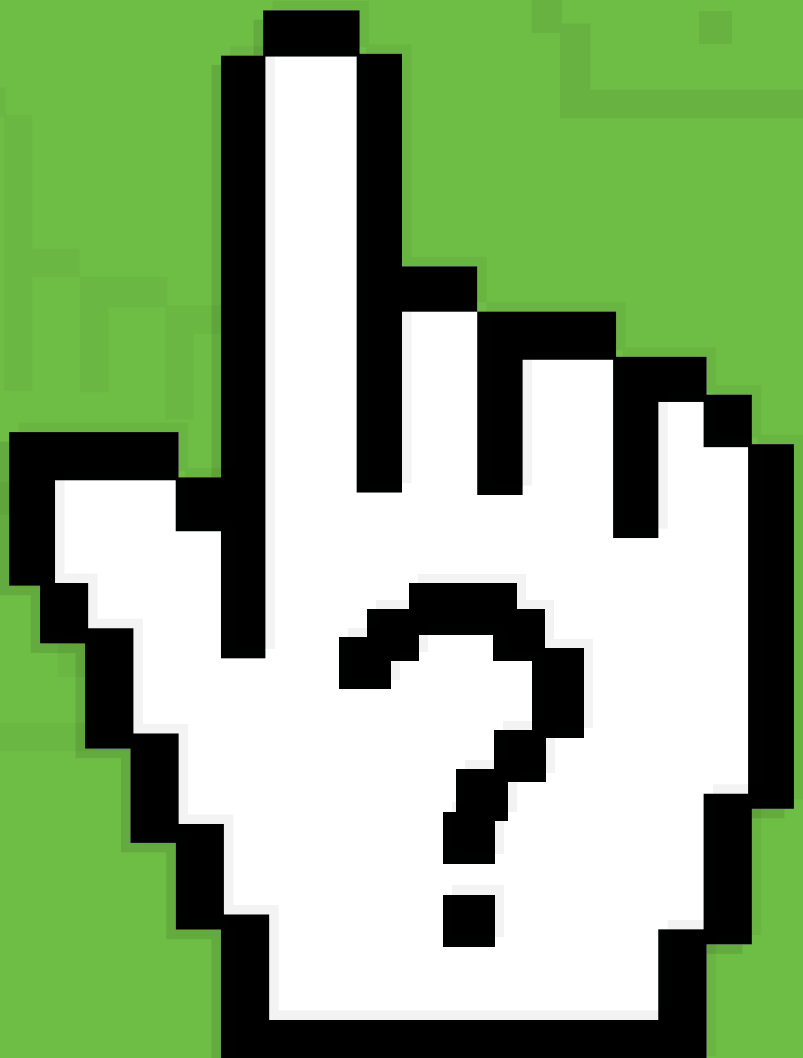
SMALL
The computer of 2000 will "have the same dimensions as a standard notebook" and "look like an 8 ½ x 11 monolith from the movie *2001.*"

TOUCH
The interface would be "a high-resolution touchscreen that yields slightly to the touch."

SEAMLESS
The best input device would be a stylus, with an on-screen keyboard, permitting "the ultimate integration between text and graphics."

VIDEO
A high-resolution color display would support video and video communications.

the future of the internet: what's next?



40 years ago

no one could have predicted the evolution of the Internet.

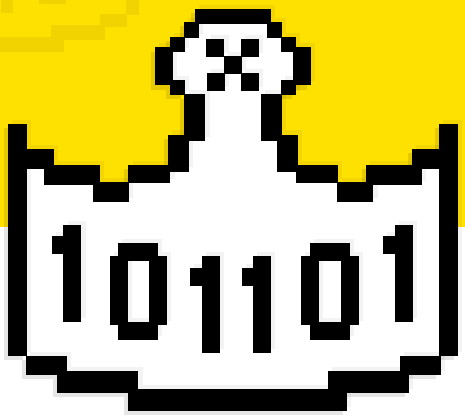
But of course, the Internet has far exceeded initial expectations. In so doing, it has stretched initial assumptions, and its original communication model is no longer up to the task. Social, economic, and legal considerations that were unheard of forty years ago are paramount today, to say nothing of the usability and applications concerns that today's users demand.

In 2009, the National Science Foundation challenged the network science research community to look past the constraints of today's networks and engage in collaborative, long-range, transformative thinking inspired by lessons learned and promising new research ideas.

"As our reliance on a secure and highly dependable information technology infrastructure continues to increase, it is no longer that emerging and future needs of our society can be met by the current trajectory of incremental changes to the current Internet," said Ty Znati, director of the Computer and Network Systems Division within CISE at the National Science Foundation.

Illinois computer science professors Tarek Abdelzaher and Matt Caesar are part of two separate efforts totaling $15.4 million to rethink Internet architectures. The two are pursuing differing versions of tomorrow's Internet. Abdelzaher is pursuing a vision in which data and content take precedence; Caesar sees a future in which cloud computing data centers become the primary locus for computation.

> "...it is no longer clear that emerging and future needs of our society can be met by the current trajectory of incremental changes to the current Internet."
>
> Ty Znati, director of the Computer and Network Systems Division within CISE



Tarek Abdelzaher

content is king: *named data networking*

What if a simple shift could put all the information you need at your fingertips?

When the networking protocols that govern today's Internet were designed, Internet Protocol (IP) made the machines first-class citizens, allowing them to find and talk to one another.

But rather than finding individual machines, today's Internet users are interested in finding content. This fundamental change is making it increasingly inefficient to conform to IP's requirement to discover and specify machine addresses, when what the user really wants are pieces of information. To carry the Internet into the future, a conceptually simple, yet transformational architectural shift, is required, from today's focus on *where*—addresses and hosts—to a focus on *what*—the content that users and applications care about.

Computer science professor Tarek Abdelzaher and his team of researchers will be working to make that transformational shift happen. Abdelzaher and his team will be working with researchers from UCLA and other institutions as part of a $7.9 million Future Internet Architectures grant led by Lixia Zhang at UCLA to create a new Internet architecture called Named Data Networking (NDN). The chief architect of the overall project is Van Jacobson, one of the Internet pioneers credited for great advances in TCP/IP, who has had the vision of NDN for some time.

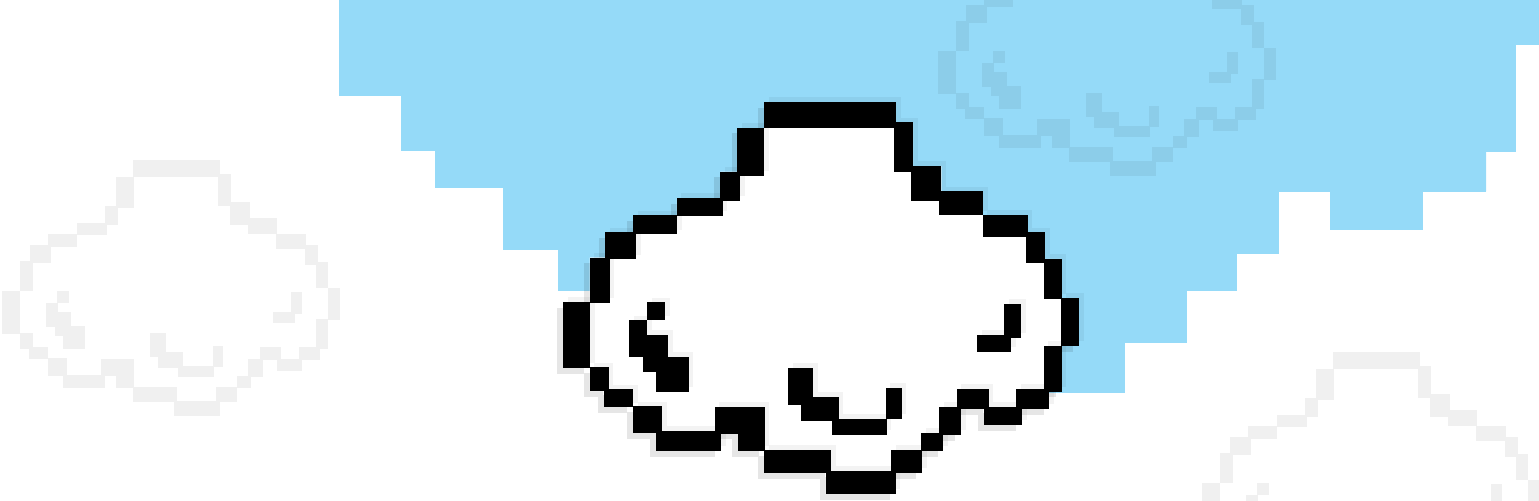
According to the team, NDN capitalizes on strengths and addresses weaknesses of the Internet's current host-based, point-to-point communication architecture in order to naturally accommodate emerging patterns of communication not well supported by today's Internet.

The project studies a set of problems necessary to validate NDN as a future Internet architecture: routing scalability, fast forwarding, efficiency of signature generation and verification, trust models, network security and defense, content protection and privacy, and fundamental communication theory.

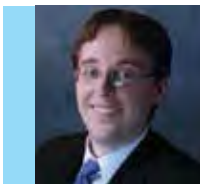
Abdelzaher and his team, in collaboration with UCLA, will lead application development for the future Internet. The Illinois team will demonstrate how the named-data networking paradigm can significantly simplify development of such applications and improve their efficiency and automation, as well as help make them more reliable and trusted. In the process, Abdelzaher hopes to discover new insights that improve the underlying architecture of the named-data networking paradigm itself.

"Since the amount of information that sensors and other modern technology generates and stores grows exponentially, whereas our ability to comprehend and consume it does not, future applications will be centered increasingly around some notion of information distillation—that is to say, bridging the growing gap between the increasing amounts of raw data on one end and the human need for succinct actionable information on the other," explained Abdelzaher, a Willet Faculty Scholar. "One can think of Web browsing as one example of (a rather poorly automated and inefficient form of) information distillation, where humans look for useful information in a sea of possibly irrelevant data."

The new paradigm has the potential to significantly improve Internet performance and greatly simplify authoring and dissemination of future information-centric Internet applications, including cloud computing applications, sensing applications, and smart spaces, where data is the first-class citizen.



Matthew Caesar



the cloud is the network: nebula

What if cloud computing didn't just utilize the network, but actually *was* the network?

In this future model, cloud computing data centers connected by a high-speed, extremely reliable and secure backbone network would become the primary repositories of data and the primary locus of computation.

According to the leaders of the Nebula project team, the growing trend toward migrating storage, computation, and applications into the "cloud" is creating unprecedented opportunities for global-scale, network-centric computing infrastructure, enabling new ways of fast resource provisioning, utility pricing, and consistent and easy management.

As part of a $7.4 million effort, computer science professor Matthew Caesar will join with project lead Jonathan Smith at the University of Pennsylvania and researchers at MIT, Berkeley, Stanford, Cornell, and others to create a new kind of cloud-based Internet architecture. The project focuses on developing new trustworthy data, control, and core networking approaches to support the emerging cloud computing model of always-available network services.

Their architecture, called Nebula, will surround a highly available and extensible core network interconnecting data centers with new trustworthy transit and access networks that enable many new forms of distributed communication and computing.

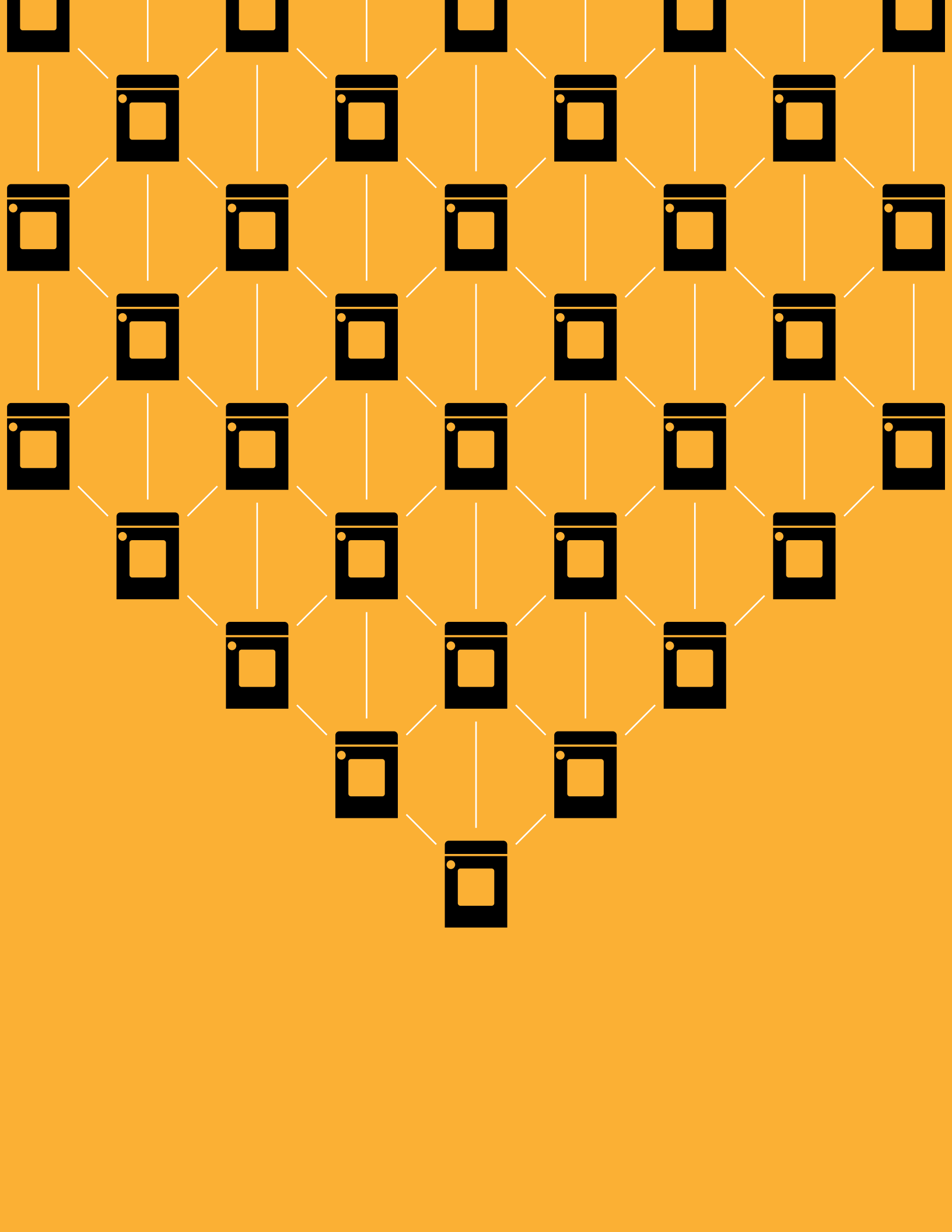
With this new architecture, Nebula mobile users would have quick, secure, 24/7 access to services such as financial transactions and electronic medical services at any location. Local device software systems would evolve to select from a continuum of distributed computing and storage services provided by data centers accessible via Nebula.

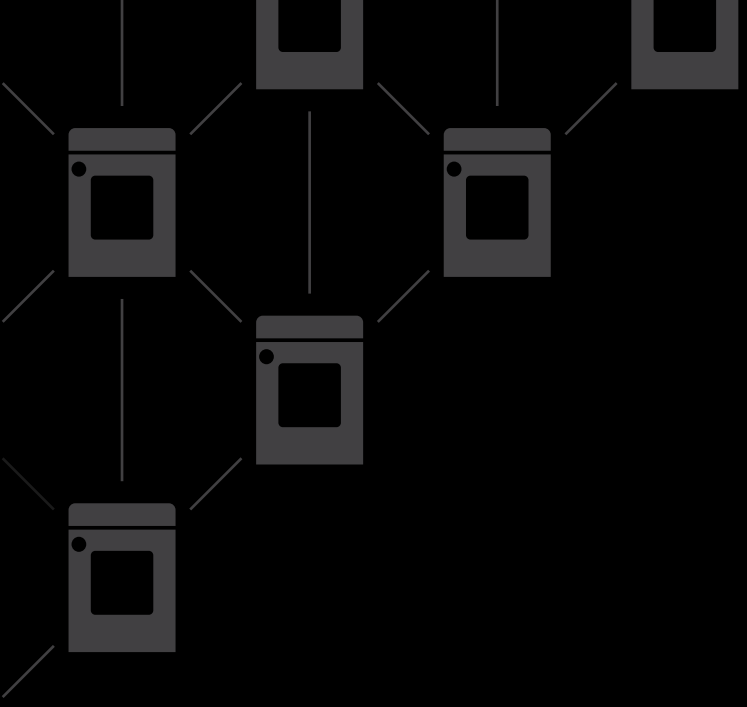
The trust and reliability concerns of such an architecture would be significant. A cloud-based architecture would have to not only satisfy privacy and security concerns of individual user data, but would also face heightened reliability and availability threats and concerns.

As part the effort to build Nebula, Matthew Caesar will address the reliability of such a large-scale distributed system.

Caesar's research focuses on protocols and systems that are able to bootstrap, configure, and troubleshoot problems with only minimal manual intervention. In particular, Caesar aims to create systems capable of self-configuring in the presence of arbitrary topologies and failure modes, self-diagnosing routing problems, and self-tuning operation based on diagnoses.

In the context of the project, Caesar will investigate how to leverage existing protocols, and will also be developing new ones that have strong guarantees and new properties appropriate for a cloud-based architecture. "I'll be working to create new protocols with an emphasis on building router software that reacts better to failures—both traditional outages and also more complex failure models, like software errors," said Caesar.





PLATO:

the world's first
online community

Ray Ozzie (B.S. 1979, computer science) recalls the first time he saw PLATO as the "career-defining moment" of his life.

PLATO was a pioneer system for online forums, message boards, email, chat rooms, instant messaging, online news services, blogging, and even multiplayer games.

"I had my career-defining moment in college, in the early 1970s," said Ozzie, now the chief software architect at Microsoft, in an article written for the *New York Times* in 2002. "On my way to work, I kept passing this building that had a strange orange glow emanating from the windows. I looked in and saw people sitting at rows and rows of terminals."

What Ozzie had discovered was PLATO—an acronym standing for "Programmed Logic for Automated Teaching Operations"—a networked teaching system launched at the University of Illinois by engineering professor Don Bitzer 50 years ago.

In the early 1970s, PLATO was evolving into the fourth generation, with touch-sensitive terminals, gas-plasma flat-panel displays, and a powerful authoring language called TUTOR for developing almost any kind of program imaginable.

Ozzie wrangled himself a job as a systems programmer on PLATO IV and was eventually hired at the minimum wage of $1.75 an hour. Fifteen years later, inspired by the "interactive environment" he'd experienced with the system, Ozzie released Lotus Notes, a popular email and collaborative workspace software package that now sits on nearly 100 million desktops around the world.

Ozzie is just one of many PLATO alumni who spent their college years with the system and eventually started their computing careers from the Computer-based Education Research Laboratory (CERL), where the system was housed. Together they built a system of distributed computer-based learning and, unexpectedly, harnessed a culture innovation which produced the precursors of a stunning universe of applications: online forums and message boards, email,

A BRIEF HISTORY OF PLATO

"My real goal of PLATO was to make it possible for everyone to get a good education. The online community was actually an accident."

Don Bitzer, creator of PLATO

1960

PLATO, an acronym standing for "Programmed Logic for Automated Teaching Operations," started as a "teaching machine" project of the Coordinated Sciences Laboratory (CSL) at the University of Illinois.

The first system, PLATO I, operated on the local ILLIAC I computer. It included a television set for display and a special keyboard for navigating the system's function menus.

chat rooms, instant messaging, online news service, blogging, and multiplayer games, leading to the emergence of the world's first online community.

"The interesting thing is, my real goal of PLATO was to make it possible for everyone to get a good education," Bitzer said. "The online community was actually an accident."

Talk to most PLATO alumni and they can give you a quick summary of how the world's first online community started to emerge on PLATO, usually as a short personal story.

David Woolley (B.A. 1977, psychology), now a Web consultant specializing in online collaboration and Web conferencing, said when he started to work on PLATO in 1972, there were very few terminals. The user community was quite small and most terminals were still in a single building.

"In fact, I didn't even have one in my office, so sometimes I had to wander down the hallway to try to find one to use," Woolley added.

Around the same time, PLATO started a transition to the fourth generation of mainframes that would eventually support up to 1,000 users simultaneously. "Over the next year or so, more and more terminals were installed," said Woolley. "This is why in the summer of 1973, I was assigned to develop a program to facilitate communication via the computer—the result was PLATO Notes."

PLATO Notes was originally designed as a two-way medium to allow the system staff to talk to other users. It started with three files: System Announcements for PLATO system staff to post things like "new features," Help Notes for people to ask technical questions, and Public Notes for users to post anything else.

Surprisingly, Woolley found that Public Notes became the most crowded forum among the three files. "Despite attempts to limit discussion to PLATO-related topics, it quickly became a public forum where people talked about everything under the sun—politics, books, movies, recipes, religions, interpersonal relationships, you name it."

Soon after, people realized that a public forum was far from enough to fulfill their rising desire to communicate with each other within the growing PLATO community. In the same year, Talkomatic and Term-Talk were released.

"Talkomatic was kind of today's chat rooms and Term-Talk is the precursor of today's instant messaging," said Woolley. People logged into Talkomatic to chat in groups and used Term-Talk to start private conversations.

From 1978 to 1985, the PLATO system logged 10 million hours of use. About 3.35 million of those hours were spent in PLATO Notes, while games probably accounted for about 20 percent of PLATO usage.

1961

PLATO II appeared as a multiple-student, computer controlled automatic teaching device.

1967

PLATO III allowed "anyone" to design new lesson modules using its TUTOR programming language. At that time, the system could simultaneously run up to 20 lessons.

1972

The PLATO IV terminal was a major innovation, which included the Plasma Display Panel (PDP) technology and student touch input technology.

"Both of them were very successful," Woolley added. "Soon Talkomatic was logging over 40 hours of use per day."

With PLATO Notes and Term-Talk in place, people began to use PLATO as a means of regular communication within the community. What it apparently lacked at the time was a way to send private mail. One year later, another program called "Personal Notes" was released.

Kim Mast (B.S. 1977, M.S. 1984, electrical engineering), the creator of Personal Notes, viewed his innovation as a "logical follow-on" of the "PLATO Notes."

"Personal Notes is just like today's email," Mast said. "When you logged in, you'd see that you have a new note—it's kind of the precursor of 'you've got mail.' It was pretty thrilling when you logged in: 'Wow, somebody sent me a note, this is so cool!'"

This is where the idea of the online community began to emerge on PLATO, as the scale of the user community expanded to about 1,000 terminals and as PLATO Notes, Talkomatic, Term-Talk, and Personal Notes were introduced in quick succession.

"At the time, people met and got acquainted in Talkomatic, and carried on romances via Term-Talk and Personal Notes," Woolley recalled. "It was really amazing. Even I, who kind of started the community with PLATO Notes, didn't really have in mind what it was going to be."

The community also built its own additions to the official lesson development and major software infrastructure in the form of multiplayer games and alternative online communications, often using file space other departments had abandoned.

One famous program was News Report, an online newspaper published periodically by Bruce Parrello, aka "The Red Sweater."

"Everybody had a nickname they used when playing the games; there were three

"At the time, PLATO was probably a decade ahead of anything else and it's extremely influential."

David Woolley, former PLATO programmer and user

1973–1974

The online community emerged. There were about 1,000 terminals and many thousands of students all around the U.S., which brought out the birth of social computing: email, instant messaging, chat rooms, message boards, the world's first online newspaper, blogging, and multiplayer games.

In 1973-74 PLATO had:

PLATO Notes
Today's online forums and message boards

Talkomatic
Today's chat rooms

Term-talk
Today's instant message

Personal Notes
Today's email

News Report
Today's online newspaper and blogging

Multiplayer games

Red Barons, and since I liked wearing red sweaters, I decided to call myself 'The Red Sweater'," said Parrello (B.S. 1975, computer science). "When I decided to create a program people could use to post news stories for others to view, I named it 'News Report' and subtitled it 'The Red Sweater News Service'."

Essentially, the News Report was an online news service that enabled anybody on PLATO to write a letter to and have it posted. In a very real sense, however, they were also doing something very similar to what became blogging.

"We were all citizen journalists, and we had a steady stream of readers who knew they were getting a decidedly non-mainstream voice," Parrello added.

The other rapidly growing aspect of the PLATO community was the multiplayer gaming. The users were so obsessed with these games that they always stayed overnight at the lab, until the UI campus police put the curfew signs up.

According to Woolley, unpaid programmers wrote most games on PLATO. The only reward they could hope for was the prestige of having written a popular game.

Airfight, a precursor to Microsoft Flight Simulator, written by Brand Fortner, was among the most popular games on PLATO.

1976

Control Data Corporation (CDC) entered into a series of agreements with the University of Illinois to commercialize the PLATO system. The result was a great expansion of PLATO throughout the world, with systems installed in Canada, France, Belgium, Israel, Sweden, Australia, South Africa, United Kingdom, and elsewhere.

"Airfight was a very elementary graphical flight simulator, where we used a few lines to represent the horizon, runways, and other items on the ground," said Fortner (B.S. 1977, M.S. 1982, Ph.D. 1993, physics) now a research professor at North Carolina State University. "But it was the first complex, highly interactive, combat simulation game on PLATO, and became exceptionally popular until Empire (a multiplayer game based on Star Trek) made its appearance."

Eventually, the crowds that used to flock to Airfight instead flocked to Empire, and later to other interactive combat games. Fortner said he believed the reason for this is that gaming is greatly enhanced by the social interactions between gamers.

"Empire's communications capabilities were much superior to Airfight," said Fortner. "And all serious games that followed Airfight made extensive use of social interactions as part of the gaming experience."

Fortner also said that all the multiplayer games on PLATO did a great job of enhancing the community, by being a focal point for social interactions and discussions between online individuals who may not have interacted otherwise.

According to Woolley, from 1978 to 1985, the PLATO system logged 10 million hours of use. About 3.35 million of those hours (over 30 percent) were spent in PLATO Notes, while games probably accounted for about 20 percent of PLATO usage during this period.

In 1976, Control Data Corporation (CDC) entered the picture, establishing PLATO IV as a commercial educational product that, by 1985, had established systems in over 100 campuses around the globe.

In the late 1980s, however, when microcomputers were becoming a more cost-effective platform for education than PLATO with its mainframe-based architecture, the system slowly faded. Now it's still carried on through NovaNET courseware for high school and adult learners and PLATO Learning, a company that provides teaching resources for K–12 and higher education.

"From today's point of view, the PLATO technology is kind of the dinosaur of the computing world: it doesn't have good ways to display images, it's orange dots on the black screen, it doesn't even do scrolling," Woolley said. "But the thing is, at the time, PLATO was probably a decade of ahead of anything else and it's extremely influential. People that experienced PLATO went on to use that experience in developing all kinds of products, like Ray did with Lotus Notes."

1987

The PLATO network offered more than 12,000 instructional hours in some 100 subjects to on-campus terminals and others scattered across the globe.

real world, meet the network. network, meet the real world.

Extreme Scale Social Networks

BY JENNIFER LAMONTAGNE

Computer science professor Sanjay Kale and the Parallel Programming Lab (PPL) of the University of Illinois are part of a collaborative group that has been awarded a $1.45 million grant to develop petascale computing environments that model billions of individuals in extremely large social and information networks.

The goal of the proposal "Coupled Models of Diffusion and Individual Behavior Over Extremely Large Social Networks" is to use new computer technology breakthroughs to study events like disease pandemics, financial crises, as well as the spread of opinions, attitudes, or social beliefs, through populations on a global scale. Current state-of-the-art agent-based computer models can simulate the spread of a disease like influenza through a population the size of the United States. Petascale modeling would make comparable agent-based studies of disease transmission possible for global populations.

Professor Sanjay Kale

Professor Kale will lead the Illinois effort to construct a petascale computational modeling environment—MTML-Sim—that will scale to billions of individuals and their social and information networks. The scaling will be achieved by developing innovative parallel algorithms as well as their implementations that will allow researchers to map the networks on petascale computing environments that are in the process of being built and deployed at places such as the National Center for Supercomputing Applications at the University of Illinois at Urbana-Champaign. This environment will be used to test simultaneously multiple theories of social interaction amongst individuals and groups.

"Our efforts will focus on improving the performance and productivity of agent-based modeling applications on these 100,000+ processor petascale computer architectures," said Kale. "Guided by direct collaboration with application developers, we will make enhancements to the Charm++ runtime system and associated performance analysis tools, which will give us a handle on designing and improving the software environment to accelerate application development for the next generation of petascale computer systems."

CS@ILLINOIS Leads $16.75 Million Army Information Network Center

BY JENNIFER LAMONTAGNE

Faculty in computer science will develop new technologies designed to support information networks in uniquely challenging environments as part of a $16.75 million research center funded by the U.S. Army Research Laboratory. The Information Network Academic Research Center (INARC) will address the research challenges inherent in complex, mobile, self-forming, and rapidly changing networks such as those utilized on the battlefield by the Army and its soldiers.

The center will focus on how to best support the primary task of a military information network: providing users with reliable and actionable intelligence across the full spectrum of Network Centric Operations (NCO), including humanitarian support, peacekeeping, force protection, and full combat operations.

This unique environment has guided the development of the Illinois INARC research agenda focused on building a foundation for scalable, hierarchical, and most importantly, dynamic and resilient information networks. The proposed research addresses critical issues of connected and interrelated entities that form sophisticated relationships and networks.

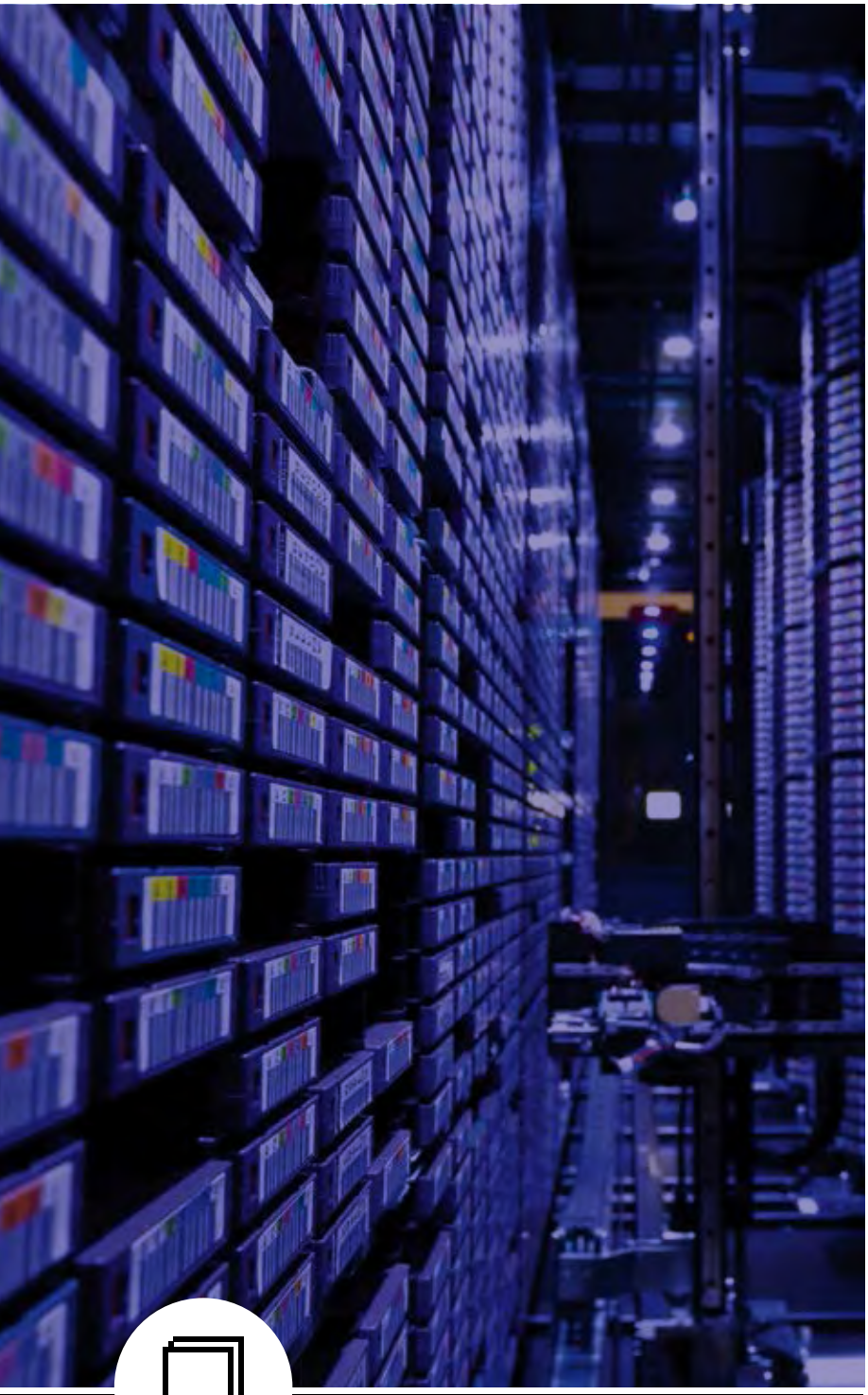
"Modern warfare and military missions demand superior mastery of information and data of various forms. Such data and information may be massive in volume, generated from multiple sources, interrelated, and connected by logical relationships, sometimes defined by the underlying physical network or the social network above," said consortium director and Illinois computer science professor Jiawei Han.

Addressing information network challenges in this environment requires a multi-disciplinary approach that breaks new ground and builds on existing research in communication, information, and social and cognitive research.

The Illinois INARC will bring together a team of world-class researchers in several disciplines, with Illinois as the principal member. Illinois computer science will receive $8.162 million of the total funding. Partners in the effort include UC-Santa Barbara, IBM, and CUNY as general members, and Carnegie Mellon University, University of Michigan, Northwestern University, and Palo Alto Research Center as sub-awardees.

The consortium will be led by Illinois computer science professor Jiawei Han. Other Illinois faculty members contributing to the effort include computer science professors Tarek Abdelzaher and Dan Roth, and electrical and computer engineering professor Thomas Huang.

Professor Jiawei Han



briefs

Using Untrusted Software Without Fear

BY JENNY APPLEQUIST, INFORMATION TRUST INSTITUTE

Imagine being able to download and run software of unknown origin without having to worry about vulnerabilities in it that could be exploited by hostile entities. With the support of a new four-year, $4.1 million research award from the U.S. IARPA agency, University of Illinois computer science professor Vikram Adve and his team are going to bring us a few important steps closer to that goal. His new project at the Information Trust Institute (ITI), entitled "Secure Virtual Architecture: A Foundation for Integrating Analysis, Confinement, and Diversification," will develop techniques for the effective, automatic mitigation of software vulnerabilities in C/C++ and Java programs.

The new project has an ambitious goal: to prevent exploits for a wide range of vulnerabilities, and combine all three kinds of strategies in novel ways that work cooperatively to maximize effectiveness. The work will culminate in the production of two new security tools: one for use with programs written in C/C++, and another for Java. The two tools will share many key components. "These tools must be able to operate fully automatically, without programmer intervention," explained Adve, whose primary academic appointment is in the Department of Computer Science. "Moreover, they will have to detect and prevent exploits with very low impact on the performance of the code."

The work will build on Secure Virtual Architecture (SVA), a system previously developed by Adve and his research group. SVA is a compiler-based virtual machine for commodity operating systems that enhances system security and reliability. In Adve's words, "SVA has some unique capabilities, including the ability to do both powerful static analysis and sophisticated run-time code transformations for many different programming languages. These will enable novel approaches to the integration of analysis, confinement, and diversification."

Do You Really Have 324 Friends?

BY ALYSSA EADE

Recent Ph.D. alumnus Eric Gilbert recently won a Best Paper Award for his work on a piece about predicting tie strength with social media. "Our work bridges this gap between theory and practice. In this paper, we present a predictive model that maps social media data to tie strength," said Gilbert of his work.

The idea of tie strength was originally introduced by Mark Granovetter. Strong ties are the people you really trust, people whose social circles tightly overlap with your own. Weak ties, conversely, are merely acquaintances and often provide access to novel information, information not circulating in the closely knit network of strong ties. With this information in mind Gilbert sought to answer one question with this research: can social media predict tie strength?

"The model we present builds on a dataset of over 2,000 Facebook friendships, each assessed for tie strength and described by more than 70 numeric indicators. It performs with surprising accuracy, modeling tie strength to 10-point resolution and correctly classifying friends as strong or weak ties more than 85% of the time," said Gilbert.

The team illustrates how modeling tie strength can improve social media design elements, including privacy controls, message routing, friend introductions, and information prioritization. A model of tie strength has the potential to significantly impact social media users.

See Eric Gilbert's tie strength model in "Evolution of Social Networks" on page 3.

the **anxiety index:** a measurement of how often anxiety is expressed in blogs.

Predicting the Future from Blogs & Tweets

BY JENNIFER LAMONTAGNE

Blog posts can be used to predict stock market behavior, according to Eric Gilbert and Karrie Karahalios at the University of Illinois at Urbana-Champaign, who presented their findings last month at the International Conference on Weblogs and Social Media in Washington, D.C.

They used over 20 million posts from the LiveJournal website to create an index of the U.S. national mood, which they called the Anxiety Index. It is a measure of the frequency with which a range of words related to apprehension, such as "nervous," appear in the posts. Gilbert and Karahalios described how they have used the index to improve forecasts of the movement of the S&P 500, a stock market index based on large, public U.S. companies.

Movement of the S&P 500 can be predicted with some degree of accuracy using a model that extrapolates from the past three days' prices. Gilbert and Karahalios found that when the Anxiety Index rose sharply, the S&P 500 ended the day marginally lower than the three-day model predicted. This shows, the researchers say, that the index can be a useful bellwether of economic behavior. "Blogs provide a sample of what is going on in society," said Gilbert.

geometric approximation algorithms tend to be simple, fast, and more robust than their exact counterparts.

New Text on Geometric Approximation Algorithms

A new text on geometric approximation algorithms authored by professor Sariel Har-Peled is the first to cover the subject in detail. *Geometric Approximation Algorithms* describes key techniques in geometric approximation algorithms and also surveys some of the more traditional computational geometry techniques, such as sampling and linear programming.

The field of geometric approximation algorithms is a subfield of both computational geometry and approximation algorithms, explained Har-Peled.

"Exact algorithms for dealing with geometric objects are complicated, hard to implement in practice, and slow," said Har-Peled. "Over the last 20 years, a theory of geometric approximation algorithms has emerged. These algorithms tend to be simple, fast, and more robust than their exact counterparts."

What began as a collection of class notes on the subject was expanded by Har-Peled into his full-length text. While writing the text, Har-Peled took a different approach than that used by other texts on computational geometry. In the book, Har-Peled unified several data-structures to use compressed quadtrees as the basic building block and provides an elaborate introduction to VC dimension, a subject he said can often be "somewhat mysterious." In addition, the text covers some topics, including locality sensitive hashing and metric space partitions, that are not part of traditional computational geometry.

New Threats, New Systems

Professor Sam King is working on what many see as the only solution to a growing number of online security threats: a radically redesigned Web browser. King and his team are building a new browser known as the Opus Palladianum, or OP, browser. OP is intended to address the many security vulnerabilities of current Web browsers. King and other researchers in his lab, including Ph.D. students Chris Grier and Shuo Tang, are borrowing concepts typically seen in operating systems to enable the OP browser to securely manage Web applications and data access.

"From a security perspective, browsers are completely broken," King said. The problem with traditional browsers is that the way people use the Web has changed. Instead of just looking up information on static pages coded with HTML, or HyperText Markup Language, people are using the browser to run Web versions of applications that used to reside on a PC, such as email, social networking, and online banking.

AUTISM AFFECTS 1 IN 110 CHILDREN IN THE U.S.

WITH A LIFETIME COST OF CARE OF $3.2 MILLION PER PERSON. CURRENT BEST PRACTICES FOR EVALUATING BEHAVIOR AND ASSESSING RISK ARE BASED ON DIRECT OBSERVATION BY HIGHLY-TRAINED SPECIALISTS. IT'S LIKELY EARLY ASD DIAGNOSES LEAD TO BETTER TREATMENT OUTCOMES,

BUT SCREENING YOUNG CHILDREN IS DIFFICULT, AND SO MANY CHILDREN ARE NOT SCREENED.

ENTER COMPUTING

Novel computing techniques to assist doctors in identifying at-risk children

TWO COMPUTER SCIENCE PROFESSORS from the University of Illinois at Urbana-Champaign are part of a $10 million effort to develop new computing techniques and approaches for identifying children at risk for autism and other developmental delays. As part of the effort, professors Karrie Karahalios and David Forsyth will develop novel computational methods to measure and analyze the behavior of children and adults during face-to-face social interactions. The two will be working with researchers from Georgia Tech, Carnegie Mellon, MIT, Boston University, the University of Pittsburgh, and the University of Southern California as part of an NSF Expeditions grant led by Georgia Tech.

The team hopes that by developing methods to automatically collect fine-grained behavioral data, this project will enable large-scale objective screening and more effective delivery and assessment of therapy. The project will develop multiple sensing technologies, including vision, speech, and wearable sensors, to obtain a comprehensive, integrated portrait of expressed behavior.

Professor Karahalios (top right) works with her research team at the University of Illinois at Urbana-Champaign

"People can show they're engaged with gaze, gestures, expressions, body posture, and tone of voice," said Forsyth, "so the project will use many different sensing modes to get a comprehensive portrait of what subjects are doing."

The project will be developing unique capabilities for synchronizing multiple sensor streams including cameras, microphones, and wearable sensors, and then using these streams to measure behavior. "We'll develop methods to model interactions between people," said Forsyth, "to help screen for ASD and help therapists know the best time to encourage or discourage a behavior."

Karahalios will expand her existing research into the use of speech visualization technologies and techniques to teach children with Autism Spectrum Disorder (ASD) how to create speech. To date, Karahalios and her team have visualized vocalization in the form of utterances, phonemes, and syllables in real time. Children and clinicians use the visual feedback to modify their vocal behavior, and to provide a metric for improvement.

The goal of her new effort is to move from utterances and syllables to words and phrases. Additionally, the team will develop visualizations to aggregate data from doctor's visits for early diagnosis of ASD by visualizing performance of an evaluation metric called Rapid ABC.

"There are many ways that technology can augment diagnosis and therapy. One of the things we stress is that we do not want the technology to replace the clinicians or therapists, but rather to aid them in their work and provide a context. Visualizations of mass data sets may reveal patterns that are yet unknown, and provide new insights to parents and clinicians alike."

"WE DO NOT WANT THE TECHNOLOGY TO REPLACE THE CLINICIANS OR THERAPISTS, BUT RATHER TO AID THEM IN THEIR WORK AND PROVIDE A CONTEXT."

The long-term goal of the overall project is the creation of a new scientific discipline of computational behavioral science, which draws equally from computer science and psychology in order to transform the study of human behavior.

"We hope to build technologies that will allow us to observe how people behave in a wide range of settings for long periods of time," said Forsyth. "Data could help everyone from architects, who might build better buildings, to marketers, to therapists."

To support their long-term goal, the research team plans comprehensive educational activities, including a new interdisciplinary summer school for young researchers and the development of new courses in computational behavior. In addition, the team will be extending their on-going and significant collaborations with major autism research centers in Atlanta, Boston, Pittsburgh, Urbana-Champaign, and Los Angeles.

CS researchers to lead $15 million project on electronic health records

By Hong Shen

SHARPS

Ask any doctor about the benefits of having easy access to patient data, and you're likely to hear a litany of reasons: electronic records help find information more efficiently, can help avoid redundant tests, screen automatically for drug interactions, and gather huge amounts of data for research.

Without adequate attention to security and privacy, however, these virtues can quickly become vices.

cybersecur

"The advancement of security in healthcare information technology is an issue with far-reaching implications warranting immediate attention," said John D. Halamka, chief information officer of Harvard Medical School and Beth Israel Deaconess Medical Center. "We need interoperable health care to ensure the right care is given to the right patients at the right time, while always protecting privacy."

Although the Bush Administration set the goal of making electronic health records available for most Americans by 2014, a Congressional Budget Office (CBO) report pointed out that by 2006, only about 12 percent of physicians and 11 percent of hospitals in the U.S. have adopted it. Among many other reasons, the privacy and security concern is one of the biggest barriers to the national health IT movement.

Richard Berlin, a doctor at Carle Foundation Hospital, who co-teaches the course "Healthcare Infrastructure" in the Computer Science Department at the University of Illinois, said Carle started to fully implement electronic medical records about four years ago.

"Compared to paper records, electronic records are obviously much better," Berlin said. "But if people want to break into the system, it's also very easy."

"Computers are left on all the time; it's easy to get people's passwords and log in the system. Almost

ity

"Compared to paper records, electronic records are obviously much better, but if people want to break into the system, it's also very easy."

anyone who knows how the system works could conceivably get in," Berlin added.

In an attempt to put these concerns to rest, the United States Department of Health and Human Services has awarded the University of Illinois a $15 million grant to create a new center for health information and privacy.

As part of the effort, Illinois computer science faculty will lead a multi-university consortium of researchers at 12 of the country's top computer science and medical universities, including Harvard Medical School, Johns Hopkins University, and Carnegie Mellon University to improve the privacy and security issues of health IT.

The Bush Administration set a goal of **2014** for most Americans to have electronic health records. By **2006** only **12%** of physicians and **11%** of hospitals had adopted them, even though a fully standardized system could save the healthcare industry **$80 billion** every year.

The project, called "Strategic Healthcare Information Technology Advanced Research Projects on Security (SHARPS)," is a collaborative effort of 20 senior investigators who represent expertise in cybersecurity and health care around the country. It aims to develop cutting-edge technologies that will reduce security and privacy barriers to the meaningful use of health information technology.

Carl Gunter, lead investigator of SHARPS and professor of computer science, explained the program's motivation: "It is essential for patients and healthcare providers to have confidence in the information technologies on which modern health care is becoming increasingly reliant. SHARPS will address a key range of security and privacy barriers that currently limit the free exchange of data that can improve the quality, convenience, and efficient delivery of care."

According to Gunter, SHARPS is organized around three health information environments: electronic health records (EHRs), health information exchanges (HIEs) and telemedicine (TEL).

THE EHR PROJECT

The EHR project focuses on issues related to the security and privacy of health records within a single enterprise, such as a hospital or doctor's office. SHARPS aims to apply attribute-based encryption to health records to provide protection for enterprise collaboration and outsourcing; analyze a policy map that addresses the implications of achieving contextual integrity and usability; and develop a scientific basis for privacy policies to prevent indiscriminate sharing of personal health information.

For example, it will allow patients to protect their records using fine-grained, policy-based access control. It will also develop attribute-based proxy re-encryption to enable doctors to delegate their decryption rights to other doctors without revealing secret keys.

When patients and their doctors are separated geographically, they need to exchange health information to deal with emergencies. SHARPS tries to address the inadequacy of current exchange service models.

THE HIE PROJECT

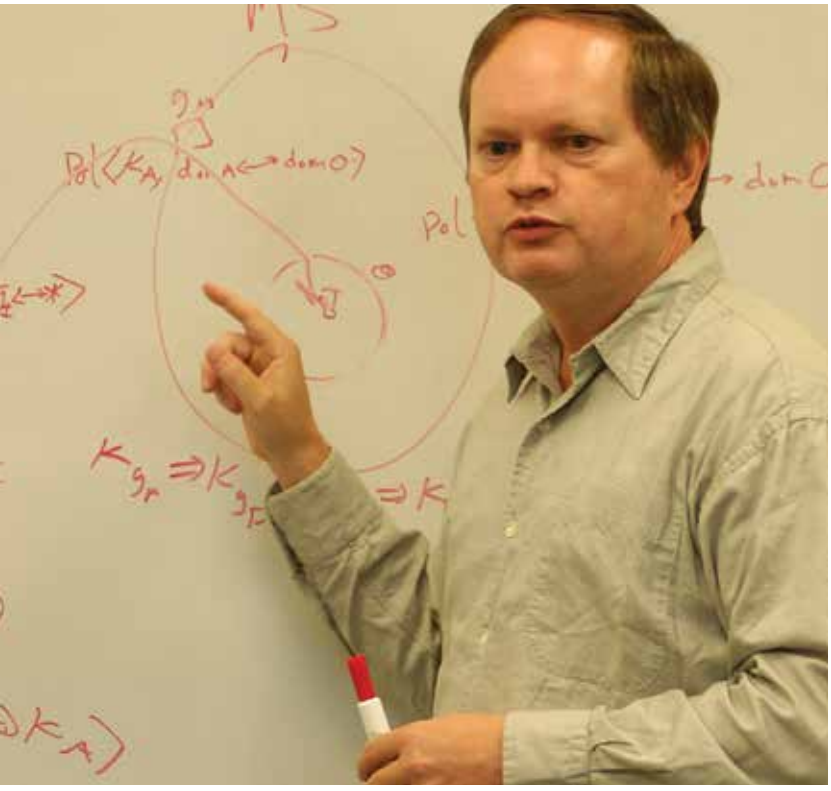
The HIE project is concerned with security and privacy of health records that are exchanged between enterprises and/or individuals. When patients and their doctors are separated geographically, they need to exchange health information to deal with emergencies. SHARPS tries to address the inadequacy of current exchange service models by demonstrating how model-based design can be applied to health IT; establish a continuously evolving model for access control rules to limit insider threats; and address the inadequacy of privacy standards for third-party personal health records through policy exploration with personal health records stakeholders.

For example, it will develop new methods of enforcing different policies and preferences to ease the burden of uses in which data-sharing agreements are a necessary adjunct to laws and institutional policies. It will also help develop and test better methods of managing identities and responding to different security threat levels.

Sonia Jahid, a computer science Ph.D. student, is currently working under the HIE project. She is analyzing medical access logs provided by Northwestern Medical School, trying to learn people's behavior patterns and using them to detect privacy violations.

"After the analysis, you can apply the knowledge you learned to refine the policies and rules of the system and therefore improve the entire access control mechanism," Jahid said.

> "It's really all about trust. If people know they can send the information elsewhere for its intended purposes, we can exchange information more completely."



Carl Gunter, lead investigator of SHARPS and professor of computer science

THE TEL PROJECT

Telemedicine allows people to monitor and manage their health at home, while security and privacy risks are major barriers to its adoption. The TEL project will try to provide criteria for what constitutes sufficient computer and interoperability safety for Implanted Medical Devices (such as pacemakers and drug pumps); protect sensitive personal health information collected through remote monitoring (such as smart phones); address the security and privacy needs of remote diagnoses and treatments by linking classification to encryption; and offer accurate technological risk assessments grounded in a review of FDA data to increase patient confidence regarding the safety and security of telemedical devices.

For example, it will develop software and hardware protocols to secure interoperability between Implant Medical Devices and wireless home telemedicine monitors.

The whole project is to make the technologies involved in electronic health records, health information exchange, and telemedicine trustworthy enough to earn the confidence of doctors and patients, Gunter said.

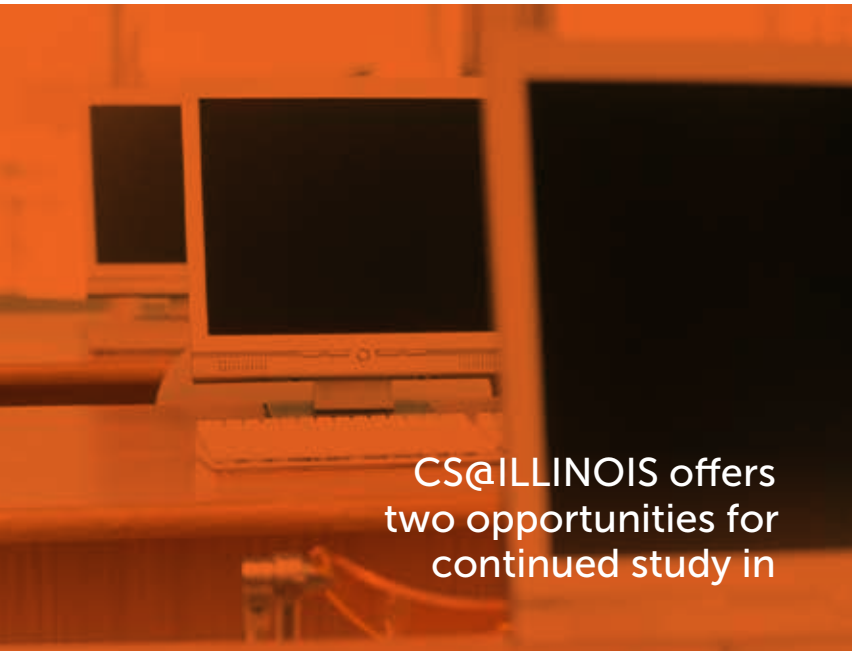
"It's really all about trust," said Mark Frisse, a senior investigator of SHARPS and professor of biomedical informatics at the Vanderbilt University Medical Center. "If people know they can send the information elsewhere for its intended purposes, we can exchange information more completely."

Frisse also pointed out that a recent study by the Center for Information Technology Leadership (CITL) has estimated that fully standardized electronic healthcare information exchange and interoperability could yield annual net savings to the healthcare sector of about $80 billion.

"The challenges addressed by the research objectives of SHARPS are exactly those that patients today or will face in the near future," said Gunter. "Our goal is to not just innovate new technologies and policies, but to remove barriers that are preventing healthcare IT from being used in more meaningful ways."

Universities involved in the research team:

University of Illinois at Urbana-Champaign
University of California at Berkeley
Carnegie Mellon University
Dartmouth College
Harvard Medical School
Johns Hopkins University
New York University
Northwestern Memorial Hospital
Stanford University
University of Massachusetts-Amherst
University of Washington
Vanderbilt University



CS@ILLINOIS offers two opportunities for continued study in

summer school

Data Sciences Summer School

BY ALEX INIGUEZ, COLLEGE OF ENGINEERING

While some students use the summer as a time to regroup and catch up on sleep before starting another school year, a select group of them spends their summer in Champaign-Urbana at the University of Illinois' Data Sciences Summer Institute (DSSI).

The six-week-long program gives students the opportunity to grow through intensive courses in the mathematical foundations of data science, contact with experts in the field, and do significant work on a group research project.

"You are unlikely to find a community more supportive or more focused on solving problems rather than their

a look at DSSI projects

P2P systems

This spring, students in professor Klara Nahrstedt's Multimedia Systems (CS 414) course took part in a unique competition, and demonstrated the video-on-demand peer-to-peer streaming systems they have built over the past semester.

The students have been working in teams in the Pavlov Media Multimedia lab to create a system that is capable of fetching video segments from a video server or other neighboring peers, and putting the videos into the local video buffers. As part of the competition, the teams were judged by Nahrstedt, members of the CS department staff, and Marc Goodman, director of the University Innovations Program at Alcatel-Lucent.

The student-created systems were required to play video from the buffer to a GUI (graphical user interface) interface; respond to commands like play, pause, and stop; manage the video buffer and fetch missing video segments over the network to display to the end user; perform time synchronization so that the video content is displayed in streaming mode; and handle peer failure by adaptively fetching content from the server or finding new neighbors in the event of neighbor failure. Extra features that the students could include for additional

own particular individual accolades and rank than this one," said Evan Misshula, doctoral student at the John Jay College of Criminal Justice and Public Service at the City University of New York.

Student groups at DSSI select a project to work on from a provided list of topics and present their projects at the end of the six weeks. This year, the three projects were the CrimeMap Project, the Expert Finder Project and the P2P Systems Project.

DSSI provides students a chance to work on a research project, but it also lets students work with world-class experts and faculty and learn what resources are available for engineers. Alexandra Mirtcheva, a fourth-year computer science major at the University of Florida, said the DSSI offered her experiences unavailable elsewhere.

The program is funded by the United States Department of Homeland Security's Center of Excellence–Command, Control, and Interoperability Center for Advanced Data Analysis at the University of Illinois' Multimodal Information Access and Synthesis Center. The connection to the Department of Homeland Security made for an underlying theme of public safety in the student research groups. The groups took this to heart, in addition to their more general hunger to research and learn.

how do we take data and learn what is important?

"The larger question the Data Sciences Summer Institute addresses is how do we take data and learn what is important? How do we make inferences and resolve controversies?" Misshula added. "I can't think of more fundamental questions to answer. Moreover, if along the way we make the world a safer and more caring place, it has been a pretty good summer."

consideration included a seek bar to jump to a particular point in the movie, and the ability to play videos full screen. Teams were also judged on their presentations.

The "Fiery Cheese" team, comprised of Richard Shen and Simon Jenkins, won first place in the competition by creating a system that used a gossip-based approach to peer-to-peer streaming to create a system that seamlessly fetched and displayed video on multiple peers. In addition, their system included a seek bar and the ability to play videos at full screen. The team was able to demonstrate their enhanced audio quality, of which they were "extremely proud."

CrimeMap Project

Crime raises some difficult questions: Where is crime happening around me? Is the area less safe than before? Where will criminals strike next?

CrimeMap aims to study crime patterns from a variety of sources and provide real-time information about where crime is occurring and statistically where it is likely to occur in the future. CrimeMap uses unstructured police reports, news articles, and location-aware services (such as Twitter) to depict on a map where crime is occurring, and who was nearby (and could be a potential witness). CrimeMap provides "heatmap" visualizations over a map that allow users to see where hotter (or more frequent) areas of crime are occurring as well as when they are occurring.

Expert Finder

Expert Finder utilizes data crawling and information extraction, data integration, topic modeling, and map visualization techniques to create an expert and expertise search system. The Expert Finder system tracks and retrieves researchers and professors based on their research expertise, visualizes their related information via an automatically generated webpage, and displays their geographic locations via a Google map panel.

summer school

parallel computing. multicore programming. worldwide interest.

Summer School on Multicore Programming Has Global Reach

BY CHERI HELREGEL, UNIVERSAL PARALLEL COMPUTING RESEARCH CENTER

Over 150 programmers from all over the world either traveled or tuned in online to participate in the Universal Parallel Computing Research Center (UPCRC) Illinois Summer School on Multicore Programming. Another 20+ will participate in a satellite program from Singapore in mid-August.

Of the 50 participants that attended at the Thomas M. Siebel Center for Computing Science on the Illinois campus, some traveled from as far away as France, Germany, Israel, Italy, Mexico, Newfoundland, and Turkey. Over 100 programmers worldwide registered to participate in the program online. About half of all summer school participants were graduate or undergraduate students of computer science, computer engineering, math, and electrical or other engineering disciplines. Academic faculty, research programmers, and industry developers rounded out the other half of this diverse group of global participants.

This was the second year UPCRC Illinois produced the summer school which offered experienced programmers, with little or no exposure to parallelism, an opportunity to learn about multicore programming. The curriculum provided a solid foundation in the fundamentals of multicore programming and offered hands-on learning experiences with the use of multicore languages and libraries. Participants also enjoyed a lab environment that featured the most current parallel programming tools available from Intel and Microsoft.

UPCRC Illinois co-director Marc Snir opened the event on Monday evening with an introduction to parallelism and multicore technology. Joining Snir in teaching this year's summer school were UPCRC Illinois co-director Wen-mei Hwu, Maria Garzaran and Danny Dig of UPCRC Illinois, John E. Stone of the Illinois Beckman Institute, Clay Breshears and Paul Petersen of Intel, and Phil Pennington and James Rapp of Microsoft. Illinois graduate students from UPCRC and the departments of computer science or electrical and computer engineering served as teaching and lab assistants and forum moderators. The week concluded on Friday with Snir's Taxonomy of Parallel Programming Models and tours of the new Petascale Computing Facility at Illinois.

Throughout the week, online participants watched presentations via live streaming and submitted questions to live discussion forums available during all presentations. Online participants in different time zones also had the option of attending asynchronously

via archived lectures that were accessible from the course website. All participants were encouraged to submit questions and comments to lecture and lab forums that were regularly moderated by school faculty and teaching assistants throughout the program.

For lab projects, on-site participants used local lab facilities or their personal laptops to remotely connect to virtual machines hosted on UPCRC Illinois multicore servers. Online participants were provided multicore virtual machines hosted by the Microsoft Platform Adoption Center. All participants had the option of installing software packages or a pre-configured virtual machine image on their own systems for use during or after the school.

New this year was the addition of a satellite program in Singapore. The Advanced Digital Sciences Center (ADSC) and the Institute of High Performance Computing (IHPC) hosted a satellite summer school on multicore programming at the Fusionopolis engineering research and development complex. ADSC and IHPC provided a local lab environment and deliver the course using archived videos and instructional materials from the program at UPCRC Illinois. Teaching assistance will be provided by a participant who attended the UPCRC Illinois summer school.

Adapt and Innovate

BY ALYSSA EADE

Alumni who were students while Siebel Center was being built might remember the Open Collaboration Lab as the site of the "Big Fun Game" during the building's grand opening. Originally designed in response to student feedback, the Open Collaboration Lab was a large, open, configurable space for groups to meet and work on homework.

Over the years since the building opened, student utilization of the space waned. At the same time, computer science instructors Lawrence Angrave and Cinda Heeren were seeking new ways to engage computer science underclassmen early in their educational career.

Angrave and Heeren saw an opportunity to transform the lab. Their vision was to create an interactive learning community for computer science freshmen and sophomores in the CS 125 and CS 225 courses. They were seeking an innovative space that would help promote inter-year friendships, learning, and problem solving.

The new and improved CS 125/225 lab area is fluidly divided into two parts: a social side where students can work collaboratively and a lab side where students battle with the latest course assignment or are busy creating a new game. This larger space hosts new, updated machines, open space for white boards, concealed desktop machines, drop "docs," and robotic arms. It has become a space for all things CS 125/225, and it provides new CS students with a feeling of a larger community.

Before the lab area's makeover, students in these courses didn't have a central location to talk about the course or other CS topics with other students. Now, the lab provides a welcoming environment where students in both courses can come to learn and explore at office hours or on their own time.

continued on page 50

mobile **learning**

Hands-on Freshmen

BY TOM HORD

A mobile phone that can only send calls and receive texts is "so 2005"—the capabilities of those little slivers of ingenuity have multiplied over the course of months, not decades as they had in the past. They can send email, surf the Web, and even scan a credit card. What will they do next, teach a class?

Not quite, but you're getting warmer. Lawrence Angrave, an instructor of computer science at the University of Illinois, is currently teaching a class in the Department of Computer Science that involves 100 Google Android phones donated by Google and a throng of eager freshmen. The goal of this foray into mobile technology "is to create a community of students bound together with mobile apps that they wrote themselves," said Angrave.

The students will be given open-ended projects in order to prompt creativity and brainstorming tactics, applied to the field of computer science. Because the majority of the students in the class are freshmen, the emphasis is on learning how to create new things the students never thought were possible before.

However, the computer science courses at Illinois have been no strangers to mobile technology before this semester. Angrave's vision for the freshman class complements another class, taught at the junior level, on "Mobile Learning Communities." This class also uses the Verizon phones from Google to "educate and engage CS juniors," while using education applications written by senior undergrads in the same computer science program.

Ultimately, Angrave has a golden idea in mind for the program, namely, to "make students realize that they can change the world." And while that might sound like a lofty goal for a beginner course in programming, Angrave's hopes are founded in good, sound logic—computers are becoming smaller, and phones and portable devices are featuring more prominently on the personal and commercial scene than ever before. New programming for these devices has already changed the world in profound ways, and there's no way of knowing where it will lead us next. Besides, pessimism is so 1999.

social computing.
educational tech.
communication.
and trust...
via bluetooth?

Learn As You Go

BY FORREST IANDOLA, CS JUNIOR

As any visitor to libraries and coffee shops around campus knows, students have long worked together in study groups to collaborate on projects and to help each other learn challenging material.

Through the work of a team of computer science and communications faculty at the University of Illinois, students may soon have a better way to tap into their peer networks for learning. The team is working on a test bed for peer-to-peer Mobile Learning Communities (MLC), sponsored by the National Science Foundation planning grant, Vodafone, and Qualcomm, which seeks to enable students to share trusted educational services with each other via iPods, cell phones, and other handheld mobile devices.

The team is tackling the challenge from every angle. Led by computer science professor and multimedia expert Klara Nahrstedt, the team includes faculty in social computing (Karrie Karahalios) distributed systems (Roy Campbell and Indranil Gupta), networking (Robin Kravets), educational technology (Sam Kamin), communication (Scott Poole, LAS), and trust (William Sanders, ECE).

Under the guidance of Nahrstedt, CS 425 (Distributed Systems) students are developing a variety of MLC features, including chat clients and peer-to-peer file sharing programs. The class is using Android-based G1 phones thanks to the generosity of Vodafone and Qualcomm.

The team is also considering the system-level infrastructure needs of such a network, and are researching viable approaches using 802.11 wireless, ad-hoc wireless networks, and possibly bluetooth to provide connectivity among learning community users.

Through the Mobile Learning Community, students will have a new avenue for collaborating with classmates and making new connections.

hacker champs

Sharabash Brothers Win National Facebook Hackathon

BY ALYSSA EADE, COMPUTER SCIENCE

Brothers, teammates, and computer science students Hani and Islam Sharabash won the Facebook Camp Hackathon competition on November 11, 2010. The competition featured a face-off between winners of smaller hackathons on five college campuses who then came to Facebook headquarters to create new applications in just one night. Facebook leaders including president of engineering Mike Schroepfer, director of design Kate Aronowitz, and chief executive Mark Zuckerberg judged the young developers.

The Sharabash brothers' winning app, called Airchalk, is an augmented reality app that allows users to use their phones to draw on a display, much like that of a virtual white board. A phone's camera can track a wand for drawing, or the phone itself can be used to control the cursor. Multiple users can collaborate and draw on the same canvas.

Hani said, "The Airchalk idea was entirely my brother's. He just whipped out his phone and started imitating what a person would do with this app and I understood it immediately. I didn't think it was possible for us to do it in 24 hours, but all the other ideas we had paled in comparison to this one. I am glad my brother is crazy and confident, or none of this would have happened."

Hani and Islam received the official prize of $500 Amazon gift certificates but also a summer internship at Facebook. The two are currently interns at State Farm in the University Research Park.

Mark Zuckerberg said that team members Islam and Hani Sharabash had an "interesting vision of how the app could be used in the future, though since there is the option to collaboratively draw, I thought you'd allow users to invite their friends."

The team of brothers decided to enter the Illinois competition as a learning experience, to hang out more often, and for fun, with no expectation of winning. Their initial idea at the Illinois competition was to expand on their idea of texting song requests to Grooveshark, and by the end of the competition Hani and Islam had a great start on a cool product and also a win.

"The competition at Illinois completely took us by surprise when we won, which then led to the competition at Facebook. During the Hackathon at Facebook we had a vision of what we wanted to do, and no back-up plan, so it was do or die. We put the pressure on ourselves, and ran into road blocks, but we always took a step back and consulted with one another," said Islam.

The second Hackathon proved to be more intense and competitive. The team had less time to work on each idea and also faced a setback prior to the competition.

"We had a good idea of the product we wanted, but not a great understanding of how to do all the parts. A couple days before the Hackathon our planned design fell through completely, we panicked and found something else that would work in its place," said Hani.

Hani and Islam helped keep each other's spirits up and only had to communicate during critical times. They both fell into their roles naturally and moved forward as a team. An alumnus from the University of Illinois, Dan, served as an advisor for Hani and Islam as well.

The Hackathon at the Facebook headquarters was a hectic, but fun, atmosphere for the Sharabash brothers, who were completely immersed into the Facebook culture during the competition. Facebook engineers were on hand to lend advice, the great food and snacks were plentiful, and MTV was there shooting a documentary.

"We talked to the camera several times and had to do a little bit of acting too," said Islam, "We were even asked to 're-do that hug' by the cameramen."

But of course the competition was not all play and no work. The team ran into many challenges along the way during both competitions. The teams at the Facebook Hackathon were not able to access openCV to build on their phones, which is what the Sharabash team initially wanted to use.

"Two nights before flying out we stayed up really late, and the night before the competition I only got 45 minutes of sleep because I was researching other libraries," said Islam.

we didn't have enough time to learn how to do it right so we just hacked things together. **name of the game, right?**

The team did not have much experience using tech, the augmented reality library, or node.js prior to the competition. They had to dig deep into the augmented reality library to find coordinates that worked for them.

"Near the end of the competition we were trying to make trackers, and were having trouble making our own. We didn't have enough time to learn how to do it right so we just hacked things together. Name of the game, right?" said Islam.

The team was forced to learn new concepts quickly, and had to just jump in and "start breaking stuff instead of reading too much, which can be uncomfortable," said Hani. However, amidst all of these challenges was the pressure of time.

"I work best in high-pressure, time-limited environments, so all night hackathons are the perfect microcosm for bringing out the best coding in me. The sense of accomplishment after a night of intense coding can't really be matched," said Hani.

At the end of the competition Hani and Islam Sharabash emerged victorious and are excited to further their relationships with others at Facebook and begin their internships.

The team plans to take their ideas to a new level in the future. They would like to open their concept up to developers and users in a way similar to QR codes. The grand idea from here is that all viewable reality becomes a chalkboard for which you need nothing more than your phone and your finger to write on; essentially the world is your chalkboard, all compliments of the Sharabash brothers.

The team urges others to become involved in future Facebook Hackathon competitions and leaves these words of advice to all future hackers: "Absolutely do not underestimate yourself. You are much better than you think. Be ambitious."

continued from page 45

The new lab provides a reliable, persistent, physical space to go for help or even just for company. "The room is never empty," said Heeren. "Our intention is to engender a sense of community in our students so that they identify their study of CS with collaboration, intellectualism, productivity, and ultimately, academic excellence."

Gone are the days of traditional settings for teaching and learning; this new lab area encourages talking with your neighbor, open-ended problem solving, and above all, teamwork. With a constant buzz of collaboration and creativity in this lab, students are able to form a strong foundation for the rest of their CS education in the early phases of their time at Illinois.

"Students are getting excited about learning, and are able to learn much more by working and talking out problems together," said Angrave.

CS 125 students, who often enter the course with little experience in computer science, are able to apply what they learn in lecture, while also learning industry-standard skills. In one assignment this semester, CS 125 students were asked to develop a Pong game. In this new collaborative environment Angrave observed that students were able to think beyond current standards, innovate their own twists to the game, and challenge themselves in ways that weren't previously possible.

By establishing this presence, a physical point for students to ask questions, students are recognizing more value in their CS education at Illinois, and having more fun while doing so. With so much energy in the labs and lectures, and students who are excited to learn and engage, it should come as no surprise that exam scores are on the rise.

"I have seen more student-led projects outside of class and students have even told me they want to switch their majors to CS," said Angrave of the student reactions to this new lab. Heeren added, "The space is already recognized as a great place to be. It's common to see groups of people finish their 225 work and then move on to homework in another class."

BRIDGE DOCTORS AND GRID SECURITY

Researchers Create Novel Computing Solutions to Protect Civil Infrastructure

BY HONG SHEN

Computing is already omnipresent in our modern daily life, and now through close collaborations among computer, electrical, and civil engineers at Illinois, novel computing technologies have been created to address critical issues in many non-traditional fields, such as monitoring structural health of bridges and enhancing cybersecurity of the power grid.

BRIDGE DOCTORS:

Wireless Sensor Network to Study Structural Health of Bridges

For computer science Ph.D. student Kirill Mechitov, the most exciting part of his job with the Illinois Structural Health Monitoring (SHM) project is to provide engineers with the "right tools" to effectively monitor the health of a bridge.

The Illinois SHM project, which is led by computer science professor Gul Agha and civil and environmental engineering professor Billie F. Spencer, aims at "providing engineers with the right tools to collect timely, detailed data about the condition of the structures and detect potentially damaged structural elements," said Mechitov. "It's like providing doctors with MRI and X-ray machines."

By "right tools," Mechitov means dense arrays of smart wireless sensors that could be affixed to the bridge with strong magnets. The sensors that have mini computer chips inside are designed to record and transmit complex, high-fidelity data (vibration, temperature, cable tension, and other quantities) of the bridge more cheaply and efficiently than manual inspections or traditional wired sensors.

"Manual inspections of bridges are relatively unreliable and the cost of deploying the traditional wired monitoring system is both labor-intensive and expensive," said Spencer. "So the wireless sensors offer the potential for both easy installation and low cost."

A significant challenge is the vast amount of data these sensors generate. "The traditional centralized approach is not feasible with large numbers of sensors, because it requires expensive, difficult-to-install wired networking and introduces a single point of failure," said Agha. "We address this problem by enabling distributed damage detection algorithms to work within the sensor network, rather than shipping the data to a centralized server."

Agha and his team in computer science have developed an open-source software platform for the project—a Service-Oriented Architecture (SOA) that lends itself to further expansion, customization, and development of applications for SHM. The SHM Services Tool suite includes utilities for resetting nodes remotely, listing the nodes within communication range of the local node, testing radio communication performance, and changing the radio channel and power for local and remote nodes.

According to Mechitov, the team has recently collaborated with KAIST in Korea and the University of Tokyo to complete the deployment of a 117-node prototype sensor network on a 500-meter long Jindo bridge in South Korea. It is the first dense deployment of a wireless sensor network on a cable-stayed bridge and the largest of its kind for civil infrastructure to date.

"The data collected from the bridge can be accessed and analyzed remotely over the Internet," said Mechitov. "It is already helping civil engineers better understand the structural characteristics of the bridge, and will be used to develop more advanced damage detection algorithms."

According to Spencer, over 75 research groups in 15 countries throughout the world are now using the hardware and open-source software developed by the project.

"The ability to continuously monitor the integrity of civil infrastructure in real time offers the opportunity to reduce maintenance and inspection costs, while providing increased safety to the average consumers of transportation," said Spencer. "And it was through this very close collaboration between computer scientists and civil engineers that we were able to make leaps forward that just would be really challenging to do on our own."

A significant challenge is the vast amount of data these sensors generate. "The traditional centralized approach is not feasible with large numbers of sensors, because it requires expensive, difficult-to-install wired networking and introduces a single point of failure."

Gul Agha, professor of computer science and Illinois SHM project lead

GRID SECURITY:

Trustworthy Cyber Infrastructure for the Power Grid

Electrical power is like the air we breathe: most of the time no one notices it until it is missing. It travels from the power plant to our houses through a system called the power grid. Now, as the nation moves to integrate advanced computing communication and control infrastructure within the existing physical power-distribution infrastructure, it also introduces complex security vulnerabilities like cyberattacks into the system.

The U.S. Department of Energy and Homeland Security recently awarded an $18.8 million, five-year (2009–2014) grant to the University of Illinois Information Trust Institute (ITI) to develop smart grid technology and procedures to address these security issues.

The institute will work with faculty and researchers at Dartmouth College, the University of California-Davis, Washington State University, and Cornell University on the Trustworthy Cyber Infrastructure for the Power Grid (TCIPG) program to develop and integrate information technologies with properties—such as real-time availability, integrity, authentication, and confidentiality—that are key to a modern, reliable, and efficient electric power grid.

"Electricity is probably our most important infrastructure," said Himanshu Khurana, principal research scientist at ITI and computer science affiliate professor. "When the blackout happens, it's not only a matter of being hot or cold, it could happen in hospitals and emergency rooms. The results could be very serious."

"Electricity is probably our most important infrastructure."

The TCIPG research program will build upon the successes of the former TCIP program, which was funded primarily by the National Science Foundation in 2005, to develop technologies for a secure, real-time communication system; an automated cyberattack response system; risk assessment; security validation; and smart grid applications including wide-area control and monitoring, controllable load demand response, and plug-in hybrid electric vehicles.

Several computer science faculty members, including professors Roy Campbell, Carl Gunter, Klara Nahrstedt, and Marianne Winslett lead projects and initiatives related to the program, including efforts into quantitative and qualitative validation, secure and reliable computing base, and communications and control protocols.

Campbell said his team is trying to provide security assessment at a reasonable rate of the computing infrastructure that controls the power grid. They have built a distributed monitoring system that can do such assessment of a very large network. "It should be able to do the same thing at the scale of a power grid," said Campbell.

Nahrstedt explained her team is working on several projects under the TCIPG program, including applying a new set of protocols to identify insider-based jamming attacks, developing integrated dynamic soft real-time architecture to guarantee a true end-to-end delay, and providing authenticating time-critical multicast data to allow timely control of power flow over physical power networks.

According to Pete Sauer, electrical and computer engineering professor and the industry liaison of the program, a more secure grid will also allow consumers to manage their electricity consumption more flexibly and efficiently.

"With a secure smart grid infrastructure, people can use computing technology to determine when using an electrical appliance is cheaper in the morning or afternoon, depending on the price of electricity at that time," said Sauer. "It impacts so many levels and this is why we're trying to make sure it functions in a trustworthy manner."

Roy Campbell, professor of computer science


1000 ml
32 oz
900
800
700
600
500
400
300
200
100
MIN
4:20

Clockwise from top: Yun Young Lee, Maurice Rabb, and Nicholas Chen

healthy trend

CIMIT Prize Finalists

A team of Illinois computer science Ph.D. students was selected as 1 of 10 finalists in the highly competitive 2010 CIMIT Prize for Primary Healthcare, and was awarded $10,000 to develop a final proposal. A national competition open to graduate and undergraduate engineering students from accredited engineering programs, the CIMIT Prize for Primary Healthcare competition seeks ideas for technological innovations with great potential to support and catalyze improved delivery of health care at the frontlines of medicine.

The team, Nicholas Chen, Yun Young Lee, and Maurice Rabb, are all conducting their Ph.D. research in software engineering with professor Ralph Johnson. The group was inspired to enter the healthcare IT competition following a course in Healthcare Infrastructure (CS 598HI), taught by computer science affiliate professor Bruce Schatz and Dr. Richard Berlin. The course focused on the ways in which a decentralized infrastructure for health care might have the same impacts on health delivery that evolved from innovations like the automobile and telephones—namely, empowering individuals to provide the inputs previously only provided by a centralized operator. Schatz is the head of the Department of Medical Information Science in the College of Medicine, and is using his office in Siebel Center to write the first book on Healthcare Infrastructure based on the course and interactions with computer science students.

"Professor Schatz and Dr. Berlin really inspired us computer science students to apply the same sense of scalability to health care as we are accustomed to applying to IT," remarked Rabb.

During the course, the group teamed together for the final course project. Inspired by the stereotypical life of a graduate student—one high on stress, and low on sleep, exercise, or healthy eating—the team set out to monitor their daily habits using mobile devices readily available.

The team created tracking methods for their sleep and exercise patterns, took weekly stress questionnaires,

at first the results were amusing, but then we really could see a pattern **between how we lived and how we felt.**

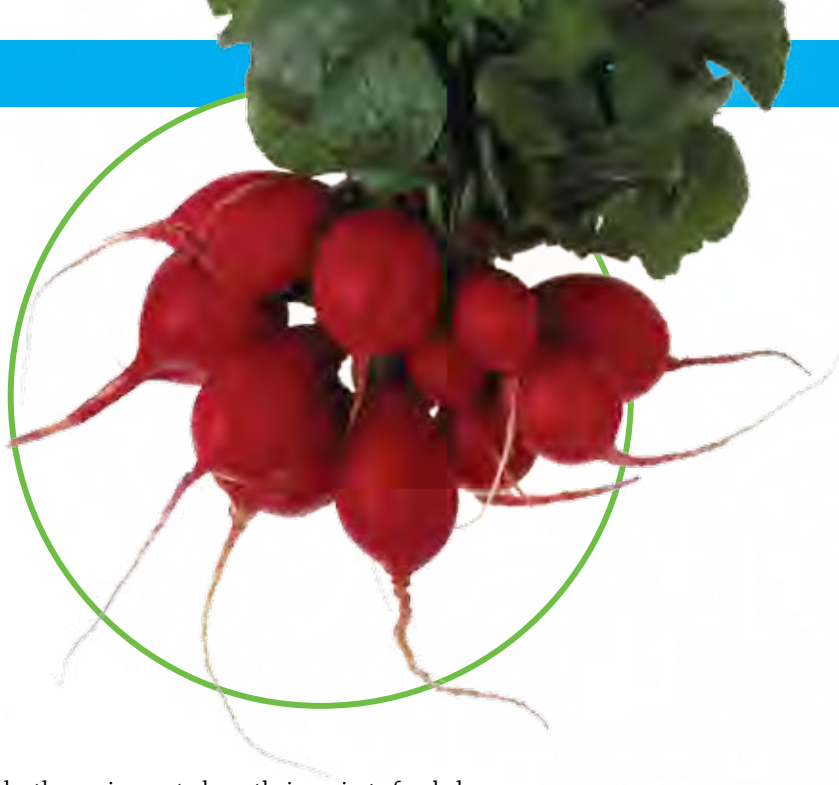
and took photographs of all of the food they ate during a 7-week period. The food photographs proved to be a novel way of tracking eating habits. The team took concepts from the Japanese Goshiki tradition extolling the virtues of eating five colors of food with every meal.

"At first the results were amusing," said the team. "But then we really could see a pattern between how we lived and how we felt." And it motivated them to change their own eating, sleeping, and exercising behaviors.

So the team turned their class project into a proposal for the CIMIT competition. The proposal focuses on broadening the data pool available to primary care providers by making it simple for healthcare consumers to monitor their health and wellness inputs each day.

Current primary health care suffers from the single feature, single point-of-failure syndrome, explained the team. Typically, our vital signs are measured only when we visit a primary care facility. Even when measured, they represent only a partial snapshot of our everyday health, failing to capture the continuous spectrum of our lives. Yet our general health is affected by our everyday lifestyle choices.

The team's proposal aims to create the software tools and mobile monitoring infrastructure that will aid in both data collection and analysis of the monitoring data collected. The team's approach uses readily available, inexpensive devices to continuously instrument and integrate a breadth of lifestyle aspects.



"Our goal is to leverage existing technologies, so that any ordinary person can make use of what we've done to improve their health," said Rabb.

Working with their proposed infrastructure hands-on for seven weeks gave the group an excellent idea of what the daily issues and challenges are, and a better sense for how to create software to help people while being minimally intrusive in their daily lives.

In creating their proposal, the team worked closely with Schatz and Berlin on the healthcare infrastructure side, Johnson on the software engineering elements, and computer science professor Karrie Karahalios, an expert in human computer interaction and mediated communication. They also had the benefit of the advice of Brant Chee, a Ph.D. student in library and information science, who had also taken the Healthcare Infrastructure course and was a CIMIT finalist the previous year.

"Healthcare informatics as a field is emergent right now, and Illinois is at the forefront," said Rob A. Rutenbar, head of the Computer Science Department and the Abel Bliss Professor of Engineering. "The collaborative environment at Illinois is leading to some very innovative ideas in terms of the future of healthcare delivery and healthcare informatics."

The team and mentor Schatz have submitted a paper on their work to the American Medical Informatics Association, the major professional society in this discipline.

While refining their proposal for the final competition, the team is also creating additional tools to assist them in launching the project if they are selected as one of the three winners to have their projects funded for the grand prize of $150,000. Currently the team is working closely with staff at Bevier Café, the campus café run by the Food Science and Human Nutrition Department as a course taught by Jill Craft North, to build a photographic database of foods to aid in their analysis of diet. By working directly with the Bevier staff, the team is making use of a real commercial kitchen, which is also a research laboratory run by chef Jean-Louis Ledent, with full access to their food preparation, portions, recipes, and nutritional information. Their research is thus a good example of engineering students leveraging the campus to solve socially relevant problems.

"Ultimately, we want this system to help people feel good about themselves, to be fun, and to not induce guilt," said the team. The data that the team's infrastructure will collect and analyze is a wealth of information that was once impractical to obtain. More importantly, the data will be accurate and continuous, so primary care providers can make more accurate and confident decisions about their patients' care.

Beyond helping individual healthcare consumers from a wellness perspective, the team anticipates that their work will be easily scalable and deployable over a large population, towards both individual and epidemiological ends.

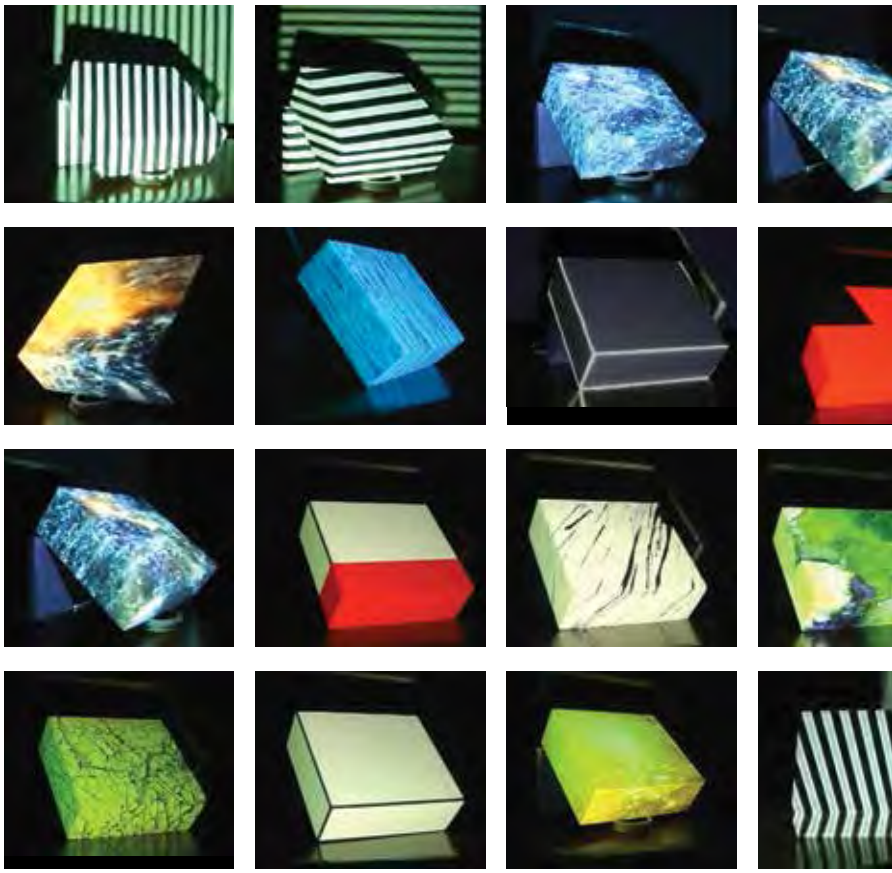
light and space

Jones and Sodhi Create Next Generation Entertainment

BY ALYSSA EADE

Brett Jones and Raj Sodhi, both current third year Ph.D. students in computer science at the University of Illinois, are focusing their attention on human computer interaction and computer graphics. More specifically, they are exploring how people can interact with everyday objects through the use of video projectors. “Interaction with computers is currently limited by the size of the display device. Ideally we would like our new iPhones to have a 30-inch monitor; however, carrying a 30-inch monitor in your pocket or purse would be a serious challenge. Through the use of video projectors, any object can become a display and interaction surface,” said Brett.

By making display truly ubiquitous Brett and Raj will enable a host of new possibilities in a variety of application areas. Their research and focus on novel interaction techniques and novel devices that can make interaction more immersive ties directly into the work they did while conducting research at Walt Disney Imagineering this summer.



Part of the team's research involves figuring out what a projector can see. Visit www.youtube.com/user/bjonessoda and watch "Re-Implementation of Projector Calibration" to see a demo of the calibration process.

"At Disney we had the opportunity to work directly with artists to determine the key bottlenecks in using our field in the wild. We were exposed to a wealth of real-world practical issues and use cases that would be difficult to imagine in a laboratory setting," said Raj.

Brett and Raj had the abilities to sit next to an artist and understand what works and doesn't work for them, instead of sitting in a lab and trying to imagine the workflow an artist would want to project onto scenic elements.

"It is phenomenally amazing to see the content an artist can create using a less than ideal workflow. At Disney we learned what can be hacked, what is broken, and what the future should look like," said Brett of their experiences.

Walt Disney Imagineering is responsible for the design and engineering of Walt Disney Attractions and Theme Parks, the places children and adults around the world get to enjoy. Brett has now worked for Walt Disney Imagineering three summers, and Raj has spent two summers there. However, this past summer the two focused mainly on creating novel tools and algorithms for utilizing video projectors as theatrical light sources.

Brett and Raj elaborated and said that "instead of using a red stage light, a video projector can output red light onto the scene. Using video projectors, lighting can be tweaked on a per-pixel level allowing for a variety of captivating effects. Stages can be transformed with high dynamic range lighting or animated effects can be displayed on static stage elements."

However, a large problem with using a projector as a theatrical light source is having an appropriate model of the scene that is being lit. So Brett and Raj had to first understand what the projector can see, which typically involves establishing dense correspondences between the projector and an adjacent camera. Then 3D scanning or image-based methods can artificially create a view of the projector and the projector can be utilized as a theatrical light source.

"Our work at Disney was essentially finding easy ways to figure out what a projector 'sees' of a scene. The work is currently being productized for use in creating future theme-park attractions," said Raj.

Their internship experience also exposed them to the complexities of developing a new theme park attraction. "From the idea, to the finances, to the

through the use of video projectors, **any object can become a display and interaction surface.**

engineering manpower, you got a feel for why it is so valuable to have people with such unique backgrounds. As computer scientists, it was very special to see respected researchers with backgrounds in computer graphics, vision, and HCI among many others, present their work and offer comments and suggestions to improve our summer project," said Brett and Raj.

While we can all imagine how great it would be to work at Disney, and create future theme-park attractions, the best part about working at Disney for Brett and Raj was the people they worked with. Obviously the group of artists, engineers, and researchers at Disney are among the best in the world, but they also went out of their way to welcome Brett and Raj, and treat them like family. Sounds like Walt Disney truly is "the happiest place on earth."

After an amazing internship experience like this, where do you go next? The research team's next steps are to continue investigating different ways to interact with everyday objects. One example of this is changing the way painters create set pieces for theatrical performances. Brett and Raj want to design a tool that allows artists to do this digitally, so that you never have to worry about incorrectly painting a surface since virtual paint is easily erased.

Brett and Raj continued by saying that "there are several challenges associated with physically painting an object, and an artist trains many years to become a skilled painter. Mimicking the types of interactions they would expect is a monumental challenge."

Another big technical challenge in this area is the ability to track an object that moves or changes shape. This type of research could be applied to enable a doctor when operating on a patient. Brett and Raj said, "You can project a series of visualizations directly on the patient, showing the doctor images of internal organs or the optimal location to make incisions during surgery. The challenge comes when you realize that a patient is moving when breathing, and that the patient's skin can easily change shape when small amounts of pressure are applied by the doctor. For surgical operations that require absolute precision, you would need a very detailed and accurate model of a person that is updated in real-time."

A similar problem exists in other applications, that of object recognition. Solving this type of research problem would allow a director of a theatrical performance to project on objects that move. But if "you project effects on an actor, or a moving set piece that goes from one side of the stage to the other, we have to understand which object just moved so that the projection can follow accordingly without falling behind," said Brett.

Brett and Raj have their work cut out for them, but this imaginative research team undoubtedly has more great things ahead.

awards

Sarita Adve

ACM Fellow

CRA Board of Directors

Bill Gropp

National Academy of Engineering

IEEE Fellow

SIAM Fellow

IEEE TCSC Medal of Excellence in Scalable Computing

HPC Community Leader

R&D100 Award

Michael Heath

SIAM Fellow

IEEE Taylor L. Booth Education Award

AIAA Associate Fellow

Laxmikant Kale

IEEE Fellow

Karrie Karahalios

Sloan Fellow

David Kuck (emeritus)

IEEE Computer Pioneer Award

Jiawei Han

IEEE W. Wallace McDowell Award

Sheldon Jacobson

IIE Fellow

IIE Operations Research Teaching Award

Award for Technical Innovation in Industrial Engineering

Outstanding IIE Publication Award

Ralph Johnson

ACM SIGSOFT Outstanding Research Award

Josep Torrellas

ACM Fellow

ChengXiang Zhai

ACM Distinguished Scientist

IBM Faculty Award

Craig Zilles

IEEE Mac Van Valkenburg Early Career Teaching Award

Sam King
Darko Marinov
Luke Olson
Madhusudan Pathasarathy
Manoj Prabkaharan
Saurabh Sinha
Matthew Caesar
Derek Hoiem
Julia Hockenmaier

NSF CAREER Award

Best Paper Awards

2011 IEEE Transactions on Computer-Aided Design: Donald O. Pederson Best Paper Award.

"Statistical Blockade: Very fast Statistical Simulation and Modeling of Rare Circuit Events and Its Application to Memory Design", R. Rutenbar and A. Singhee

2010 ACM/IEEE Design Automation Conference: Best Paper Award.

"Bayesian Virtual Probe: Minimizing Variation Characterization Cost for Nanoscale IC Technologies via Bayesian Inference," W. Zhang, X. Li, and R. Rutenbar.

19th USENIX Security Symposium (USENIX Security 10): Best Paper Award, August 2010.

"VEX: Vetting Browser Extensions for Security Vulnerabilities," S. Bandhakavi, S. King, P. Madhusudan, and M. Winslett.

Best Paper Awards (cont.)

32nd International Conference on Software Engineering: ACM SIGSOFT Distinguished Paper Award, May 2010.

"Test Generation Through Programming in UDITA," M. Gligoric, T. Gvero, V. Jagannath, S. Khurshid, V. Kuncak, and D. Marinov.

15th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS 2010): Best Paper Award, March 2010.

"A Real System Evaluation of Hardware Atomicity for Software Speculation," N. Neelakantam, D. Ditzel, and C. Zilles.

ACM-SIAM Symposium on Discrete Algorithms (SODA 2010): Best Student Paper Award, January 2010.

"An Online Scalable Algorithm for Average Flow Time in Broadcast Scheduling," S. Im and B. Moseley.

42nd International Symposium on Microarchitecture (MICRO 2009): Best Paper Award, December 2009.

"The BubbleWrap Many-Core: Popping Cores for Sequential Acceleration," U. R. Karpuzcu, B. Greskamp, and J. Torrellas.

Asian Conference on Computer Vision 2009: Sang Uk Lee Award, September 2009.

"Natural Image Segmentation with Adaptive Texture and Boundary Encoding," S. R. Rao, H. Mobahi, A. Yang, S. S. Sastry, and Y. Ma.

GreenMetrics 2009 SIGMETRICS Workshop: Best Student Paper Award, June 2009.

"Blackbox Prediction of the Impact of DFVS on End-to-End Performance of Multitier Systems," S. Chen, K. R. Joshi, M. A. Hiltunen, R. D. Schlichting, and W. H. Sanders.

28th ACM International Conference on Human Factors in Computing (CHI) 2009: Best Paper Award, April 2009.

"Predicting Tie Strength With Social Media," E. Gilbert and K. Karahalios.

Professor Paris Smaragdis

The University of Illinois Department of Computer Science is pleased to welcome Professor Paris Smaragdis to the faculty. Smaragdis is a joint computer science and electrical and computer engineering faculty member. His work on signal processing, machine learning and statistics as they relate to artificial perception, and computational audition promises to open up exciting new avenues for collaboration at Illinois.

Named one of *MIT Technology Review*'s Top Young Technology Innovators in 2006, Smaragdis' primary research interests lie at the intersection of machine learning and signal processing. His current work to create machines that can listen is pioneering new devices to improve music recordings, safety, and even televised broadcasts.

Dealing with superimposed signals is one of the most challenging problems in audio and speech processing today. Smaragdis' work has discovered a new way to approach this problem, and he's created state-of-the-art methods for working with mixed signals. Smaradgis' research explores the computational foundations for constructing systems that can understand sound the same way that humans do.

"Making computers that understand their world around them is an incredibly hard problem. Fortunately, it is also fascinating," said Smaragdis. "On the theoretical side, my work involves creating new tools for processing and analyzing time-series. On the practical side, this results in constructing actual machines with hearing abilities, such as TVs that can find when the football game gets interesting, stethoscopes that detect and analyze heartbeats, music players that automatically DJ for you, and smart traffic lights that can hear accidents that happen at their intersection."

Smaragdis is also interested in anything involving audio and computation and has been involved in the fields of computer music, audio synthesis algorithms, and real-time performance.

"Part of my research agenda is creating an artificial sense of hearing," Smaragdis said. "This is a highly interdisciplinary area that, at times, will require me to act as an electrical engineer designing signal processing algorithms, as a computer scientist thinking about artificial intelligence, as a psychologist or neuroscientist that examines our ability to hear, or as a musician that tries to teach computers the elements of sound. At Illinois, I have a chance to tap into world-class departments and scholars in all these areas and many more. How could I resist the opportunity [to come to Illinois]?"

"Illinois has a long track record of innovation in the area of computational perception," said Rob A. Rutenbar, Bliss Professor and head of Computer Science. "Machine vision, machine reading, and machine learning are all core parts of the CS discipline. Paris adds a whole new dimension to our department: machine listening. His work at the intersection of machine learning and signal processing is generating remarkable new methods for manipulating acoustic information in novel ways."

Smaragdis was formerly a senior research scientist at Adobe Systems. He completed his graduate and postdoctoral studies at MIT, where he conducted research on computational perception. Prior to Adobe, he was a research scientist at Mitsubishi Electric Research Labs.

Paris teaches a new CS 598 course, Machine Learning for Signal Processing.

Jon Salvani, Director of Advancement

Jon Salvani joined the department in 2011 as the Director of Advancement. Jon will be working with the CS network of alumni and friends to support their needs as well as foster new partnerships to support the continued excellence of CS@ILLINOIS.

Jon is busy traveling the country getting to know the many faces of the alumni network. Share your alumni experience with Jon at alumni@cs.illinois.edu or by phone at (217) 265-6823.

Professors Alex Kirlik and Wai-Tat Fu

Two Illinois faculty in human factors joined the Computer Science Department. Professors Alex Kirlik and Wai-Tat Fu are conducting their research as part of the department's Graphics & Human-Computer Interaction research group.

Human factors, the science of understanding and supporting how people interact with technology, draws upon and creates knowledge in at least three traditional academic disciplines, and draws upon and contributes to engineering approaches for systems analysis and modeling. In addition, human factors research aims to improve the representation of information flow between people and technology. The research contributes to advances in aviation, health care, transportation, computing, the Internet, medical devices, and more.

Kirlik's research interests are in the mathematical and computational modeling of cognition and performance in human-technology interaction. His focus is on decision making, interface design, human-automation interaction, and training in technological workplaces. The systems Kirlik works on range from the small, such as a person using a computing or communication device, to the large, such as the design and operation of an air traffic control system or a severe weather forecasting center.

Kirlik joined the University of Illinois in 2002, where he served as acting head of the Human Factors Division, and professor of human factors, psychology, computer science, mechanical science & engineering, and industrial, enterprise and systems engineering. He also holds a part-time faculty appointment in the Human-Computer Intelligent Interaction Group at the Beckman Institute for Advanced Science and Technology. Kirlik is founding editor of the *Human-Technology Interaction* book series for Oxford University Press, associate editor of *IEEE Transactions on Automation Science and Engineering*, member of the editorial board of *Human Factors*, and senior member of IEEE.

Fu is broadly interested in understanding how computational methods and tools can be developed as natural extensions of the human mind, in ways that are similar to how human vision can be extended by telescopes. In particular, Fu's research focuses on methods that facilitate the use of the Web or other large information databases as an extension of human knowledge and intelligence, such that we can search for and utilize information to more effectively learn, acquire complex skills, solve problems, and make better decisions. His work has implications to domains such as health informatics, education, complex skill training, dynamic decision making, group creativity, and social intelligence.

in memory

Saburo Muroga

University of Illinois computer science professor emeritus Saburo Muroga was one of Japan's computer pioneers and a globally significant leader in the extensive field of information processing, and he taught and mentored generations of computer science researchers.

1925–2009

Professor Muroga was a pioneer in threshold logic, and was the author of the classic book *Threshold Logic and Its Applications*, published in 1971. The book enjoyed a renewed interest in recent years, as researchers of neural networks recognized its relevance to their field as well.

Muroga's research in threshold logic was directed at minimizing the complexity of networks that would still be able to support high-level performance by, for example, minimizing the number of logic gates, interconnections among gates, or number of levels in a logic circuit. His revolutionary thinking led also to the creation of the 'transduction method,' representing a new method for simplifying logic circuits based on permissible functions. The transduction method was adopted by major CAD companies and is now considered an industry standard.

Muroga also published widely on improving design automation using mathematical approaches and computer-aided design of VLSI chips.

In addition to his revolutionary research, Muroga was well-known for his mentorship of students. Many of his former students have had highly successful careers in industry, serving as executives and chief executives at companies including Dell Computer, Sun Microsystems, Silicon Graphics, Toshiba, United Microelectronics, and more.

His legacy as a mentor lives on in the department through two endowed gifts: the Saburo Muroga Endowed Fellowship, established by former student Shigenori Matsushita and others, and the Michael Faiman and Saburo Muroga Professorship, established by former student Doug MacGregor.

Muroga was born in 1925 in Numazu, Japan. He received his Gakushi degree, the highest conferred at that time, from the University of Tokyo in 1947. He was awarded a Ph.D. degree in electrical engineering from the University of Tokyo in 1958, based on papers he had published demonstrating his expertise in the field.

Muroga garnered international fame early on in his career when he was able to calculate Channel Capacity, a core concept of C.E. Shannon's information theory that Shannon concluded would be difficult to calculate.

In 1953, Muroga participated in a summer research program at the Massachusetts Institute of Technology supported by a Fulbright grant. While there, he began research into error-checking codes, and spent six months at the University of Illinois, working on the ILLIAC computer, the first and only big computer available for education at the time. According to the Japanese Computer Museum, when Muroga returned to Japan, he was a celebrity—the first Japanese scientist who had ever used a big computer.

Muroga immediately started to promote the basic concepts of computer technology in Japan. It was there that he directed the design, construction, and operation of Japan's first large-scale computer, MUSASINO-1, based on the ILLIAC.

Muroga joined the computer science faculty at the University of Illinois in 1964. While initially he planned to spend only three years at Illinois before returning to Japan, in fact, he remained at the university teaching and conducting research for 38 years until his retirement in 2002.

In 2004, Muroga was honored by his homeland, receiving the Order of the Sacred Treasure from the Office of the Emperor. His award, the "Gold Rays with Neck Ribbon," was given in recognition of his contributions to the area of information processing, and to the industry of computing in Japan.

More information about the life and career of Saburo Muroga may be found at the **Japanese Computer Museum** (http://museum.ipsj.or.jp/en/pioneer/muroga.html), or the **Muroga-mura and Muroga Family History website** (http://www.makaimedia.com/muroga/index.htm) maintained by family friends.

Remembrances about his life and career can be posted to the **Remembering Saburo Muroga blog** at http://go.illinois.edu/RememberingMuroga.

Donations in Professor Muroga's honor may be made to the Saburo Muroga Endowed Fellowship in Computer Science at the University of Illinois. Checks may be made payable to the University of Illinois Foundation with reference to the fellowship, and mailed to:

University of Illinois Foundation
1305 West Green Street, MC-386
Urbana, IL 61801

Brett Daniel

1984–2010

Brett Daniel died Sunday, December 5, 2010, with his family by his side.

Brett graduated as a National Merit Scholar from Hamilton Southeastern High School in 2002. From there, he attended Purdue University where he graduated with honors with bachelor's degrees in computer science and mathematics. Brett continued his educational journey at the University of Illinois at Urbana-Champaign, where he was pursuing his Ph.D. in computer science. He has published and presented a number of technical papers related to his research.

Brett was very positive and always happy, and demonstrated to everyone he knew what it meant to truly live. He had a neverending thirst for knowledge and adventure and loved to share what he learned. Brett was the inspiration and architect of the Lego Siebel Center (opposite page), which was unveiled in his honor in January and placed on permanent display at Siebel Center.

Lego Siebel Center honors former student

Inspired by the Lego Guggenheim and Fallingwater kits, Brett Daniel started his Lego Siebel Center project initially as a digital model in 2009.

He blogged at the time, "I cannot comment on how Siebel Center's architecture compares to the Guggenheim or Fallingwater, but the building has some interesting features that were a challenge to translate into Lego. In particular, choosing the correct scale, building the angled sections, and sculpting the topology of the courtyard took a lot of experimentation.

"I needed a scale that provided a good level of detail, allowed walls and other structures to be subdivided into 'nice' Lego sizes, and produced a model of reasonable size. As is often the case, the simplest solution was the best. If I used a single 1x1x1 block for each window, then everything fell together like magic. At this scale, the full model is about 70 studs (≈22 inches) long by 60 studs (≈19 inches) wide."

Brett began with Siebel Center's brick-and-window western wall, continuing counterclockwise until he reached the glass-faced northern façade.

"The glass-faced northern facade angles out from the main body of the building," wrote Brett. "I built this pie-shaped section separately and slid it into place against an otherwise blank wall. Many angled 'wing' pieces hide the gap."

A patio sits in a depression at the bottom of the angled section. Brett first attempted to orient the depression to the main building and rest of the courtyard but found that the grass and stairways did not meet the patio nicely. Instead, he connected the slope to the patio and slid the slope under the rest of the grass using stubless plates.

At the time Brett built the digital Siebel Center, he calculated that it would cost roughly $850 to purchase all of the Legos necessary to build the

Lego Siebel Center Architect: Brett Daniel

Construction Crew: Brett Daniel, Yun Young Lee, Nicholas Chen, Maurice Raab, Milos Gligoric, Joshua Hailpern, Lucas Cook, Alejandro Gutierrez, Ellick Chan, Alejandra Reynoso, Jeff Overbey, Sam Nelson, Kevin Lin, Munawar Hafiz, Kamilah Taylor, Marina Danilevsky, Darko Marinov, Danny Dig

real-life version. So Lego Siebel remained digital—and enormously popular online and among CS students.

Brett satisfied his desire for construction by building, with 10 other CS students, a 10-foot-by-10-foot igloo on the Siebel Center lawn during a winter snowstorm.

But constructing the real-life version remained a dream of Brett's. When Brett's prognosis and treatment options for his continuing battle with cancer began to look less promising, his close friends and fellow CS graduate students determined to build Lego Siebel Center as a tribute to their friend.

With funding from Google and Lockheed Martin, the department purchased $900 worth of Legos for the group.

Construction began at Brett's family home, with the help and supervision of Brett and his mother and father. Students, family, and faculty members worked in shifts over several days to bring Brett's dream to reality.

Brett was able to see the completed building. Sadly, shortly after construction was completed, Brett lost his battle with cancer.

In early January, the department held an unveiling event with the student body in attendance. Lego Siebel Center is now on permanent display in the first-floor atrium of Siebel Center as a tribute to a student who brought inspiration to all those who knew him with his passion and his joy in life.

Daniel Schreiber

1986–2010

To those who knew him, Daniel H. Schreiber was a passionate young man full of life and quirky ideas, always ready to take on a new project. Dan, 24, died in July in Urbana.

Dan graduated in 2008 with a B.S. in math and computer science and stayed on to pursue his Ph.D. in computer science. He had recently taken a leave of absence from the program to focus on artisanal bean-to-bar chocolate making.

After deciding he wanted to make chocolate, Dan pursued the idea in the last year, first distributing chocolate bars to friends and taking donations, to starting Flatlander Chocolate, renting a commercial kitchen on Urbana's east side and becoming a vendor at Urbana's Market at the Square. He quickly became a local fixture in the community, known by many for his passion and enthusiasm.

Erich William Hauptmann

1984–2010

Erich William Hauptmann (B.S. 2008) died as a result of a fall at the film studio where he worked. Erich received a B.S. degree in computer science from the College of Engineering at the University of Illinois at Urbana-Champaign, where he was a member of Sigma Phi Delta fraternity. His employment with Digital Domain, the award-winning special effects studio in Venice, California was a dream come true for him.

He worked on *The Curious Case of Benjamin Button*, *G.I. Joe: The Rise of Cobra*, *Transformers: Revenge of the Fallen*, *Star Trek*, *Speed Racer*, and *2012*. He is credited as technical assistant for *Percy Jackson and the Olympians: The Lightning Thief*. Shortly before his death he was promoted to assistant technical director of the commercials division and participated in the production of the first 3D cinema spots ever created for a consumer electronic brand, the Samsung LED TV.

One of Erich's managers said: "Erich was able to cross the line between artist and engineer, teacher and student, colleague and friend. … [He] earned the respect of his colleagues by his sheer motivation, proving that he could tackle any problem thrown his way, no matter how difficult."

Feng Chen

1977–2010

Computer science Ph.D. student Feng Chen died on August 8th due to complications from an undetected blood clot.

Feng conducted his research under Professor Grigore Rosu in the Formal Systems Laboratory. His research was dedicated to developing effective techniques and methodologies for building reliable and secure complex software systems. His interests covered a wide range of areas, including software engineering, programming languages, formal methods, and algorithm design.

Feng's seminal work in runtime verification, some of it included in his thesis, serves as a scientific foundation that challenged several research groups around the world.

Feng was widely published, and his research was presented at all of the major conferences in formal methods, software engineering, and programming languages. He received the ACM SIGSOFT Distinguished Paper Award for his paper in the ASE 2008 conference, and was the recipient of the C.L. and Jane Liu Award in the Department of Computer Science, an award given once per year to a most promising graduate student.

The Feng Chen Memorial Award, established in his honor, recognizes computer science graduate students who have won Best Paper Awards.

the #lastword

@IllinoisCS

CS has ~300 new students this semester! Alumni, students, what advice would you give to new CS students?

@kevinlange
also, there tends to be free food in the conference rooms

@timyardley
always look beyond the coursework. Network with fellow students and apply your new knowledge to build something

@dpaola2
take risks. It's easier to ask forgiveness than permission.

@melangeau
talk to profs about their research-it's really cool; maybe you'll want to help out :)

@ryanjm33
learn to git asap

@bobsley
The companies you'll be applying to will care about your online presence. Manage it well.

@gavinr
Go to office hours! (Practical tip: put office hours in your daily calendar as reminder)

@fiandola
work HARD. computer science is difficult, not impossible.

@IllinoisCS
We agree (also, WCS, !bang, or LCSC) RT @kevinlange join ACM, meet people

@wsetchell
foreach(day in week){shower(); useDeodorant();}

@krowemax
Eat healthy. Exercise. Don't sleep in class. Wear deodorant. Read the text. Start your projects more than 1 day before due.

@bmishkin
Do not bring your laptop to 1404 to surf facebook.

Department of Computer Science
University of Illinois at Urbana-Champaign
Thomas M. Siebel Center for Computer Science
201 N Goodwin Ave
Urbana, IL 61820

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