The Link

NEWS FROM

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ITTC Hosts Technology Day, IAB Meeting in May

On May 19, ITTC Industry Advisory Board (IAB) members and other invited guests attended the ITTC Technology Review Day. Throughout the day, ITTC investigators provided summaries of their research to almost 100 attendees. Researchers spoke on bioinformatics, radar and lightwave communication, e-learning, wireless systems, and security.

"I enjoyed Technology Day very much," said IAB member **Marc Epard** of Netopia, Inc. "Not only did I hear about projects in my own interest areas of networking protocols and applications, but I was able to broaden my horizons, so to speak, and see what's happening in other areas."

Participants met the Center's students and learned about their research during the student poster session. Thirty ITTC projects were showcased in the lobby of Nichols Hall.

"I benefited from the visitors' instant feedback," says graduate student **Jason Bengel.** "It provided us with ideas to consider as we move forward in our research."

ITTC and Sunflower Broadband also conducted a technology trial that provided Technology Day participants with high-speed, wireless Internet connections at different sites throughout Lawrence, including ITTC facilities in Nichols Hall.

"I was able to check e-mail on my Pocket PC and conveniently stay in touch with my office," said **Wayne Morgan** of Midwest Research Institute, an IAB member.

Graduate student Jason Bengel (second from left) talks with a group during the student poster session at Technology Day.

The following morning, May 20, the Center held its annual IAB meeting, which 19 members attended. The board, which helps guide ITTC's research and development, discussed new research initiatives in a variety of areas.

"We want to offer our support so that KU and the state of Kansas can continue contributing to the economic and physical security of our nation through responsible, timely, and innovative research," said board member **Gary Mastin** of Lockheed Martin Management & Data Systems/Intelligence, Surveillance, and Reconnaissance Systems. ■

Minden, Evans Lead National Workshop in D.C.

Cell phones, radio and television broadcasts, and satellite communication systems all clamor for space on the radio frequency (RF) spectrum. These different technologies create a high demand for the finite frequencies. The demand, coupled with the government's classification of spectrum as a scarce resource, has led to exorbitant costs for use of the spectrum. As demand has increased, availability has not, which causes a sharp rise in costs.

Further, the desire for additional commercial-use frequencies must be balanced with the government's growing spectrum needs for homeland security.

Professors **Gary Minden** and **Joseph Evans** conducted a workshop on the RF spectrum and its future, in Alexandria, Va., on May 28 and 29. The National Science Foundation (NSF) and Federal Communications Commission (FCC) sponsored

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Director's News

Information technology (IT) has changed the way we do many things in our lives, such as communicate, work, learn, and shop. IT also continues to present a variety of new challenges. The continued benefits to be derived from IT keep researchers at work developing innovations to smooth the convergence of communication, computing, and sensors for the next generation of information technologies.

Director Victor Frost

Many people carry around a small army of devices—cell phones, laptops, pagers, and personal data assistants—to stay connected and deal with a fast-paced life style. Many have become dependent on a "technology tool belt," with each tool providing a service now considered essential, which makes it difficult to jettison any tool to lighten the load. It would be helpful to have this diverse set of tools replaced by devices that are much easier to use and tuned to the user's particular needs.

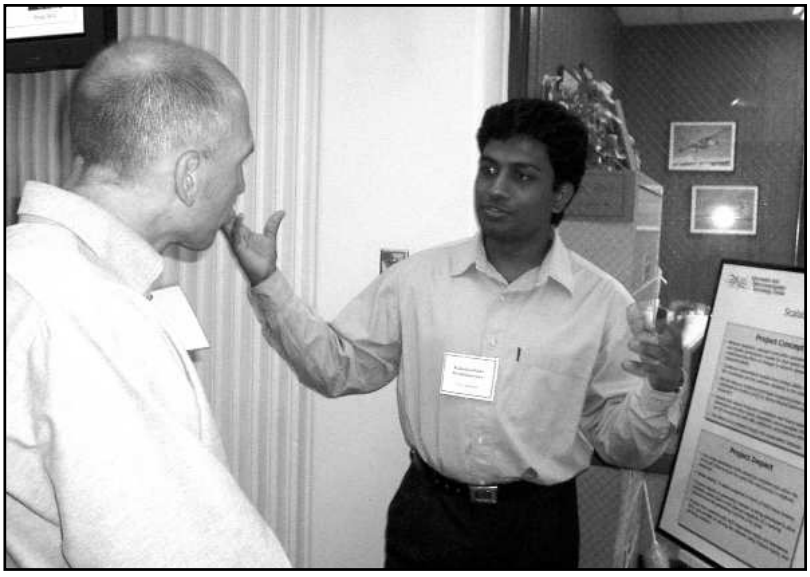
Evolving context-based services could provide the answer. These services would intelligently take into account where we are, what we are doing, and what we would like to do, customizing IT services for us. For example, if you were working with Ms. Jones on a time-critical project, the system would forward her e-mail to your wireless mobile device. However, once the project is completed, her e-mail would no longer be deemed critical and would not be forwarded. This would be accomplished entirely without your manual intervention. The IT industry must not only make the technology more usable but also find more cost-effective ways to deliver it.

Health care and life-sciences research are also being changed by IT. Not only are wireless technologies and notepad computers being applied in clinical environments but also the area of bioinformatics is rapidly expanding. "Bioinformatics" uses computer programs and databases to analyze huge amounts of biological data and is based on the application of computing and systems theory to biological problems.

The nation's growing dependence on information technology, combined with the potential of new and emerging uses of IT, seems at odds with the "gloom and doom" predictions about the industry. The implosion of the dotcoms has led people to question the future of IT, but IT *is* the future! The multibillion-dollar industry will continue to grow and strengthen the nation's international competitiveness as long as we continue to pursue the necessary research and development. This R&D will not only address current problems in health care, life sciences, and homeland security but also will expand the ways we interact, receive entertainment, and play. Innovative researchers will continue to find marketable new uses for IT.

The University of Kansas and ITTC are playing a role in tackling these challenges. ■

Students Highlight Research at Technology Day



Graduate student Ramakrishnan Krishnaswamy discusses his project with a Technology Day participant. Krishnaswamy's research deals with performance models for networks with correlated traffic. He was one of 30 students who participated in the poster session on May 19 in the lobby of Nichols Hall.

Information and Telecommunication Technology Center
A KTEC Center of Excellence at The University of Kansas Center for Research.

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Center Works as Subcontractor on New DARPA Project

ITTC's Intelligent Systems and Information Management Laboratory has received a subcontract on a new Defense Advanced Research Projects Agency (DARPA) project through Washington University in St. Louis. The collaborative project also involves the University of Rhode Island and Ohio University.

The project, which began in April, will improve interaction between computers and programs working together. This will allow each unit to know what actions are taking place and when they are executed, says **Douglas Niehaus**, ITTC's principal investigator on the project.

Programs are written to carry out tasks. Sometimes, several programs on different computers are needed to perform a function. Examples of such systems include computers in high-end automobiles, sets of computers controlling machines in a factory, or sets of computers in a military aircraft or ship that track, identify, and possibly destroy a target. The last problem is the one in which DARPA, a unit of the Department of Defense, is particularly interested.

KU researchers will concentrate on two major tasks—the development of a System State Information Service (SSIS), and middleware supporting Group Scheduling (GS) of computation components. The SSIS will collect, classify, and distribute information to other system components so that they can perform resource allocation and scheduling duties. The SSIS will include the current use of system resources including memory, network bandwidth, and the central processing unit (CPU) that actually carries out the computer's instructions.

The GS involves components (parts of programs) that must work together in unison to perform a job. Each component is called a thread, so programs with more than one component are multi-threaded.

At the ITTC Technology Day in May, KU Associate Professor Doug Niehaus talks about one of his current research projects. He recently received a DARPA subcontract.

Computers supporting many threads have to share the CPU among them. The computer's operating system scheduler dictates when each thread executes its part of the assignment. While this decision is made thread by thread, users care about the big-picture view of how the job is progressing. ITTC researchers are creating schedulers that are able to tell which group of threads is supporting different phases of the job, ensuring that the job is advancing as planned.

This scheduling affects numerous applications, such as the downloading of music. Multiple threads process each track. The stream of audio bits is read from a file and is processed before it is written into another file. This is all done though a variety of threads, which need to be coordinated. If the threads processing track number five pull five seconds ahead of the others, it will disrupt the whole process, since all the tracks must be mixed together. Schedulers that consider only single threads have no knowledge of how the progress of one thread compares to another. But a group scheduler would be able to consider this. It would know the set of threads that make up a group and treat them as a unit, improving the behavior of the computer. ■

Minden, Evans Lead National Workshop in D.C., continued from page 1

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the by-invitation-only conference, which had more than 60 participants.

"The Future of Spectrum Workshop provided an opportunity for researchers and policy makers to engage in a lively and productive discussion of technology and regulatory issues," said Evans, Charles E. Spahr professor of EECS.

Workshop participants worked to clearly define the problems with spectrum and community needs. The workshop also explored new research areas and gathered ideas about ways to manage the spectrum, which were then submitted to NSF.

"The workshop was a great success," said Minden, professor of EECS. "One of the exciting outcomes was a decision by the group to continue working together across a broad range of technical and policy issues related to radio spectrum."

The FCC is responsible for dividing up and allocating the RF spectrum for its various uses. Most TV channels possess high information capacity along with low signal distortion, making them desirable for both TV transmission and wireless cellular or personal communications devices. The explosion of wireless communication devices has created increasing competition for prime spectrum.

At ITTC, Evans and Minden continue researching ways to better utilize the RF spectrum. They are creating a new, higher-powered radio system using "empty pockets" within the higher ranges of the RF spectrum. While cellular telephones and radio and television broadcasts already occupy most of the spectrum, space within the spectrum is not used efficiently, leaving unused pockets in higher frequencies. The ITTC system will take advantage of these pockets to create a longer-range device than currently exists. Since these systems, which emit very narrow, short-duration pulses, carefully avoid interfering with each other and other radios, many more people and businesses can have their own local wireless networks. This will make it easier for people to exchange information between computers and share communal resources such as printers. ■

Kanagaratnam Earns High Honor for Dissertation

Pannirselvam Kanagaratnam has developed radar that measures the internal layers of the polar ice sheets. The new system will help scientists better understand the role of melting ice sheets in sea level rise.

Kanagaratnam

For his doctoral dissertation, Kanagaratnam developed radar to map near-surface internal ice layers so as to estimate snow accumulation. This snow radar coupled with ice-thickness radar will give scientists the needed data to begin assessing whether recent polar ice changes are part of a normal cycle or indicate a more significant shift in the earth's climate.

A rise in sea level of only a few meters would affect 60 percent of the world's population. The rate of evacuation for the two billion people living along the world's coast will be determined in part by how fast the vast West Antarctica ice sheet melts. Earth scientists have theorized that water released from the Antarctica and Greenland ice sheets is an indicator of long-term global climate change, but there is insufficient data to confirm this theory.

Kanagaratnam's work earned him the prestigious Haglund Prize for an outstanding doctoral dissertation from KU's graduate school. He received the award at the doctoral hooding ceremony on May 17. Kanagaratnam is the first engineering student to win the award.

The Dorothy Haglund award was established in 1979 in her memory. Haglund was director of graduate admissions and records and later assistant dean of the College. She worked with KU graduate students for 43 years.

Kanagaratnam and fellow researchers are working under the guidance of **Prasad Gogineni**, Deane E. Ackers distinguished professor of electrical engineering and computer science, to develop various radar systems. As an undergraduate and graduate student, Kanagaratnam has spent the last 10 years developing radar with Gogineni.

With his radar, Kanagaratnam is able to map the internal layers of ice. This will allow scientists to estimate snow accumulation rates and compare the past and present rates. He has made it possible to gather data relatively quickly on the ice sheets, while in the past this had been a time-consuming, expensive endeavor.

Gogineni nominated Kanagaratnam for the award. He served as Kanagaratnam's advisor during graduate school and has guided his research in radar systems. The two work together in ITTC's Radar Systems and Remote Sensing Laboratory (RSL).

"It is a great honor to receive the Haglund award. It is another validation of the importance of Dr. Gogineni's Greenland project," said Kanagaratnam, a Malaysian native. "I am grateful to Dr. Gogineni for having given me the opportunity to pursue my Ph.D. Under his guidance, I was able to obtain a NASA fellowship and pursue my research interest."

NASA Fellow **John Paden** has spent the last two years working with Kanagaratnam in RSL.

"Pannir is great to work with because he is always willing to answer questions and spend time working through problems with you even when you are not working on the same project," says Paden.

Kanagaratnam continues his work at ITTC and was promoted to a research assistant professor this spring.

"The Haglund award was given in recognition of the significance of Pannir's research," said **Victor Frost**, ITTC director. "As a research professor at ITTC, he is continuing that record of excellence." ■

Navy Recruits KU Professors to Teach IT Short Course

Professors **Joseph Evans**, **Victor Frost**, and **Gary Minden** taught a one-day class on the Internet and networking technology to more than 30 Navy reservists at the Naval Reserve Center in Kansas City. The professors presented the foundations for information technology (IT) before going on to more difficult IT topics at the April 5 workshop.

The KU faculty condensed material from four different graduate courses to present the workshop. Topics covered for the reservists included general network protocols, how the Internet works, and information security. ITTC provided booklets filled with material about modern communications networking. A significant amount of information was provided to the enlisted personnel during the one-day class.

"I believe that having presenters as knowledgeable as the KU faculty would provide the unit personnel with additional knowledge that would make them more valuable to the United States Navy in the event of mobilization," said Lt. Cmdr. **Bob Lambrechts**, commanding officer of the Naval Computer and Telecommunications Area Master Station.

These reservists were information systems and electronics technicians, who provide automated information and telecommunications support and services to local, regional, and global customers.

"I passed out written surveys to each of the unit members that attended the presentation, and the feedback was overwhelmingly positive," Lambrechts says. "The challenge we face is the diverse level of knowledge on IT-type issues that exists within the unit. Consequently, I tasked Dr. Frost and his colleagues with starting out slow and working toward more complex issues, gradually bringing people up to speed."

Given the international situation, Frost said that ITTC greatly appreciated the opportunity to provide a service to the US Navy at this time. He hopes ITTC and the Naval Center in Kansas City will have other chances to collaborate in the future. ■

Researchers Obtain U.S. Patent for Optical Recovery Clock

Professor **Ken Demarest** and Associate Professors **Chris Allen** and **Ron Hui** received a U.S. patent in April. The ITTC researchers developed an all-optical clock-recovery device, which holds the promise of making fiber-optic networks more cost effective.

Clock-recovery devices are critical to digital signal retrieval. These devices reconstruct the transmitter's clock and pinpoint for the receiver when information bits were sent. This allows the receiver to know exactly when data will be passing along on the fiber.

Conventional clock-recovery devices take the optical signals from the fiber and convert them to an electrical version, and then extract the clock from this electrical signal. This is inefficient, as the clock on each wavelength must be recovered by a separate circuit. The ITTC clock completely bypasses the optical-to-electrical process and derives the clock for all wavelengths optically.

Other all-optical clock-recovery schemes exist, but ITTC's is unique in that it can process multiple signals on a fiber simultaneously. This means that only one device is needed to obtain the clocks of numerous wavelengths being transmitted. This is a huge advantage, since normally one clock recovery is needed for each channel. Typically, there are up to a hundred optical data streams transmitted along a fiber, each at a different optical wavelength. The ability to extract the clocks of each of these signals simultaneously in the same device would represent a huge cost savings compared to present-day optical networks.

Demarest has applied for a NSF grant to allow further investigation. ■

ITTC Director Victor Frost (second from the left) presented Associate Professor Ron Hui (far left) with a U.S. patent plaque. Principal investigator Ken Demarest (third from the left) and associate professor Chris Allen also received plaques for the all-optical recovery clock. The technology will require less space and power from networks.

KU/Sprint Collaboration Celebrates 10th Anniversary

The University of Kansas celebrated its 10-year anniversary of access to Sprint's fiber-optic network during Technology Day on May 19. KU honored the partnership by giving Sprint a U.S. patent plaque for their latest collaboration. Sprint and three KU researchers were acknowledged for their patented all-optical recovery clock, which reduces the space and power needs of optical networks.

The KU/Sprint partnership has produced a trio of patents and numerous theses and dissertations. The collaboration has furthered development in the speed and efficiency of fiber-optic technology, which is used for long-distance communication.

ITTC's partnership with Sprint has kept the Center on the cutting edge of information technology research, combining computers and communication.

"Access to real fiber, professionally installed and subject to real environmental forces, is an incredibly valuable asset," said **Chris Allen**, co-director of ITTC's Lightwave Communication Systems Laboratory.

While fiber optics have allowed the quick transmission of large amounts of information, the glass fiber is fickle. Engineers need to work with functioning fiber to understand the strengths and weaknesses of optical networks. Through the collaboration with Sprint, KU faculty and student researchers have received a rare opportunity to work with this fiber in a university setting.

"Sprint has had an exceptionally rewarding experience with KU in applied optical research," says **Ben Vos**, Sprint's director of technology planning and integration. "It has also led to joint intellectual property development and an available hiring pool of talented optical engineers."

In the early 1990s, KU obtained the connection to Sprint's network through its participation in the Multidimensional Applications and Gigabit Internetwork Consortium (MAGIC) project, funded by the Defense Advanced Research Projects Agency (DARPA). ■

Ben Vos, Sprint's director of technology planning and integration, listens to Gayathri Chandrasekaran explain her project during Technology Day. The graduate student created a poster for her quality of service (QoS) project.
Vos accepted a patent plaque earlier in the day for Sprint. The KU/Sprint partnership celebrated its 10th anniversary this spring.

Achievements and Acclaim

ITTC Student Earns Self Graduate Fellowship

Graduate student **Heather Amthauer** has been chosen for a Self Fellowship. The Self Graduate Fellowship is a four-year award consisting of an annual $21,000 stipend, full tuition and fees, and a development program for each of up to 32 Ph.D. students. Amthauer is developing a new research project with Prof. Costas Tsatsoulis at ITTC. ■

Roddis Receives Miller Development Award

Kim Roddis, professor of civil, environmental, and architectural engineering, will receive the $4,000 Miller Professional Development Award for Service. Roddis is involved with a variety of national and international committees. ■

Ph.D. Student Achieves Spot in Final Four

Vijaya Ramasami was chosen as one of the four finalists in the 2003 International Union of Radio Science (URSI) Student Paper Competition. He will present his paper in the next round of competition later this summer. ■

International Magazine Cites WLAN Project

Brett Becker and **Matt Dunbar** had their work with wireless security featured in "The Revenge of Geography" in *The Economist.* Becker, an ITTC network specialist, and Dunbar, a graduate student, are creating a more advanced wireless 802.11b mapping and network visualization method. ■

Pingenot Competes in IEEE Contest

James Pingenot presented his paper at the annual IEEE Region 5 Conference in New Orleans this April. The University of Kansas senior highlighted his work with the multiyear, multimillion-dollar Polar Radar for Ice Sheets Measurement (PRISM) project. His paper describes how ITTC researchers will define different layers within the Greenland and Antarctica ice sheets. ■

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Center Receives KTEC Peer Reviewers for Evaluation

The Kansas Technology Enterprise Corporation (KTEC) organized a peer review for ITTC in April. As a KTEC Center of Excellence, ITTC receives an evaluation from reviewers every other year.

"It is productive to be assessed and receive constructive feedback provided by objective, outside participants," KTEC President **Tracy Taylor** says. "ITTC is an outstanding organization and will benefit from this effort as it has in the past."

The purpose of the review was to assess the Center's direction, processes, and strategy for technology-based economic development. KTEC brought three professionals experienced in the aspects of moving research toward commercialization. Reviewers were **Janet Yancey-Wrona**, director of the Maine Technology Institute; **Frank Daniher**, industry consultant in the advanced technology program for NIST (National Institute of Standards and Technology) in Maryland; and **Keith Molzer,** president of Entrepreneurial Consulting Corp. in Lenexa.

They came for a one-day site visit, in which they met with ITTC executive staff. Reviewers learned about the Center's projects, capabilities, commercialization processes, and outcomes.

The review process is still under way as ITTC responds to draft items compiled by KTEC from reviewers' comments. The Center is awaiting further feedback and the final document. In addition, **Tim Johnson**, ITTC's executive director of applied technology, met with the KTEC Center's Committee the first week in June and discussed the reviewers' comments and funding for the next fiscal year.

ITTC Director Victor Frost (front left) explains equipment built at the Center to KTEC Peer Reviewers. ITTC Executive Director for Applied Technology Tim Johnson (back right) looks on.

"The review team's feedback is invaluable as we look toward continued improvements," says Johnson. "Their positive observations are a tribute to the Center's accomplishments, and the outstanding people who work at ITTC." ■