Model Finds Optimal Fiber Optic Network Connections 10,000 Times More Quickly

Designing fiber optic networks involves finding the most efficient way to connect phones and computers that are in different places—a costly and time-consuming process. Now researchers from North Carolina State University have developed a model that can find optimal connections 10,000 times more quickly, using less computing power to solve the problem.

“Problems that used to take days to solve can now be solved in just a few seconds,” says Dr. George Rouskas, computer science professor at NC State. The model could solve problems more than 10,000 times faster when data is routed through larger “rings,” in the network.

Every time you make a phone call or visit a website, you send and receive data in the form of wavelengths of light through a network of fiber optic cables. These data are often routed through rings that ensure the information gets where it needs to go. These ring networks are faced with the constant challenge of ensuring that their system design can meet user requirements efficiently. As a result, ring network designers try to determine the best fiber optic cable route for transmitting user data between two points, as well as which wavelength of light to use. Most commercial fiber optics handle approximately 100 different wavelengths of light.

The new model developed by Rouskas and his team should speed things up considerably. Specifically, the researchers have designed a mathematical model that identifies the exact optimal routes and wavelengths for ring network designers. Read more at www.csc.ncsu.edu/news/1195.

Research Highlights

The NC State University Department of Computer Science is one of the oldest and largest computer science departments in the nation, and research is central to the success of the department. This year has been especially rewarding in terms of research funding. In 2010 our active research grants exceeded $44 million, our new external funding exceeds $10 million, and our annual external funding expenditures exceeded $8 million (and overall, in the range of $12 million). The department also received close to $1 million in gift funds. This ranks us well within the top 20 for sponsored research funding among computer science departments in colleges of engineering. Faculty research interests range from theory and algorithms, bioinformatics, high-performance and power-aware systems, to advanced analytics research, to artificial intelligence, serious games, graphics and visualization, networks, security, software engineering, and computer-based education. A list of select research projects appears on page three of this newsletter.

In the 2010-2011 academic year, faculty as a group published over 40 refereed journal papers, more than 150 conference and workshop papers, one book, eight book chapters, and a number of other edited works. They also produced over 55 publications, tutorials, editorials, news articles, or media appearances. Faculty gave over 130 professional talks related to their research and educational activities. A number of our faculty serve as editors, and on editorial boards of leading professional publications, and as members and officers in the most prestigious professional societies and organizations in their areas of specialty. Our faculty continue to be both organizers and participants in a number of prestigious professional events, as well as delivering services and functions to the university, professional societies, the state, and the nation.

Both our undergraduate and graduate programs are nationally recognized and received numerous accolades. Our graduate program is very highly ranked among computer science departments in public universities (cca 28th by US News & World Report, and in the top 20 by ASEE). In the fall of 2010 our undergraduate program successfully underwent...
Highlights (cont.)

ABET/CAC accreditation review, and our game development concentration is ranked among the top 15 undergraduate video game design and development programs in the US and Canada by the Princeton Review.

In the fall of 2010, the department had 1163 students (629 undergraduates and 534 graduates (with 168 of these PhD students)). The graduating class of 2010-2011 included 25 PhD, 167 MS and 131 BS degrees. When compared to other departments in the country, we are among the top 20 in the number of awarded bachelor’s degrees and among the top 10 in the number of awarded master’s degrees in computer science.

Demand for our graduating students continues to be very strong, and the average annual starting salary for our undergraduates averages almost $58,000 (one of the highest in the NC State College of Engineering for May 2011 undergraduates), and over $78,000 for our MS graduates. The top employers for this year’s students are Fidelity Investments, IBM, NetApp, Cisco and SAS.

In 2010-2011 our faculty received a number of prestigious awards and honors: Dr. Mladen Vouk received an IEEE Distinguished Service Award, and was named a member of IEEE Golden Core; Dr. Vouk also was reappointed for a second five-year term as Head of the Department; Dr. Barbara Adams is a 2011 recipient of the George H. Blissis Outstanding Undergraduate Advisor Award; Dr. Annie Anton testified (for the second time) before the US Congress on matters of policy and privacy; Drs. Rada Chirkova, Patrick Dreher, Xiaohui (Helen) Gu, Christopher Healey, Michael Rappa, Mladen Vouk, Laurie Williams and Tao Xie received IBM Faculty Awards totaling over $203,500; Dr. Peng Ning received a 2011 IBM Open Collaborative Faculty Award valued at $75,000; Dr. Injong Rhee received a Google Research Award totaling over $65,532; Dr. Tao Xie was named an IEEE Computer Society Distinguished Visitor for 2011-2013, and an ACM Distinguished Speaker; Dr. Laurie Williams received a 2010 IBM Smarter Planet Innovation Faculty Award valued at $10,000; Dr. Tao Xie received a 2011 Microsoft Research Software Engineering Innovation Foundation Award valued at $17,500; Dr. Xiaohui (Helen) Gu received her second Google Research Award – this one in the amount of $61,000; and Dr. Emerson Murphy-Hill received a Google Research Award in the amount of $61,000.

Our students received numerous honors and awards as well: the STARS Student Leadership Corps was awarded the Deborah S. Moore Service Award for Non-Service Club of the Year; Rogelio Cardona-Rivera received a prestigious Department of Energy Computational Science Graduate Fellowship; Ben Smith received a highly competitive 2011 IBM Ph.D. Fellowship for the second consecutive year; Brittany Strachan was selected to the ACC Women's Basketball All-Academic Team for the second consecutive year; Brittany also was selected to the Capital One second team Academic All-District women's basketball team, and was awarded the ACC/Weaver-James-Corriigan Award for postgraduate study; a textbook titled, “Practical Graph Mining with R”; written entirely by students in Dr. Nagiza Samatova's CSC 422/522 course is to be published with proceeds benefitting the NC State Computer Science Department; Xusheng Xiao was selected as one of 10 recipients of the Cascadia Innovation Fellowship; and Kelkie Jones and Natalie Kerby were awarded Donald L. Bitzer Creativity Awards.

In August 2011 he department welcomed several new faculty: Dr. Randy Avent, professor; Drs. Kristy Boyer and William Enck, assistant professors; and Dr. David Sturgill, assistant teaching professor. We now have 43 tenure/tenure-track faculty, 12 lecturers and adjuncts, and about 33 research, development, information technology and administrative staff.

Finally, the department mourns the death of Dr. Norman F. Williamson, former acting department head (1973-1974) and professor. Dr. Williamson was on the committee to establish the original curriculum for the Computer Science Department at NC State, and was on the search committee to choose the original chair of the department. He will be greatly missed.

Mladen A. Vouk
Professor and Head of the Department
Selected Research Projects

Complete list with abstracts is at http://www.csc.ncsu.edu/research/


Secure Open Systems Initiative, Dennis Kekas, Peng Ning, Miladen Vouk, Rudra Dutta. $3,336,000 by Army Research Office.

Collaborative Research: Understanding Climate Change: A Data Driven Approach, Nagiza Samatova, Frederick Semazzi. $1,815,739 by National Science Foundation.


CSR: Medium: Collaborative Research: Providing Predictable Timing for Task Migration in Embedded Multi-Core Environments (TIME-ME), Frank Mueller. $390,000 by National Science Foundation.

Research Faculty (cont.)

Sarah Heckman, Teaching Assistant Professor
PhD, North Carolina State University, 2009
Computer science and software engineering education, open educational resources

Thomas L. Honeycutt, Associate Professor
PhD, North Carolina State University, 1969
Management information systems, computer modeling and simulation, computer literacy

Xuxian Jiang, Assistant Professor
PhD, Purdue University, 2006
Virtual machines and security

James C. Lester, Professor
PhD, University of Texas, 1994
Artificial intelligence, intelligent user interfaces, intelligent tutoring systems, computational linguistics

Xiaosong Ma, Associate Professor (joint appointment with ORNL), PhD, University of Illinois, 2003
High performance computing, parallel I/O, storage systems, scientific data management

Brad Mott, Research Scientist
PhD, NC State University, 2006
Computer and network security: new techniques for building trustworthy systems and wireless security

Harry Perros, Alumni Distinguished Graduate Professor, PhD, Trinity College, Ireland, 1975
Performance analysis of optical networks, performance monitoring of grids, queuing networks

Michael Rappa, Distinguished University Professor, PhD, Univ. of Minnesota, 1987
Analytic, e-commerce, open courseware, open educational content, technology management

Douglas S. Reeves, Professor
PhD, The Pennsylvania State University, 1987
Internet protocols, multimedia computing and networking, information security, computer org.

Injong Rhee, Professor
PhD, UNC Chapel Hill, 1994
Computer/wireless/sensor networks, multimedia networking, distributed systems, operating systems

David Roberts, Assistant Professor
PhD, College of Computing, Georgia Tech, 2010
Machine learning and artificial intelligence and their application to interactive technological experiences

Robert D. Rodman, Professor
PhD, University of California, Los Angeles, 1973
Computational forensic linguistics, applying AI to error recovery in speech recognition

George N. Rouskas, Professor
PhD, Georgia Institute of Technology, 1994
Network architectures and protocols, optical networks, grid computing, scheduling

Nagiza Samatova, Associate Professor (joint apt. w/ ORNL), PhD, Russian Acad. of Sci. (CCAS), 1993
Graph theory & algorithms, bioinformatics, systems biology, data management, data integration

Carla D. Savage, Professor
PhD, University of Illinois, 1977
Combinatorics, combinatorial algorithms, network algorithms, graph theory, discrete mathematics
Senior Faculty Profiles

Dr. James Lester, professor of Computer Science and respected authority on intelligent tutoring systems and game-based learning environments, earned his PhD, MCS and BA degrees in computer science from the University of Texas at Austin. He joined the Computer Science Department at NC State soon after receiving his PhD in 1994, and has been here ever since. Lester is head of the IntelliMedia Group at NC State, where research focuses on intelligent tutoring systems and game-based learning environments that leverage interactive digital media to create effective, engaging learning experiences. By fusing human language technologies and adaptive reasoning techniques from artificial intelligence with new media and game technologies, the Group develops and evaluates high-impact interactive learning systems. Lester is a member of the NC State Academy of Outstanding Teachers. He serves as editor-in-chief of the International Journal of Artificial Intelligence in Education, and serves on the steering committees of IEEE Transactions on Affective Computing, and the International Conference on Intelligent Tutoring Systems. He is program co-chair of the Fourth International Conference on Interactive Digital Storytelling (ICIDS-2011), and chair, Virtual Agents Track, of the Tenth International Conference on Autonomous Agents and Multiagent Systems (AAMAS-2011).

Dr. Matthias Stallmann, professor of Computer Science, earned his PhD in computer science from the University of Colorado, Boulder, his MS in computer science from Yale University, and his BA in mathematics and computer science from Yale University. Stallman joined the NC State computer science department in 1984, and, in addition to his teaching and research responsibilities, serves as the accreditation coordinator for the department. Since 2004, he has been the assessment coordinator for the department providing ongoing assessment of learning outcomes for courses, preparation for accreditation visits, coordination with the COE ABET team, and controlled experiments to validate new teaching ideas. In 2010 he guided the undergraduate program through a successful ABET/CAC accreditation. This spring he served as a member of the reviewing committee for TAP, and he is a participant/investigator in the NSF CPATH Project called Incorporating Communication Outcomes into the Computer Science Curriculum. He serves as the NC State Coordinator for the AccessComputing Project, and in May 2011, he was an invited participant in the Dagstuhl Seminar 11191, Graph Drawing with Algorithm Engineering Methods. He holds membership in the Association for Computing Machinery, the Society for Industrial and Applied Mathematics, Omega Rho, and the American Society for Engineering Education.

New Faculty Profiles

Dr. Randy Avent joined the faculty as professor in August 2011. He received his BS in Zoology from the University of North Carolina in 1980. He received an MS degree from NC State University in Electrical Engineering in 1986, and a PhD in Biomedical Engineering and Mathematics in 1984 and 1986, respectively. His particular research interests are in defense analytics, which deals with unstructured and semi-structured data mining and exploitation.

Dr. Kristy Boyer joined the faculty as assistant professor in August 2011. She received her BS in Mathematics and Computer Science from Valdosta State University in 1993. She received her MS in Applied Statistics from the School of Industrial and Systems Engineering at the Georgia Institute of Technology in 2000, and her PhD in Computer Science from NC State University in 2010. Her research interests include artificial intelligence and computational linguistics, with an emphasis on natural language dialogue.

Dr. William Enck joined the faculty as assistant professor in August 2011. Enck received his BS degree in Computer Engineering from Pennsylvania State University in 2004; and his MS and PhD degrees in Computer Science and Engineering from Penn State in 2006 and 2011, respectively. His expertise is in systems security, with a focus on the design, optimization, and measurement of security for operating systems, specifically on mobile phones, and the complex environments in which they operate.

Dr. David Sturgill joined the faculty as a teaching assistant professor in August, 2011. He received his BS degree from the University of South Carolina in Computer Science and Math in 1989. He received his MS and PhD in Computer Science from Cornell University in 1993 and 1996, respectively. His primary research interest is in parallel computation and its application to computationally hard problems, including work on search techniques, parallelism, machine, and collaborative learning.