Department of Computer Science

School of Engineering and Applied Science
University of Virginia

inquiry@cs.virginia.edu

Department of Computer Science
School of Engineering and Applied Science
University of Virginia
151 Engineer's Way
P.O. Box 400740
Charlottesville, Virginia 22904-4740
Phone: (804) 982-2200
Fax: (804) 982-2214
www.cs.virginia.edu

This brochure was created by Professor Gabriel Robins and the Computer Science Web Team and is available on the Web at www.cs.virginia.edu/brochure

ABOUT THE DEPARTMENT OF COMPUTER SCIENCE

The UVa Department of Computer Science is one of the top departments in experimental systems, its main research thrust, and a nationally-recognized leader in undergraduate CS education. Since becoming an independent department in 1984, we have grown to 27 faculty, 15 professional support staff, 73 graduate students and 320 undergraduates. Federal research support has exceeded six million dollars annually, and past support includes a prestigious National Science Foundation Institutional Infrastructure Award, a five million dollar grant which has greatly enhanced our research capabilities.

Our faculty have garnered an impressive roster of awards and peer recognition: two are members of the National Academy of Engineering and one is NAE President; one is a Fellow of the American Academy of Arts and Sciences; one holds a National Science Foundation Young Investigator award; one holds a Packard Foundation Fellowship; four are Fellows of the IEEE; three are ACM Fellows; three hold NSF Career Awards; two are presidents of IEEE societies and another is past Chair of an ACM Special Interest Group; two are University Teaching Fellows; one received an All-University Outstanding Teaching Award; one received a Faculty Mentor Award; four hold endowed chairs or University Professorships, and many are editors or editors-in-Chief of major professional journals. In addition, our faculty and research activities have received considerable media and press coverage. We are currently planning a new Information Technology building to house the Department of Computer Science.

We are to scholarly and research excellence as well as to educational excellence. For example, we have undertaken a complete reform of the undergraduate curriculum that is a National Science Foundation "flagship" project. Its hallmarks include a high degree of mathematical rigor reinforced through use, an emphasis on a philosophy of engineering, hands-on experience with industrial systems in team-oriented laboratories, increased personal attention, undergraduate involvement in research projects, and a carefully crafted progression of material as the students advance through the program. We are now revising the graduate program with the same vigor.

Our Department is also solidly committed to community service, both inside and outside the University. Recent examples include the Grounds-Wide Tele-Tutoring System that enables students to receive remote interactive help over the Internet, the InterCom project which leverages the World Wide Web to facilitate electronic commerce and create new information technology-based businesses, and the tele-medicine effort which could save lives by enabling doctors and surgeons to treat physically inaccessible patients remotely.

MASTER & DOCTOR OF PHILOSOPHY DEGREES

The Department offers two Master's degrees, which serve to prepare a student for professional opportunities or for further Ph.D. studies. The Master of Science (MS) degree places strong emphasis on research and requires, in addition to coursework, a thesis reporting the research accomplished in collaboration with a faculty research advisor. The Master of Computer Science (MCS) degree requires a project instead of a thesis. Students with a strong undergraduate background in computer science may complete an MCS within a year. For both degrees, core courses in theory, architecture, languages, and systems provide a solid basis in fundamentals, which are supplemented by elective courses in computer science, engineering, and mathematics.

The Doctorate degree is a symbol that its bearer has achieved an in-depth understanding of a segment of human knowledge and has contributed significantly to that knowledge. The Department encourages qualified students to pursue the Ph.D. Typically, students with a Bachelor's degree will first complete a Master's degree before entering the doctoral program, although a Master's degree may be bypassed. The Ph.D. requires additional course work, satisfactory completion of oral and written comprehensive examinations, submission of a research proposal, and finally a dissertation based on independent, original research. The student may tailor an individual program of study.

Message From Our Chair

There is a tremendous amount of activity and excitement in our great and expanding department. For example, we hired seven new assistant professors in the past three years, and added many new state-of-the-art research projects. Come and discover us through our Web pages or in person. You will find students, faculty, and professional staff who are pushing the envelope of experimental computer science in both teaching and research.

Our undergraduates are actively involved in research and are immersed in an integrated CS curriculum that is becoming a model for other universities. Our graduate students are active participants in world-class research projects, our faculty are leaders in the field, and our facilities and equipment are first-rate.

John A. Stankovic,
BP America Professor & Chair

"...pushing the envelope of experimental computer science in both teaching and research."

MORE ON THE DEPARTMENT

The Department of Computer Science is a community of faculty, students, and staff engaged in education and research. One of our strengths is the friendly and collegial interactions that prevail amongst its members. Students are considered colleagues and are on a first-name basis with faculty, and members of the Department share a strong sense of community and cooperation. Departmental decisions are generally made by consensus, and students have representation on many departmental committees. Students and faculty participate together in a number of sports and hobbies including basketball, volleyball, jogging, swimming, weight training, frisbee, hiking, camping, whitewater rafting, skating, folk dancing, and many other activities. All of our graduate students have offices with workstations on their desks, and most of our graduate students are supported by the Department, including tuition waiver and a monthly stipend.

This productive environment is supported by state-of-the-art computing and laboratory facilities. While the major departmental research emphasis is in experimental systems, departmental research interests span the computer science spectrum. Recent journal publications cover topics in algorithms, computational geometry, computer-aided design of VLSI circuits, computer architecture, parallel and distributed computing, operating systems, grid computing, real-time systems, embedded systems, programming environments, user interfaces, compilers and programming languages, distributed systems and databases, computer vision, artificial intelligence, scientific computing, computer networks & distributed multimedia, computational biology, combinatorial optimization, information retrieval, and software engineering.

University and School commitment to continued departmental growth is reflected in recent multimillion-dollar equipment grants and current planning for a new Computer Science building. We actively involve our undergraduates in research projects, and many of them co-author technical papers and give conference presentations. Our strong departmental undergraduate and graduate degree programs reflect the emphasis that the University of Virginia places on education. For example, the quality of our graduate program, even at the Master's level, is demonstrated by the numerous refereed publications that have resulted from Master's theses and projects. Another indicator is the multiple awards our faculty have received for innovative and distinguished teaching. Our graduate students attract multiple job offers from industry as well as from academia.

GRADUATE STUDENT ORIENTATION

Each Fall, the entering graduate students participate in a semester-long "orientation seminar," where they are rapidly acclimated to the Department, and are exposed to issues related to research, productivity, the hardware and software infrastructure, and various professional responsibilities. Guest speakers introduce a wide variety of interesting topics, including productivity tools, programming environments, debuggers, library resources, web searching, the philosophy and practice of academic research, public speaking, and personal time management skills. In addition to these talks of general interest, faculty present a short overview of their research. At the end of this seminar, students are matched with faculty advisors based on mutual research interests. This seminar serves as a mechanism which ensures that students transition smoothly into graduate life and become quickly involved in research.

What People Say About Us

"I like the cooperative feeling. Everyone, graduate students and faculty, is friendly and positive. There are all sorts of social events and speakers, and the department becomes a large part of your life. I have never felt so at home in an academic setting before!" - ***Andrea Paige Rowan***, *graduate student*

"The department is a great environment for research. It is a wonderfully helpful collaborative community. People are willing to cooperate and help each other out beyond the bounds of their research groups. I have had the chance to publish several conference papers and a journal article, and to go to the conferences to give talks on my research. The faculty here realize the importance of graduate students and treat us accordingly. I like the fact that grad students are present on all major departmental committees." - ***Gabriel Ferrer***, *graduate student*

"Our department takes teaching very seriously and takes pride in doing it well, at both the undergraduate and graduate levels, Things such as the Graduate Student Orientation Seminar show that the department is serious about making life better for students." - ***David Evans***, *faculty*

"Virginia is a beautiful state with lots of outdoor things to do like hiking and camping in the Blue Ridge. I like the fact that I'm constantly in contact with people from different countries and cultures. I love the friendliness of the people." - ***Rashmi Srinivasa***, *graduate student*

"Even after being here for several years , I have not become jaded to the sights at this University. Step out on a bright day and see the fall colors at the Rotunda and you'll be convinced that this is one of the prettiest Universities in the country." - ***Anand Natrajan***, *research scientist & former graduate student*

"Ours is a department in which it is easy to cross-pollinate. I have published with many different faculty members in areas of mutual interest. This keeps life interesting and keeps me in touch with all aspects of CS - not just my own areas." - ***Jim French***, *faculty*

"We have some of the best researchers in several areas. The environment here is conducive to research. Students are friendly and Charlottesville is a great place to go to school. I also like the healthy interaction between faculty and graduate students." - ***Nisanti Mohanraj***, *graduate student*

END TO END EXPERIMENTAL SYSTEMS RESEARCH

The design and study of "end-to-end" experimental systems is a major research emphasis in the department. This effort reflects the unusually strong interest in systems in the department. This emphasis is strengthened and broadened by our close collaboration with the Center for Semicustom Integrated Systems in the Department of Electrical Engineering. The joint program addresses problems associated with the full spectrum of computer system design and engineering. At one end of the spectrum is the capability to design, test and fabricate custom VLSI circuits. Further along the spectrum is the ability to create board-level systems, using these to build larger integrated general-purpose or application-specific systems. Finally, the program supports the development of appropriate software systems for these artifacts.

The strength and importance of this program were instrumental to the award of a five-year, five million dollar grant from the National Science Foundation under its Institutional Infrastructure Program (IIP). This grant has greatly increased our research capabilities, and in particular, a sophisticated infrastructure has been put into place for support of experimental systems research. It has provided an array of capabilities to support state-of-the-art research in integrated circuits, hardware integration, systems software, and applications. The grant has also supported the expansion and enhancement of general-purpose computing and network resources in both departments.

COMPUTING AND RESEARCH FACILITIES

The Department provides extensive computing and communications resources in support of its research activities. Powerful servers (Sun and Intel systems) are interconnected by a Gigabit switched Ethernet which interfaces directly to the University's main 622 Mbps ATM network ring, which is in turn connected to the NSF VBNS at 155 Mbps. Desktop machines include workstations from Sun and SGI, as well as PCs with X-window client software, all connected by 100 Mbps switched Ethernet to the cluster servers and a RAID file system. Students and faculty also have access to central university computing resources and network facilities that provide high-speed Internet access, including access to the "Internet 2". The new LAVA architecture laboratory is building a simulation system that will grow to over 60 Intel Pentium-III's. The Department's web server is attracting over one hundred thousand "hits" per day from all over the world, and one of the Department's Web pages (the "Oracle of Bacon at Virginia" won Time Magazine's "Top Ten Web Sites of the Year" award and was the subject of a Discovery Channel special.

LEGION AND CENTURION

As part of the Legion project, our faculty have built Centurion, a leading-edge multi-computer composed of commercial, off-the-shelf components. Centurion includes heterogeneous processors based on the DEC Alpha and Intel Pentium architectures, and uses Myrinet high-bandwidth, low-latency networking hardware. Centurion has over 400 processors, 400 GF peak performance, 64 GB of memory, and over a terabyte of disk space. Centurion will provide the computing power for research projects across the School, including computer science research in operating systems and distributed computing, simulations for materials science and electrical engineering, and genomics research.

School of Engineering Overview

The Department of Computer Science is one of nine departments in the School of Engineering and Applied Science. The other eight departments are Biomedical, Chemical, Civil, Electrical, Systems, Materials Science, Mechanical and Aerospace, and Technology, Culture and Communications. There are 170 faculty members in the School, and the external research budget of the School has been rising substantially in recent years, now exceeding $30 million annually.

The School has 1,900 undergraduates and 600 graduate students. The undergraduate students have the highest SAT scores in the University, with a mean of 1335. The average GRE score for the incoming graduate students is 1300. Each of these numbers places the school within the top three public engineering schools in the country in terms of student quality. Approximately 340 Bachelor's degrees, 200 Master's degrees, and over 50 Doctorate degrees are awarded annually by the School.

> *"...these numbers place the School within the top three public engineering schools in the country in terms of student quality."*

SYSTEMS INTEGRATION LAB

The Systems Integration Laboratory provides infrastructure for implementing pre-production prototypes of board-level complex electronic systems. Facilities include state-of-the-art electronic design/test benches, high-speed logic analyzers, digital storage oscilloscopes, and a Sierra Research surface mount reflow station for prototyping fine-pitch components. In addition, the Electrical Engineering Department's Integrated Circuits Laboratory provides a complete environment for the design and testing of prototype analog and digital VLSI systems, including a clean room, high-resolution plotters, a high speed HP tester, and dozens of high-end workstations for running complete commercial electronic design software suites for both IC and FPGA-based designs.

INTERNET TECHNOLOGY INNOVATION CENTER

Virginia's Center for Innovative Technology established the Internet Technology Innovation Center (Internet TIC) to assist the information technology industry and its growing base of Internet-related businesses. The Center's mission is to (a) nurture the entrepreneurial environment for IT and Internet-related businesses; (b) accelerate the creation and deployment of network-based information technology; (c) develop the hardware and software infrastructure needed for a knowledge-based economy; and (d) expand Virginia's high-skill work force in information technology. The Center is a unique partnership among the University of Virginia, Virginia Tech, George Mason University, and Christopher Newport University. Its faculty, staff, and students perform R&D in the areas of electronic commerce, e-business software, digital libraries, knowledge management, Internet multimedia, high-speed access, Internet2, fiber optics, wireless communications, and mobile and portable radios. In its first year of operation, the Center assisted 105 companies and conducted $4 million worth of funded R&D projects.

DEPARTMENT LOUNGE

The Department maintains a student-run social lounge that features a continuous supply of snacks, candies, tea, coffee, soft drinks, and juices, in addition to kitchen facilities, sofas, plants, recent issues of popular magazines, numerous board games and puzzles, and copies of recently-published research papers authored by members of the Department. The lounge's informal atmosphere encourages collegial interactions and lively research discussions among Department members. Students as well as faculty regularly visit the lounge to relax, have a snack, engage in puzzle-solving, or play a friendly game of Chess, Checkers, Go, Scrabble, and many others. The Department also supports a student-organized weekly Social Tea event with catered food, which further helps promote interactions among members of the department.

About the University of Virginia

Founded in 1819 by Thomas Jefferson, the University of Virginia is widely recognized as one of the nation's leading institutions of higher education. The University of Virginia is consistently the top-ranked public university in the U.S. News & World Report's annual listing of top universities. Dubbed a "public Ivy," the University has achieved national stature for its teaching, research, leadership, and public service. At the heart of the "Academical Village" are the Lawn and the Rotunda, designed by Thomas Jefferson. These are national landmarks and are considered among the most outstanding achievements in American architecture.

The University has more than 2,100 faculty, including over 330 holders of endowed professorships. In addition, around 8,000 staff members are employed in the University and in the University Hospital. There are approximately 18,000 students: 11,500 undergraduates and 6,500 graduate and professional students. The students come from 80 countries and all 50 states, with females in a slight majority. In addition to its excellent Engineering School, the University is renowned for its Medical, Law, Graduate Business, and Architecture Schools, and for the quality of many of its humanities and social sciences departments.

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NEW UNDERGRADUATE CURRICULUM

The faculty of the Computer Science Department are dedicated to educational excellence at both the undergraduate and graduate level. Several years ago we decided to create an undergraduate educational program that was more rigorous and would better reflect modern computing practice. After much careful planning, we began a complete revision of our curriculum in accordance with these goals.

Computer Science has changed rapidly in its brief history, and what once were acceptable skill and knowledge levels are now outmoded. Today's computer professional must have an extensive set of skills, a detailed knowledge of many technical areas, and a rigorous grounding in the mathematical underpinnings of the discipline. These professionals must also be able to communicate clearly and to work in teams. Moreover, the profound effects on society that often result from developments in information processing make it imperative that computer professionals exercise their craft in a responsible fashion. The goal of our new curriculum is to provide the best education in the nation for these professionals. This curriculum reform activity has been partially funded by the National Science Foundation Division of Undergraduate Education and has become a "flagship" project.

Hallmarks of the new curriculum include (1) a high degree of mathematical rigor reinforced through use, (2) an emphasis on a philosophy of engineering beginning in the first course, (3) hands-on experience with industrial systems in team-structured laboratories, (4) a reordering of material to increase comprehension, (5) increased personal attention in the laboratories, (6) the participation of undergraduates in research projects, and (7) a carefully crafted progression of difficulty in the material as the student advances through the program. The new curriculum has been highly successful, providing a superior education for those students who will work in industry, as well as for those who will go on to graduate school.

COMPUTER ENGINEERING PROGRAM

Computer Engineering is an exciting field which spans topics in both electrical engineering and computer science. Students learn and practice the design and analysis of computer systems, including both hardware and software aspects and their integration. Careers in the very fast-growing Computer Engineering field are as wide and as varied as computer systems, and range from embedded systems found in consumer products or medical devices, to control systems for automobiles, aircraft, and ships, to more wide-ranging applications in telecommunications, financial transactions and information systems.

The primary objective of the undergraduate computer engineering program is to provide a solid education in the fundamentals of both electrical engineering and computer science disciplines, so that graduates are prepared to either enter the practice of the profession or continue advanced education in an appropriate graduate degree program. This program strives to facilitate the development of problem-solving, group, and communication skills, as well as an appreciation for the associated underlying social and ethical issues. The Computer Engineering program is jointly administered by the Departments of Computer Science and Electrical Engineering, and interested students can obtain a BS degree in computer engineering.

The City of Charlottesville

The University is located in Charlottesville, with a metropolitan-area population of around 100,000. The area is known for its natural beauty and historical attractions. Charlottesville also offers a substantial range of cultural resources, which include symphony orchestras, a light opera company, and other instrumental and vocal groups, as well as art galleries, museums, diverse restaurants, national landmaks, and sports events. Numerous speakers, musicians and performing arts professionals visit the community each year.

The area attracts tens of thousands of tourists yearly, who come to see the Grounds of the University, visit the homes of Thomas Jefferson and James Monroe, tour local wineries, and enjoy the scenic views and outdoor recreation in the Blue Ridge and in the Shenandoah mountains. Charlottesville and the encompassing County of Albemarle offer relaxed surroundings, rolling green hills, and pleasant weather; they are consistently nationally ranked as one of the top cities in the U.S. in terms of desirability, family life, and cost-of-living value.

“The area attracts tens of thousands of tourists yearly, who come to see the Grounds of the University...”

NEW INFORMATION TECHNOLOGY BUILDING

In order to meet the growing demands of a department rapidly on the rise, the School of Engineering is planning to construct a multi-disciplinary research and academic building to house our Department of Computer Science. This building will embody the ideals of an Academical Village and facilitate the development of new curricula for the Information Age through collaborative efforts between Computer Science, Systems Engineering, and Electrical Engineering. It will provide a facility in which multi-disciplinary research teams will tackle problems in areas such as high-performance computing, computer visualization, wireless communications, telemedicine, graphics, virtual reality, distributed multimedia, software development, and distance learning, while emphasizing interactions between industry and the University. The new building will encompass over 50,000 net assignable square feet comprising five floors, and will cost approximately $25 million. The building will include showcase space and a cyber cafe in its main atrium, and will accommodate its high-tech functions while paying homage to the architectural legacy of Mr. Jefferson.

VIRGINIA INTERNET ENGINEERING LAB (VINTLAB)

The Virginia Internet Teaching Lab (VINTLab) enables students to gain hands-on experience with networking hardware and software, and learn how the protocols of the Internet operate. The goal of the VINTLab effort is to graduate Internet Engineers who can maintain, update, improve, and even redesign future incarnations of the Internet. Through sets of closed lab sessions in the VINTLab, students can conduct supervised experiments on networking equipment which emulate a nationwide backbone network, and includes millions of dollars worth of commercial Cisco IP routers, ATM switches, FDDI concentrators, and other high-end networking equipment provided by MCI/Worldcom and Cisco Systems.

"*MCI Telecommunications, together with Cisco Systems, Inc., is committed to forming an Internet laboratory at the University of Virginia... The lab itself will immediately become one of the premier facilities for Internet technology across major universities in the United States.*"

- Vint Cerf, 1999

Vint Cerf, one of the fathers of the early Internet, co-inventor of the TCP/IP protocol, and Senior Vice President of MCI / Worldcom, along with Professor Jörg Liebeherr and other guests, at the dedication ceremony of UVa's VINTLab.

The Commonwealth of Virginia

The Commonwealth of Virginia has recently undertaken decisive strategic technological leadership, and enjoyed considerable success in attracting, creating, and retaining information-technology and Internet-based businesses. High-technology industries (such as electronics, biotechnology, pharmaceuticals semiconductors, environmental technology, and telecommunications), with a heavy emphasis on research, development and a highly-skilled and technological-savvy work force, are also growing rapidly in Virginia.

These enterprises are supported by new public and private infrastructure and technology resources, such as communications networks, federal and nonprofit R&D institutions, a coherent technology transfer system, highly-developed human resources, and an entrepreneurial climate which supports the creation of technology-based businesses. The Commonwealth of Virginia has substantial competitive strengths for the New Economy, and the quality of life in Virginia, including cultural and recreational resources, natural assets, and tax regimes, is unrivaled.

"...Virginia has undertaken decisive strategic technological leadership in recent years..."

www.cs.virginia.edu/zephyr

National Compiler Infrastructure/Zephyr - Jack Davidson

Compiler infrastructure is a key and enabling component of cutting-edge computing systems research. Whether the research is focusing on developing new optimization algorithms, designing a new programming language, creating new software tools, developing and analyzing real-time systems, or exploring new or experimental architectural features, a complete, robust, and flexible compilation system is required to perform realistic experiments in a timely fashion. The National Compiler Infrastructure will serve the needs of computing system researchers well into this new century. Zephyr is a major component of this infrastructure. The primary elements of Zephyr are a family of Zephyr Intermediate Forms; an abstract Syntax Description Language used to describe the content of different intermediate forms; a family of Computer Systems Description Languages used to describe the aspects of target machines needed for code generation, and machine-dependent code improvement, libraries and generators supporting a variety of common tasks over all intermediate forms; and demonstration compilers.

www.cs.virginia.edu/pie

PIE: Personalized Information Environments - James French, Andrew Grimshaw & Charlie Viles

The number and volume of information resources is enormous and growing exponentially. The level of care taken in the preparation of information for on-line publication varies greatly. Access to the information is often poor and, moreover, even awareness of the existence of specific data is becoming increasingly difficult. Organizational strategies provided by information publishers are publisher-centric or designed to meet the needs of a specific user group. Tools are needed that will enable users to create personal collections of information resources of interest to them. It will be necessary to cull tens of thousands of resources for those of specific interest; it will also be necessary to continuously monitor available resources to detect new useful sources or to decide that others are no longer of interest. Efficient search strategies are required to support the discovery of resources and to search and fuse information gleaned from those resources. We are developing new techniques aimed at constructing a user-customized Personalized Information Environment (PIE) that can be tailored to the needs of specific users. The techniques developed will be based on: distributed search over restricted search spaces; virtual information repositories; and a novel system architecture. In addition to user control over information access, our architecture provides for user anonymity and secure access to resources.

www.cs.virginia.edu/vision

Computer Vision - Worthy Martin

We do theoretical and experimental research on computer vision and image processing. Our goal is to develop real-time vision architectures, including applications for visually guided mobile robots. Our research agenda includes motion understanding, visual tracking of moving objects, and perception-action systems. We have several robots, a large set of image processing equipment, and an SGI reality engine at our disposal. We are interested in a variety of aspects of computer vision and image processing, with an emphasis on real-time vision applications. Topics of current interest include software for advanced vision systems, architectures and representational structures for visually guided mobile robots, and systems to facilitate the use of pipelined image processors, visual tracking of moving objects, and motion understanding.

www.cs.virginia.edu/beehive

BeeHive: Global Multimedia Database Support for Dependable, Real-Time Applications

- Jack Stankovic, Sang Son & Jörg Liebeherr

The influence of computers, communications and databases is quickly creating a global virtual database where many applications require real-time access to both temporally accurate and multimedia data. We are developing a global virtual database, called BeeHive, which is enterprise-specific and offers features along real-time, fault tolerance, quality of service for audio and video, and security dimensions. Support of all these features and tradeoffs between them will provide significant improvement in performance and functionality over browsers, browsers connected to databases, and today's distributed databases. Such results should be applicable to sophisticated real-time control applications as well as the next generation Internet. We have developed various novel component technologies that will be incorporated into BeeHive, especially with respect to real-time concurrency control, transaction scheduling, security tradeoffs, resource models, and associated admission control and scheduling algorithms. We also developed a cogency monitor, which is the interface from BeeHive (an enterprise system) into the open Internet.

www.brainpower.org

Brainpower for Business: Resources and Solutions for Business - Alf Weaver

Brainpower for Business is an electronic guide to locating business solutions at Virginia's state-supported colleges and universities. Brainpower organizes the various services provided to the business community by Virginia's higher education institutions in a way that makes sense to a business person. Brainpower provides business assistance in starting up a company, bringing a product to market, finding venture capital, writing a marketing plan, technical assistance, developing a product, researching new technology, putting a product into a process, and obtaining licenses. Additional Brainpower services include finding employees, co-op students, trainees, and other business solutions available through the Commonwealth's colleges and universities. Virginia Business magazine and Virginia's Center for Innovative Technology (CIT) worked with the state's colleges and universities to produce a print version of Brainpower. This web site is a pilot project made possible through the work of CIT, InterCom, and 37 of Virginia's colleges and universities. Brainpower for Business became CIT's first electronic product, showcasing the technical talents and resources available at Virginia for use by companies worldwide. Brainpower is now a critical resource for regional directors in identifying potential university partners for clients, and in 1997 it won CIT's award for "Best New Product or Service".

lava.cs.virginia.edu

LAVA: The Laboratory for Computer Architecture at Virginia - Kevin Skadron

Architectural innovation is vital to continued improvement in processor performance. The LAVA group is exploring key architectural issues such as instruction-level parallelism, branch prediction, architecture/compiler synergies, more efficient memory hierarchies, and architecture for embedded environments. Even in high-performance processors, these problems constrain architectural innovations, and they are especially important for embedded environments like hand-held devices. Collaborating institutions include Princeton, U-Mass, Utah, and the Legion Project. Because simulation is so important to our work, the LAVA group is also exploring new ways to make simulations fast *and* accurate.

legion.virginia.edu

Legion: World-Wide Virtual Computer - Andrew Grimshaw & Marty Humphrey

Legion is an object-based metasystems software project at the University of Virginia. From the project's beginning in late 1993, the goal of the Legion Group has been to create a highly usable, efficient, and scalable system founded on solid principles. We have been guided by our own work in object-oriented parallel processing, distributed computing, and security, as well as by decades of research in distributed computing systems. Our system addresses key issues such as scalability, programming ease, fault tolerance, security, site autonomy, etc. Legion is designed to support large degrees of parallelism in application code and manage the complexities of the physical system for the user. The first public release was made at Supercomputing 1997 in San Jose, California. Legion is an "open" system that has been designed to allow and encourage third party development of applications, runtime library implementations, and "core" system components.

www.cs.virginia.edu/survive

Survivability Architectures - John Knight, Kevin Sullivan & John McHugh

We are applying our experience with protection shells (safety kernels) and mediators to create novel architectures for the support of survivable critical infrastructure systems. We are identifying the salient features of four critical national infrastructures to learn their points of vulnerability. Vulnerabilities are addressed to improve the overall survivability of each infrastructure. Survivability of a system is expressed as a combination of reliability, availability, security, and human safety. Each critical infrastructure stresses a different combination of these four facets to ensure the proper operation of the entire system in the face of threats from within (malfunctioning components) and threats from without (malicious attacks). The goal of the research is to produce a framework of software which can be easily tailored to each infrastructure system to ensure the intended operation of existing components (legacy applications and commercial off-the-shelf software).

www.cs.virginia.edu/isotach

Isotach: Concurrency Control Without Locks or Barriers - Paul Reynolds

Isotach systems are distributed or parallel computer systems with special support for interprocess coordination. Isotach systems provide low cost ordered message delivery — a basic service useful or essential in many applications in which processes must share data or otherwise coordinate their actions. These applications include distributed databases, cache coherence in multiprocessors, distributed shared memory, parallel production systems, and distributed control systems. Isotach systems also provide support for fault-detection and checkpointing. Isotach systems provide these benefits by maintaining a logical time system that enables processes to predict and control the logical time at which its messages are received. This control is a powerful mechanism for interprocess coordination in a parallel or distributed computation.

www.cs.virginia.edu/vlsicad

VLSI CAD: Physical Design of High-Performance Circuits - Gabe Robins & Jim Cohoon

Recent trends in deep-submicron Very Large Scale Integrated (VLSI) circuit technology have resulted in new requirements for circuit layout algorithms. Much of our research centers on new formulations which capture performance and density criteria in computer-aided design (CAD). Our results include near-optimal approximation algorithms for computationally intractable problems such as placement, partitioning, global and detailed routing, resource-based routing, low-skew clocking, cost-radius trade-offs, bounded-density trees, circuit probe testing, multi-port terminal routing, and new formulations for manufacturing yield enhancement. Our methods address not only traditional and leading-edge integrated circuit technologies, but also newer design styles such as field-programmable gate arrays (FPGAs) and multi-chip modules. We are also investigating other topics in discrete algorithms and combinatorial optimization.

www.cs.virginia.edu/ftree

Package-Oriented Programming - Kevin Sullivan

The Galileo Fault Tree Analysis Tool is an experimental system being built within our Package-Oriented Programming (POP) project. Galileo supports advanced fault tree analysis capabilities developed under the direction of Professor Joanne Bechta Dugan. Specifically, Galileo supports Dugan's DIFtree analysis method. Package-Oriented Programming is a research project investigating the reuse and integration of very large-scale components. By very large, we mean "on the order of a million lines of code equivalent." We are exploring the use of shrink-wrapped software applications as massive building blocks, because it appears that new package architectures are sufficiently promising (but also lacking in certain essential ways) to warrant considerable research attention. Key issues include the design of mechanisms supporting restriction, specialization, extension and integration of packages. Our research addresses several issues, including (1) architectural styles for POP systems; (2) generalizing the architectural approaches that appear to make POP a reasonably successful approach to large-scale reuse and integration; and (3) investigating the software development life-cycle for systems developed in the POP style.

www.cs.virginia.edu/robins

Computational Biology - Gabe Robins & Bill Pearson

We are addressing important problems in computational biology. Our major focus is the development of more effective strategies for multiple sequence alignment, particularly methods that minimize the phylogenetic tree-cost of the alignment, rather than the more commonly used sum-of-pairs cost. The tree-cost criterion more accurately reflects the biological process through which sequences evolve, but is considerably more costly to compute. In addition, we have worked on construction of evolutionary (phylogenetic) trees over a given set of taxa (typically DNA sequences), where the optimization objective entails the best-fit of tree topologies under a least-squares or parsimony criteria. We are also investigating the structure of phylogenetic solution spaces and efficient biological sequence comparison methods.

www.cs.virginia.edu/infotech

InfoTech: Information Technology for Mobile and Web-Based Systems - Sang Son

As computer technology becomes more integrated into society, information management for human activities necessitates computing that responds to requests in real-time. Many information systems are now used to monitor and control appliances as well as large complex systems which must have predictable and timely behaviors. Millions of users will soon be carrying mobile computers that access the Internet wirelessly. To support those users in applications such as web-based information systems, e-commerce, and Internet appliances, providing consistent data and transaction services in real-time with acceptable quality and security will be a key requirement. This project aims to design and evaluate models and methodologies for developing robust and responsive information systems for those new applications. Current research issues include timeliness and predictability, adaptive QoS management, flexible security paradigms, data consistency in mobile environments, and applying real-time and information technology in web-based systems.

www.cs.virginia.edu/dbrogan

Dynamically Simulated Characters in Graphical Environments - David Brogan

Groups of birds, fish, and many other animals are able to move gracefully and efficiently through complex environments. These animals skillfully utilize the control they have over their own movements to satisfy their current goals and to integrate with the environment and the actions of their neighbors. We would like to reproduce complex high-level behaviors such as these for herds of physically simulated characters that possess significant dynamics. To accomplish this goal, we specify a hierarchy of control algorithms for each simulated character that computes actions ranging from low-level joint torques to high-level navigation strategies. This approach provides natural looking motion for such low-level behaviors as walking, running, and climbing while utilizing such high-level behaviors as obstacle avoidance, grouping, and rough terrain locomotion. We have used these techniques to simulate groups of one-legged hopping robots and human bicyclists as they function in and interact with a complex and unpredictable environment. Using distributed computing environments we have created interactive environments where users can herd roaming robots or race with a team of cyclists through city streets.

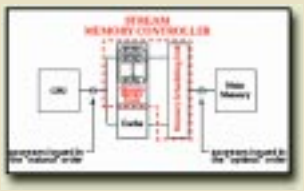
www.cs.virginia.edu/luebke

Perceptually-Driven Rendering Using Gaze-Based Simplification - David Luebke

We are investigating a class of unique computer graphics techniques, rigorously grounded in perceptual psychology. In these techniques local geometric simplification operations are driven directly by perceptual metrics. Equations derived from psychophysical studies determine whether the simplification operation will be perceptible; the operation is performed only if its effect in the final image is judged imperceptible. In this way the load on the graphics hardware is reduced without introducing visible artifacts. To increase the amount of simplification, we incorporate *gaze-directed rendering*. A commercial eye tracker monitors the direction of the user's gaze, allowing the image to be simplified more aggressively in the periphery than at the center of vision. Our perceptual model addresses many interesting topics in geometric simplification, including gaze-directed rendering, silhouette preservation, and imperceptible simplification.

www.cs.virginia.edu/smc

Computer Architecture / Stream Memory Controller - Bill Wulf



The Stream Memory Controller (SMC) implements dynamic access ordering - the hardware reorders stream accesses at runtime to improve memory system performance. The compiler detects the streamable loops, and generates code to transmit information about the streams to the hardware at runtime. The SMC then prefetches read operands and buffers write operands, issuing the accesses in an order that takes advantage of both the memory system architecture (i.e., it tries to keep all banks busy in an interleaved system) and the DRAM component characteristics. The stream buffers look like FIFOs to the processor; each stream is mapped to one FIFO. The CPU simply issues its accesses in the natural order of the computation, referencing the head of the appropriate FIFO in order to access the next element of a given stream. This project involves compiler development, derivation of analytic performance bounds, simulation of the proposed design, design and fabrication of two VLSI implementations of the SMC, a complete board-level computer integration, and performance evaluation of the results.

mng.cs.virginia.edu

Multimedia Networks Group (MNG) - Jörg Liebeherr & Steve Patek

The multimedia networks group (MNG) addresses the challenges of building next-generation multiservice networks which support the stringent requirements of distributed multimedia applications. The research agenda of the MNG includes analysis of Quality-of-Service networks, design of network protocols, and design and implementation of multimedia applications. Much of the work in the MNG is done in collaboration with other universities and research labs in government and industry. For example, in INDRA, a joint project with CMU, Rice University, and MCI, MNG members are designing and implementing a reference architecture for service differentiation on the Internet. In HyperCast, MNG members investigate, by analysis and implementation, protocol mechanisms which can achieve highly scalable (super-scalable) multicast communications on the Internet. The core approach is to organize multicast group members in very highly symmetric topologies, and use these for the exchange of control information between multicast group members. The MNG has available a formidable testbed environment for experimental research, which is equivalent to that of a backbone network.

www.cs.virginia.edu/holst

HoLSt - Hierarchical Loadable Schedulers - Jack Stankovic

Audio and video applications, process control, agile manufacturing and even defense systems are using commodity hardware and operating systems to run combinations of real-time and non-real-time tasks. We are developing an architecture that will allow a general-purpose operating system to schedule conventional and real-time tasks with diverse requirements, to provide flexible load isolation between applications, users, and accounting domains, and to enforce high-level policies about the allocation of CPU time. This is accomplished by implementing a dynamic, hierarchical scheduling infrastructure. The infrastructure is integrated with a resource manager that provides a level of indirection between resource requests and the scheduling hierarchy. A scheduling infrastructure separates scheduler code from the rest of the operating system.

naccio.cs.virginia.edu

Naccio: Policy-Directed Code Safety - David Evans

Naccio is a general architecture for code safety that addresses some of the weaknesses of traditional code safety systems: they are closely tied to a single platform, they are limited in what policies can be enforced, and they express policies in ad hoc ways. Naccio demonstrates that it is possible to solve these problems without sacrificing performance or convenience. Naccio policies are defined in terms of constraints on abstract resources described using general languages. A platform interface specifies a particular platform in terms of how it manipulates those resources. Naccio enforces a policy by transforming the target program. We have built prototype Naccio implementations that enforce policies on executions of JavaVM classes and Win32 executables.

www.cs.virginia.edu/QoS

Multimedia and Web QoS - Tarek Abdelzaher

We investigate middleware, OS, and networking solutions for performance-guaranteed services. A next-generation Internet service architecture is contemplated to deal with emerging critical application requirements. Current QoS-sensitive applications and services such as e-commerce and streaming multimedia require a reliable, survivable infrastructure with predictable performance guarantees, fault-tolerance, scalability, adaptation, and graceful degradation. The Multimedia and Web QoS program is dedicated to investigating the challenges of the next generation performance-guaranteed service architecture along three dimensions. On the network front, we investigate innovative services that can be migrated into the communication infrastructure to provide solutions to scalability, reliability, availability, and performance guarantees. We specifically address the caching problem. In the middleware area, we explore services that can lie above the existing infrastructure to export a more reliable abstraction capable of providing QoS guarantees on top of unreliable distributed best-effort components. We focus on QoS-aware middleware for web, e-commerce, and multimedia services. On the end-system front we investigate design issues relating to providing scalable QoS-sensitive solutions for emerging performance critical applications. Both application-level and OS solutions are being investigated.

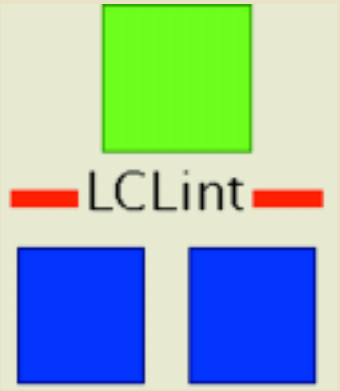
intercom.virginia.edu/SurveySuite

SurveySuite: Automated Electronic Surveys - Alf Weaver

SurveySuite allows a user to create, edit, publish, notify, and tally an electronic survey. It supports the creation of electronic survey instruments with any number of sections and questions. Each question can have an individual response type, such as yes/no, satisfaction (2-5 levels), multiple choice allowing one or multiple responses, open-ended (one or more lines of text), numeric or dollar value, tabular response, or custom design. Having designed a survey, it can be published to an email list (with the recipient email addresses being typed or cut-and-pasted into a text box, or retrieved from a named private list) along with an electronic cover letter. When the survey is complete, the administrator can tally the results and see them immediately as bar graphs, or download the results file into an Excel spreadsheet and use its display wizard to produce colorful, labeled graphics.

lclint.cs.virginia.edu

LCLint: Annotation-Assisted Static Checking - David Evans



LCLint is a tool for statically checking C programs using information provided in source-code annotations. Annotations are stylized comments that document assumptions about functions, variables, parameters, types and control flow. LCLint can exploit these annotations to perform aggressive checking and detect a large class of common programming errors including violations of information hiding, memory management errors including uses of dead storage and memory leaks, dangerous data sharing, and undefined program behavior. Current work is exploring ways to support user-defined annotations and associated checking.

www.cs.virginia.edu/fcrts

Feedback Control Real-time Scheduling - Jack Stankovic, Sang Son, Gang Tao, & Tarek Abdelzaher

Despite the significant body of results in real-time scheduling, many real world problems are not easily supported. While algorithms such as Earliest Deadline First, Rate Monotonic, and the Spring scheduling algorithm can support sophisticated task set characteristics (such as deadlines, precedence constraints, shared resources, jitters, etc.), they are all open-loop scheduling algorithms. Open-loop refers to the fact that once schedules are created they are not adjusted based on continuous feedback. While open-loop scheduling algorithms can perform well in systems where the work loads can be accurately modeled, they can perform poorly in unpredictable dynamic systems. In this project we are developing a theory and practice of feedback control real-time scheduling. Feedback control real-time scheduling defines error terms for schedules, monitors the error, and continuously adjusts the schedules to maintain stable performance. We have developed a practical feedback control real-time scheduling algorithm, FC-EDF, which is a starting point in the long-term endeavor of creating a theory and practice of feedback control scheduling. We are applying our results to applications such as web servers, agile manufacturing, and defense systems.

www.cs.virginia.edu/components

Component-Based OSs for Embedded Systems - Jack Stankovic & Marty Humphrey

The use of component based software for constructing and tailoring embedded systems has promise. However, most third party components are too heavyweight and do not explicitly address time, memory, reliability, power, cost, and other cross cutting constraints. A key problem is developing the components themselves without fully addressing how they interact with other components or how they fit into a components infrastructure. While much work has been done in developing components, less has been done with components suitable for embedded systems. Our research in developing component based OSs for embedded systems can be described in three key areas: developing and implementing domain specific components and component infrastructures, developing configuration tools to help in composition of embedded systems, and nonfunctional analysis to assess, e.g., real-time and fault tolerance capabilities.

www.cs.virginia.edu/vlsir

Very Large-Scale Interactive Rendering (VLSIR) - David Luebke

Interactive rendering of very large-scale geometric datasets is an increasingly crucial problem. Despite tremendous strides in computer graphics hardware, the growth of large-scale models continues to outpace our capability to render them interactively. Such interactive visualization is an enabling technology for many far-flung fields, ranging from scientific and medical visualization to entertainment, architecture, military training, and industrial design. Today's large-scale models easily reach 100 million primitives, 2 to 3 orders of magnitude beyond what a high-end commercial graphics platform can render interactively, and tomorrow's models will measure billions of primitives. Our research investigates interactive rendering algorithms for datasets of unprecedented size. This research builds on and extends our recent work on *view-dependent polygonal simplification*, which dynamically reduces a complex geometric model to only the level of detail needed for the current view. Polygonal simplification is a tool for interactive rendering; the relatively new view-dependent approach provides improved fidelity and generality over traditional methods, with the potential for truly drastic simplification.

www.cs.virginia.edu/appID

Application Intrusion Detection - Anita Jones

Historically, the detection of intrusion into computer systems has been performed at the level of the operating system. In our research we seek to develop techniques to detect intruders in the context of applications. Of particular interest are internal intruders who are legitimate users, but limited access users, who are attempting to subvert an application. We focus on long-running, comprehensive applications such as corporate inventory systems, medical record systems, or electrical power grid monitoring systems. We are developing tools and techniques to define signature-behavior of functional portions of a large application so that routine monitoring can detect deviation from the signature-behavior.

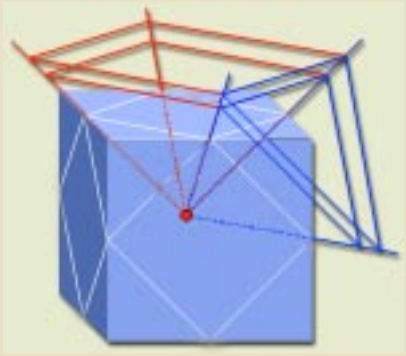
www.cs.virginia.edu/zeus

Zeus: Making Formal Techniques Practical for Software Development - John Knight

For many years, academics have claimed that the use of formal methods in software development would help industry meet its goals of producing better software more efficiently. Despite their popularity in academia, formal methods are still not widely used by commercial software companies. The goals of the Zeus project are to analyze the fundamental basis for the disparity between research and industry, and to develop techniques that enable industrial software development to benefit from formal methods. The project includes a comprehensive analysis of the operational process requirements, a detailed cost-benefit model, appropriate tools and techniques, and case studies that address the limitations found previously when trying to integrate formal techniques and that also illustrate the associated benefits and risks.

www.cs.virginia.edu/robins

Computational Geometry - Gabe Robins



We are addressing open practical issues in computational geometry, an area that lies at the interface between the fields of geometry and algorithms. Recent projects include devising new algorithms with improved approximation ratios for the Group Steiner problem in general graphs, as well as the development of a heuristic with the currently best-known approximation bound for the general graph Steiner tree problem. We have also formulated and addressed a new and practical time-dependent variant of the classical Traveling Salesman Problem, which led to a number of follow-up works. Other results include upper and lower bounds on the maximum degree of minimum spanning trees under various metrics, and efficient algorithms for pattern recognition in pointsets, which are applicable to landmine detection. Our work is motivated and driven by real-world needs and applications.

Al Gore commending Professor Anita Jones on a job well done as Director, Defense Research and Engineering (DDR&E). The autograph reads "To Anita Jones, with thanks for your outstanding contributions, Al Gore".

"Be the first to say what is self-evident, and you are immortal."

Tarek Abdelzaher • Assistant Professor of Computer Science

www.cs.virginia.edu/zaher • (804) 982-2227 • *zaher@cs.virginia.edu*

Tarek Abdelzaher received his Ph.D. in computer science at the University of Michigan in 1999. He joined the Department of Computer Science at the University of Virginia in August of 1999. Tarek's areas of interest are middleware, operating systems, and networking solutions for providing performance-guaranteed services. He is the author or co-author of 20 papers.

Research

Tarek's research interests include middleware, OS, and networking solutions for providing performance-guaranteed services in distributed environments, both in embedded systems and on the Internet. His research today lies primarily with investigating the architecture of future QoS-sensitive high performance services and communication mechanisms that allow features such as isolation between hosted services, performance differentiation, adaptation to load conditions, and attainment of QoS guarantees. He has investigated the implications of such architectural requirements on communication subsystem design and the OS kernel. He has also investigated possible middleware solutions to facilitate deployment in the short term.

Selected Publications

- "Adaptive Content Delivery for Web Server QoS," T.F. Abdelzaher and N. Bhatti, International Workshop on Quality of Service, London, UK, June 1999.
- "Web Content Adaptation to Improve Server Overload Behavior," T.F. Abdelzaher and N. Bhatti, International World Wide Web Conference, Toronto, Canada, May 1999.
- "End-host Architecture for QoS-Adaptive Communication," T.F. Abdelzaher and K.G. Shin, IEEE Real-Time Technology and Applications Symposium, Denver, Colorado, June 1998.

"Life's too short for keyframing."

David Brogan • Assistant Professor of Computer Science

www.cs.virginia.edu/dbrogan • (804) 982-2211 • *dbrogan@cs.virginia.edu*

David Brogan received a B.A. in Mathematics from the University of Virginia in 1992. He completed his Ph.D. in Computer Science at the Graphics, Visualization, and Usability Center of Georgia Tech in 2000, and joined the University of Virginia in Spring 2000 as an assistant professor. Brogan's areas of interest are computer animation, physical simulation, and multiagent control. He is the author or coauthor of seven papers.

Research

Animated characters are needed to play the role of teachers or guides, teammates or competitors, or just to provide a source of interesting motion in interactive environments, video games, and off-line simulations. For these applications to be compelling, the characters must have a wide variety of complex and interesting behaviors and must be responsive to the actions of the user. Physical simulation is a powerful character animation technique, but it requires complex control algorithms and is computationally expensive. To facilitate the development of interesting graphical environments, David creates methods that simplify the tasks required to generate autonomous groups of interacting simulated characters, and he explores such techniques as simulation level of detail to reduce the computational load these characters impose. His research in this area has been used to generate interactive environments, one of which allows a user to race with a group of simulated bicyclists through the streets of Atlanta.

Selected Publications

- "Dynamically Simulated Characters in Virtual Environments," D.C. Brogan, R.A. Metoyer, and J.K. Hodgins, IEEE Computer Graphics and Applications, pp. 58-69, September, 1998.
- "Group Behaviors for Systems with Significant Dynamics," D.C. Brogan and J.K. Hodgins, The Journal of Autonomous Robots, George A. Bekey, editor, 4, pp. 137-153, 1997.
- "Animating Human Athletics," J.K. Hodgins, W.L. Wooten, D.C. Brogan, J.F. O'Brien, 1995. Proc. of SIGGRAPH, Los Angeles, CA., 1995.

"Look sharp, be spiffy!"

James Cohoon • Associate Professor of Computer Science

www.cs.virginia.edu/cohoon • (804) 982-2210 • *cohoon@cs.virginia.edu*

Jim Cohoon received his Ph.D. in Computer Science from the University of Minnesota in 1982. He joined the University of Virginia in 1983 as an assistant professor of Computer Science and was promoted to associate professor in 1989. He was a Fulbright Scholar in 1993. He has directed four Ph.D. theses with another three in progress, and is the author or co-author of five books, three book chapters, and over sixty papers. He served as chair of the ACM Special Interest Group on Design Automation (SIGDA) from 1993-1997, and he received SIGDA's Design Automation Fellowship (1990), Outstanding Member Award (1991), and Leadership Award (1997). He also received the Department's first annual Teaching Award (1998). He is a member of ACM's Publication Board and the ACM SIG Governing Board's Executive Committee.

Research

Jim Cohoon investigates application areas such as VLSI design automation, transport scheduling and routing, and Computer Science education. His interdisciplinary approach applies and extends nontraditional techniques such as computational geometry, probabilistic search, genetics, and parallel computing. Together, he and his students produce state-of-the-art tools that are practical as well as theoretically interesting. For example, Spiffy and Quark form a complete performance-oriented VLSI layout package for FPGAs; and Presto is a new genetic algorithms paradigm and infrastructure that speedups searches by orders of magnitude.

Selected Publications

- "A Fast Method for Generalized Starting Temperature Determination in Homogeneous Two-Stage Simulated Annealing Systems," J.M. Varanelli and J.P. Cohoon, *Computers and Operations Research*, vol. 26, pp. 481-503, 1999.
- "Placement and Routing for High-Performance FPGA layout," M. Alexander, J.P. Cohoon, J.L. Ganley, and G. Robins, *VLSI Design: International Journal of Custom-Chip Design, Simulation, and Testing*, vol. 7, pp. 97-110, January 1998.
- "C++ Program Design: An Introduction to Programming and Object-Oriented Design: 2nd Edition," J.P. Cohoon and J.W. Davidson, McGraw-Hill, 1999.

"The best programmers, like the best craftsmen, understand the tools they use."

Jack Davidson • Professor of Computer Science

www.cs.virginia.edu/davidson • (804) 982-2209 • *davidson@cs.virginia.edu*

Jack Davidson received his Ph.D. in Computer Science at the University of Arizona in 1981. He joined UVa as an assistant professor of Computer Science in 1982, becoming associate professor in 1988 and professor in 1998. In 1997 he received the McGraw-Hill "Most Successful New Title" Award for his best-selling C++ textbook (co-authored with Jim Cohoon), and in 2000 he won an Outstanding Faculty Award. He is Associate Editor for ACM's Transactions on Programming Languages and Systems. He has directed six Ph.D. theses and is the author or co-author of one book and over 70 papers.

Research

Jack Davidson's research focuses on two complementary areas of computer science: compiler construction and computer architecture. In compiler construction, he investigates the development of easily retargetable, highly optimizing compilers. Earlier research developed an intermediate representation, RTL, which is the basis for two widely distributed and widely used retargetable, optimizing compilers, the GNU C compiler and VPO. Current work focuses on developing compilers and tools for embedded systems. In the past decade, it has become clear that the performance of a computer system depends on both the hardware and software. Consequently, design of high-performance computer systems depends on the interaction of hardware and software. Little is gained by including architectural enhancements that the compiler cannot exploit. Davidson's research investigates this interaction with a goal of developing effective solutions.

Selected Publications

- "A Formal Specification for Procedure Calling Conventions," M. Bailey and J. Davidson, Proceedings of the 22nd Annual SIGPLAN-SIGACT Symposium on Principles of Programming Languages, pp. 298-310, January 1995.
- "Memory Access Coalescing: A Technique for Eliminating Redundant Memory Accesses," J. Davidson and S. Jinturkar, SIGPLAN 94 Symposium on Programming Language Design and Implementation, pp. 186-195, June 1994.
- "Relating Static and Dynamic Machine Code Measurements," J. Davidson, J. Rabung, and D. Whalley, IEEE Transactions. on Computers., pp. 444-454, April 1992.

"Schools are for fish."

David Evans • Assistant Professor of Computer Science

www.cs.virginia.edu/evans • (804) 982-2218 • *evans@cs.virginia.edu*

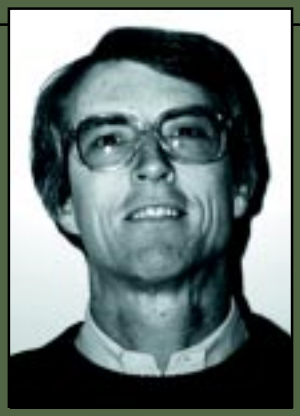
David Evans received simultaneous SB and SM degrees from MIT in June of 1994, and completed his PhD at the MIT Lab for Computer Science in October 1999. He joined the University of Virginia as an assistant professor in November 1999. David Evans' areas of interest include code safety, annotation-assisted static checking, and programming large-scale dynamic networks of devices.

Research

David Evans' current research focuses on the problem of programming large-scale networks of devices with dynamic and unpredictable capabilities. Because this environment is so different from traditional ones, it requires a new programming paradigm that is substantially different from existing paradigms. We need to be able to describe a range of desirable emergent behavior, as well as guaranteed properties, and write programs that work correctly the first time. David Evans is also investigating the opportunities for using source-code annotations to enable powerful and efficient static checking. This allows a large class of programming errors to be detected at compile time and provides a path towards industrial adoption of formal methods.

Selected Publications

- "Policy-Directed Code Safety," D. Evans and A. Twyman, IEEE Symposium on Security and Privacy, May 1999.
- "Static Detection of Dynamic Memory Errors," D. Evans, SIGPLAN Conference on Programming Language Design and Implementation (PLDI '96), Philadelphia, PA, May 1996.
- "LCLint: A Tool for Using Specifications to Check Code," D. Evans, J. Guttag, J. Horning, and Y.M. Tan, SIGSOFT Symposium on the Foundations of Software Engineering, December 1994.



"Information has no value unless you can find it."

James French • Research Associate Professor of Computer Science

www.cs.virginia.edu/french • (804) 982-2213 • *french@cs.virginia.edu*

James French received his Ph.D. degree in Computer Science at the University of Virginia in 1982. After several years in industry, he returned to the University of Virginia in 1987 as senior scientist in the Institute for Parallel Computation and became a research assistant professor of Computer Science in 1990. He is currently directing three Ph.D. theses. He is the editor of five books, and the author or co-author of one book and over 65 papers and book chapters.

Research

James French's chief research interests are in the areas of distributed information retrieval and digital libraries. Professor French is one of the principal architects of the ADAMS parallel database system. In the area of digital library technology, Professor French is currently collaborating with researchers at several other universities on the development and deployment of NCSTRL, the Networked Computer Science Technical Reports Library. Professor French is co-directing a DARPA sponsored project on Personalized Information Environments (PIE), which are user-centric information seeking environments that can be widely deployed over the Internet to provide customized search and current awareness services.

Selected Publications

- "Personalized Information Environments: An Architecture for Customizable Access to Distributed Digital Libraries," J. French and C.L. Viles, ID-Lib Magazine, vol. 5, no. 6, June 1999.
- "A Classification Approach to Boolean Query Reformulation," Journal of the American Society for Information Science, vol. 48, no. 8, pp. 694-706, August 1997.
- "Ensuring Retrieval Effectiveness in Distributed Digital Libraries," J. French and C. Viles, Journal of Visual Communication and Image Representation, vol. 7, no. 1, pp. 61-73, March 1996.
- "Availability and Latency of World Wide Web Information Servers," C. Viles and J. French, Computing Systems, vol.8, no. 1, pp. 61-91, 1995.

"Nothing is real, everything is virtual."

Andrew Grimshaw • Professor of Computer Science

www.cs.virginia.edu/grimshaw • (804) 982-2204 • *grimshaw@cs.virginia.edu*

Andrew Grimshaw received his Ph.D. from the University of Illinois at Urbana-Champaign in 1988. He then joined the University of Virginia as an assistant professor of Computer Science, and became associate professor in 1994 and Profesor in1999. He is the chief designer and architect of Mentat and Legion, and the author or co-author of over 50 publications and book chapters.

Research

Gigabit networks make possible the realization of a single nationwide virtual computer comprised of a variety of geographically distributed high-performance machines and workstations. To realize the potential of the physical infrastructure, software must be developed that is easy to use, supports large degrees of parallelism in applications code, and manages the complexity of the underlying physical system for the user. Grimshaw's research projects include Mentat, ELFS, and Legion. Mentat is an object-oriented parallel processing system designed to simplify the task of writing parallel programs. ELFS (Extensible File Systems) addresses the I/O crisis brought on by parallel computers. Finally, Legion is a new collaborative project to realize the potential of the NII by constructing a very large virtual computer that spans the nation. Legion addresses issues such as parallelism, fault tolerance, security, autonomy, heterogeneity, resource management, and access transparency in a multi-language environment.

Selected Publications

- "The Legion Vision of a Worldwide Virtual Computer," Communications of the ACM, vol. 40, no 1, pp. 39-45, January, 1997.
- "Portable Run-Time Support for Dynamic Object-Oriented Parallel Processing," ACM Transactions on Computer Systems, vol. 14, no. 2, pp. 139-170, May, 1996.
- "Metasystems. An Approach Combining Parallel Processing and Heterogeneous Distributed Computing Systems," Journal of Parallel and Distributed Computing, vol. 21, no. 3, pp. 257-270, June 1994.
- "Experiences with Mentat on a Biological Application," Concurrency: Practice & Experience, pp. 309-328, June 1993.
- "Easy to Use Object-Oriented Parallel Programming with Mentat," A. Grimshaw, IEEE Computer, pp. 39-51, May 1993.

"The key to the next generation, large-scale operating systems will be the development of new abstractions of the services provided by hardware."

Marty Humphrey • Research Assistant Professor of Computer Science

www.cs.virginia.edu/humphrey • (804) 982-2258 • *humphrey@cs.virginia.edu*

Marty Humphrey received his Ph.D. in Computer Science at the University of Massachusetts in 1996. After spending two years as an assistant professor of Computer Science and Engineering at the University of Colorado, he joined UVa in 1998.

Research

Marty Humphrey's research focuses on operating system support for parallel, distributed, and real-time computation. He has created a real-time threads package that features novel semantics for hard real-time computation. He has also created operating system support for distributed soft real-time computation such as multimedia applications, addressing the ability to write, analyze, and execute applications that explicitly and dynamically adjust to fluctuating resource availability. His current work is on providing operating system or middleware support for large, heterogeneous virtual machines in the context of the Legion project, focusing on the general issues of computer security, resource management, and application design.

Selected Publications

- "Accountability and Control of Process Creation in Metasystems," M. Humphrey, F. Knabe, A. Ferrari, and A. Grimshaw, Proceedings of the 2000 Network and Distributed System Security Symposium (NDSS2000), San Diego, CA, February 2000.
- "Wide-Area Computing: Resource Sharing on a Large Scale," A. Grimshaw, A. Ferrari, F. Knabe, and M. Humphrey, Computer, vol. 32, no. 5, pp. 29-37, May 1999.
- "Experiences Using RT-Linux to Implement a Controller for a High Speed Magnetic Bearing System," M. Humphrey, E. Hilton, and P. Allaire, Proceedings of 5th IEEE Real-Time Technology and Applications Symposium, Vancouver, Canada, June 1999.
- "Predictable Threads for Dynamic, Hard Real-Time Environments," M. Humphrey and J. Stankovic, IEEE Transactions on Parallel and Distributed Systems. vol. 10, no. 3, pp. 281-296, March 1999.

"Water and fertilize the seeds of research today if you want flowers to bloom in the US economy tomorrow."

Anita Jones • Lawrence R. Quarles Professor of Computer Science & University Professor

www.cs.virginia.edu/jones • (804) 982-2224 • *jones@cs.virginia.edu*

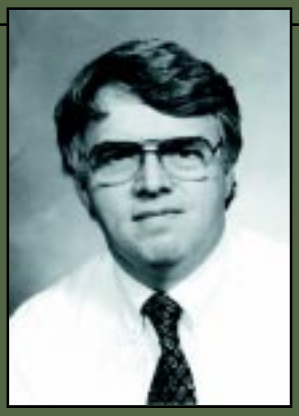
Anita Jones received her Ph.D. in Computer Science from Carnegie-Mellon University in 1973. She was an assistant professor of Computer Science at CMU until 1978, when she became an associate professor. From 1981-87 she was vice-president and co-founder of Tartan Laboratories. In 1988 she joined UVa as a professor and chair of the Computer Science Department. In 1994 she was elected to the National Academy of Engineering. From 1993-1997 she served at the U.S. Department of Defense where, as Director of Defense Research and Engineering, she oversaw the department's science and technology program, research laboratories, and DARPA. She received the U.S. Air Force Meritorious Civilian Service Award, a Distinguished Public Service Award, and a tribute in the Congressional Record from Senator Chuck Robb. She serves on the National Science Board and on the Defense Science Board. She is an ACM Fellow, an IEEE Fellow, the author or co-author of 37 papers and two books.

Research

Anita's interests focus on the design and construction of programmed systems. She has designed protection mechanisms and built secure systems that make guarantees about how information is used. She has built multi-processor operating systems and experimented with their underlying architectures and applications. By choice, she implements realistic and substantial systems to test design and implementation hypotheses so as to ensure that systems perform functionally and cost-effectively. Her current focus is survivable information systems, and interactive, distributed computer simulation for training, analysis, and entertainment.

Selected Publications

- "Challenges for the Future," Military Operations Research Society's Phalanx Magazine, March 1996.
- "Engineering in the Fast Lane," The Bridge, National Academy Press, vol. 25 no. 4, September 1995.
- "Where Economic Security and National Security Intersect," Army Research, Development and Acquisition Bulletin, July-August 1994.



"Be very careful which airplanes you fly in."

John Knight • Professor of Computer Science

www.cs.virginia.edu/knight • (804) 982-2216 • *knight@cs.virginia.edu*

John Knight received his Ph.D. in Computer Science from Newcastle in 1973. After two years at West Virginia University and seven years at NASA's Langley Research Center, he joined UVa in 1981 as an associate professor of Computer Science. He spent 1987-89 at the Software Productivity Consortium, and was promoted to professor in 1992. He has directed six Ph.D. theses with three more in progress. He is the author or co-author of over 60 papers.

Research

John Knight's research is concerned with the engineering of software for safety-critical systems, i.e., systems where the consequences of failure are very serious, such as digital flight control systems in aircraft and digital shutdown systems in nuclear reactors. The goal of his research is to develop methods by which software for safety-critical systems can be built and trusted in operation to perform as desired. He explores several different approaches including software construction based on formal mathematical techniques, carefully controlled software development using previously certified software parts, high performance software testing and inspection methods aimed at finding and eliminating faults, and software fault tolerance.

Selected Publications

- "The Effect Of Imperfect Error Detection On Reliability Assessment Via Life Testing," P. Ammann, S. Brilliant and J. Knight, IEEE Transactions on Software Engineering, vol. 20, no. 2, February 1994.
- "An Improved Software Inspection Technique And An Empirical Evaluation Of Its Effectiveness," E. Myers and J. Knight, Communications of the ACM, vol. 36, no. 11, pp. 50-61, November, 1993.
- "Information Survivability Control Systems," K. Sullivan, J. Knight, X. Du, and S. Geist, 1999 International Conference on Software Engineering, Los Angeles, May 1999.

"Computers are peripheral devices of a network."

Jörg Liebeherr • Associate Professor of Computer Science

www.cs.virginia.edu/jorg • (804) 982-2212 • *jorg@cs.virginia.edu*

Jörg Liebeherr received his Ph.D. in Computer Science from Georgia Tech in 1991. From 1990 to 1991 he was also associated with the IBM T. J. Watson Research Center. After a postdoctoral fellowship at the University of California-Berkeley, he joined the University of Virginia in 1992. He received an NSF Research Initiation Award in 1993, a UVa Teaching and Technology fellowship in 1995, and an NSF CAREER Award in 1996. In 1997-1998 he was an associate professor at Polytechnic University. He serves as Editor-in-Chief of IEEE Network and US Editor of Computer Communications, and he also serves on the editorial boards of ACM/IEEE Transactions on Networking, Real-Time Systems Journal, and Cluster Computing.

Research

Jörg Liebeherr investigates new approaches to meet the demand for a richer functionality of the global Internet without sacrificing high scalability inside the core infrastructure. Jörg Liebeherr's research focuses on two major additions to the basic IP service: transmission with service assurance (Quality-of-Service) and data dissemination to large sets of receivers (multicast). He recently established the VINTLab, an innovative teaching laboratory for applied computer networking.

Selected Publications

- "A Priority Scheme for the IEEE 802.14 MAC Protocol for Hybrid Fiber-Coax Networks," M.D. Corner, J. Liebeherr, N. Golmie, C. Bisdikian, and D. Su, IEEE/ACM Transactions on Networking, April 2000.
- "Priority Queue Schedulers with Approximate Sorting in Output Buffered Switches," J. Liebeherr and D. E. Wrege, IEEE Journal on Selected Areas in Communications, Special Issue on Next Generation IP Switches and Routers, vol. 17, no. 6, pp. 1127-1145, June 1999.
- "Exact Admission Control in Networks with Bounded Delay Services," J. Liebeherr, D.E. Wrege, and D. Ferrari, IEEE/ACM Transactions on Networking, 1996.
- "Multimedia Networks: Issues and Challenges," J. Liebeherr, IEEE Computer, pp. 68-69, 1995.
- "New Strategies for Assigning Real-Time Tasks to Multiprocessor Systems," A. Burchard, J. Liebeherr, Y. Oh, and S. Son, IEEE Transactions on Computers, vol. 44, no. 12, pp. 1429-1442, December 1995.

"Computer science, like astronomy, is done mainly at night."

David Luebke • Assistant Professor of Computer Science

www.cs.virginia.edu/luebke • (804) 924-1021 • *luebke@cs.virginia.edu*

David Luebke received a B.A. in Chemistry from Colorado College in 1993 and a Ph.D. in Computer Science from the University of North Carolina in 1998. He joined the University of Virginia faculty in the Fall of 1998 as an assistant professor.

Research

David Luebke's research focuses on the field of computer graphics, especially the problem of rendering very complex scenes at interactive rates. Though graphics hardware continues to improve, the complexity of the scenes we would like to render seems to grow even faster. Software techniques such as polygonal simplification and occlusion culling help reduce the complexity to manageable levels. Luebke's work has centered on dynamic and view-dependent approaches to these techniques. The driving application for this work has been massive model rendering, and the interactive walkthrough and inspection of extremely complex CAD models such as buildings, submarines, satellites, and power plants. An area of great interest to government and industry, the graphics, database, and memory management challenges of rendering massive CAD models provide exciting real-world research problems.

Selected Publications

- "View-Dependent Simplification of Arbitrary Polygonal Environments," D. Luebke and C. Erikson, SIGGRAPH 97, August 1997.
- "Portals and Mirrors: Simple, Fast Evaluation of Potentially Visible Sets," D. Luebke and C. Georges, Proceedings of the 1995 Symposium on Interactive 3-D Graphics, April 1995.
- "Accelerated Occlusion Culling Using Directional Discretized Occluders and System Therefor," F. Bernardini, J. El-Sana, D. Luebke, and J. Menon, United States Patent Application (IBM Docket Number Y0999-105), July 1999.
- "A Developer's Survey of Polygonal Simplification Algorithms," Technical Report #CS-99-07, Department of Computer Science, UVa, 1999.

"No one knows what the programming language for scientific computing will look like in 2010, but its name will be Fortran."

Lois Mansfield • Professor of Applied Mathematics & Computer Science

www.cs.virginia.edu/mansfield • (804) 924-1033 • *lem@cs.virginia.edu*

Lois Mansfield received her Ph.D. in Mathematics from the University of Utah in 1969. She was a Visiting Assistant Professor of Computer Science at Purdue University in 1969-70 and an Assistant and Associate Professor of Computer Science at the University of Kansas from 1970-78. She was Associate Professor of Mathematics and Computer Science at North Carolina State University from 1978-80. She came to the University of Virginia in 1979 as a Visiting Associate Professor. She was Associate Professor of Applied Mathematics from 1980-83 and has been Professor of Applied Mathematics since 1983. In 1997 she was appointed Director of Applied Mathematics and joined the Computer Science Department. She has directed 4 Ph.D. theses in Applied Mathematics and is the author or co-author of over 30 papers.

Research

Lois Mansfield's earliest research involved multivariate spline functions. She then did research on finite element methods and computational mechanics as well as on parallel algorithms for the solution of large linear systems. More recently, she has been investigating techniques for segmenting 3D images.

Selected Publications

- "On the Conjugate Gradient Solution of the Schur Complement System Obtained from Domain Decomposition," SIAM J. Num. Anal. 27, pp. 1612-1620, 1990.
- "Damped Jacobi Preconditioning and Coarse Grid Deflation for Conjugate Gradient Iteration on Parallel Computers," SIAM Journal of Scientific Statistical Computing 12, pp. 1314-1323, 1991.
- "Solution of the Stokes Problem on Distributed-Memory Multiprocessors," in Domain Decomposition Methods for Partial Differential Equations, Proc. Fifth SIAM Conference, ed., D. Keyes, T. Chan, L. Mansfield, G. Meurant, J. Scroggs, and R. Voigt, SIAM Publications, Philadelphia, pp. 394-400, 1992.
- "Segmentation of Volumetric Medical Imagery Using Multiple Geodesic-based Active Surfaces," D. Schlesinger, J. Snell, L. Mansfield, J. Brookeman, J. Ortega, and N. Kassell, SPIE Proc. vol 2710, pp. 243-253, 1996.

"Seeing is knowing, though just looking is never sufficient."

Worthy Martin • Associate Professor of Computer Science

www.cs.virginia.edu/martin • (804) 982-2202 • *martin@cs.virginia.edu*

Worthy Martin received his Ph.D. degree in Computer Science from the University of Texas at Austin in 1981. He then joined the University of Virginia in 1982 as an assistant professor of Computer Science and was promoted to associate professor in 1988. He has directed four Ph.D. thesis with three more in progress. He has authored or co-authored 55 papers.

Research

Worthy Martin's primary research interest is dynamic scene analysis, i.e., computer vision in the context of time-varying imagery, as well as the fundamental concepts involved in machine perception systems composed of independent processes operating in distributed computing environments and cooperating to form interpretations of image sequences. Another major research topic involves methodologies for parallel probabilistic problem solving, including formulations of genetic algorithms that are appropriate for implementation on multiprocessors. The applications are combinatorial optimization problems, e.g., VLSI floorplanning and feature selection for signal classification. Other research interests include content-based retrieval from image databases, and multi-source data fusion algorithms with emphasis on neural network implementations.

Selected Publications

- "The Effective Field of View Paradigm: Adding Representation to a Reactive System," F. Brill, G. Wasson, G. Ferrer and W. Martin, Engineering Applications of Artificial Intelligence, Special Issue on Machine Vision for Intelligent Vehicles and Autonomous Robots.
- "Island (Migration) Models: Evolutionary Algorithms Based on Punctuated Equilibria," W. Martin, J. Lienig and J. Cohoon, in Handbook of Evolutionary Computation, Oxford University Press, 1997.
- "System for Indexing Multi-spectral Satellite Images for Efficient Content Based Retrieval," J. Barros, J. French, and W. Martin, IS&T/SPIE Symposium on Electronic Imaging Science and Technology, San Jose, CA, February 1995.
- "Distributed Genetic Algorithms for the Floorplan Design Problem," J. Cohoon, S. Hegde, W. Martin, and D. Richards, IEEE Trans. On Computer-Aided Design, vol. 10, no. 4, pp. 483-492, 1991.

"Evolution is not efficient."

William Pearson • Professor of Biochemistry & Computer Science

www.cs.virginia.edu/pearson • (804) 982-2818 • *wrp@cs.virginia.edu*

Bill Pearson received his Ph.D. in Biochemistry in 1977 from the California Institute of Technology. He then did a brief post-doctoral fellowship at the Caltech Marine Station in Corona del Mar, CA and then moved to Baltimore, MD for post-doctoral training in the Department of Molecular Biology and Genetics at Johns Hopkins. Since 1983, he has been on the faculty in the Department of Biochemistry at the University of Virginia. He is an author or co-author of more than 60 papers and book chapters.

Research

The concurrent development of molecular cloning techniques, DNA sequencing methods, rapid sequence comparison algorithms, and computers has revolutionized the role of biological sequence comparison in molecular biology. Sequence comparison is now used routinely as the first characterization of a DNA or protein sequence and is essential to the human genome project. Bill Pearson co-developed one of the first widely used programs for searching protein and DNA sequence databases - FASTA. Currently, he is developing sequence comparison methods that will allow us to "push back" the evolutionary horizon - the distance at which related protein sequence can be reliably detected - from the current 800-1,000 million years to more than 2,000 million years. Other projects use genome-scale sequence comparison to identify potentially "young" proteins, which emerged over the last 200-400 million years. In addition to computational biology, he maintains an active "wet-lab" research program on the genetics of enzymes that detoxify chemical carcinogens.

Selected Publications

- "Empirical Statistical Estimates for Sequence Similarity Scores," W. R. Pearson, J. Mol. Biology, 276, pp. 71-84.
- "Identification of Class-mu Glutathione Transferase Genes GSTM1-GSTM5 on Human Chromosome 1p13," W. R. Pearson, W. R. Vorachek, S. Xu, R. Berger, I. Hart, D. Vannais, and D. Patterson, Am. J. Human. Gene, 53, pp. 220-233.
- "Panning for genes - a visual strategy for identifying novel gene orthologs and paralogs," J. D. Retief, K. R. Lynch, and W. R. Pearson, Genome Res., 9:373-382, 1999.
- "Evolution of Protein Sequences and Structures," T. C. Wood and W. R. Pearson, J. Mol. Biol. 291:977-995, 1999.

"The difference between sequential and parallel programming is of, at least, an order of magnitude."

John Pfaltz • Professor of Computer Science

www.cs.virginia.edu/pfaltz • (804) 982-2222 • *pfaltz@cs.virginia.edu*

John Pfaltz received his Ph.D. in Computer Science at the University of Maryland in 1969. He joined the University of Virginia as an assistant professor of Computer Science in 1968, becoming an associate professor in 1970 and a professor in 1982. He has directed nine Ph.D. theses, and is author or co-author of two books and over 40 papers.

Research

The 1970s and 1980s were the decades of process development. During this period many new approaches to hardware and processing languages/systems were devised. John Pfaltz believes that the primary frontiers in the future will be parallel processing and database management. A research team of faculty and students led by Professor Pfaltz developed ADAMS, an Advanced Data Management System. The ADAMS system has been designed to manage large scientific databases in a distributed memory, parallel processing environment. It impinges on the way we think of data and parallel operations on it (theory), the way we talk about it (languages), and the way we implement access to persistent data (systems). Consequently, all of these are important interests and research areas. Anti-matroid closure spaces are in some sense the antithesis of vector spaces, and appear to provide a unifying basis for discrete systems, with computer science applications.

Selected Publications

- "Closure Lattices," J. Pfaltz, Discrete Mathematics, pp. 154, June 1996.
- "Client/Server Architecture in the ADAMS Parallel Object-Oriented Database," J. Pfaltz and R. Haddleton, Springer-Verlag Lecture Notes in Computer Science #1343, pp. 257-266, December 1997.
- "Scientific Database Management with ADAMS," J. Pfaltz and J. French, Data Engineering, vol. 16, no. 1, March 1993.
- "Computer Data Structures," J. Pfaltz, McGraw-Hill, 1977.

"If we expect quality work from students, they will deliver quality."

Jane Prey • Lecturer of Computer Science

www.cs.virginia.edu/prey • (804) 982-2215 •*prey@cs.virginia.edu*

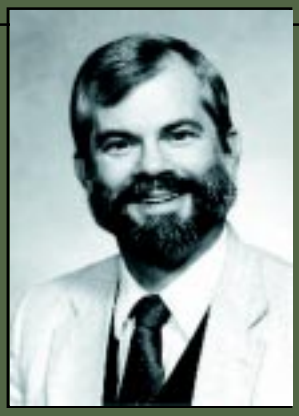
Jane Prey received a BS in Biology from the University of Illinois, an MS in Mathematics from DePaul University, an MS in Education from James Madison University, and a Ph.D. in Instructional Technology from the University of Virginia in 1991, with a dissertation on "The Effectiveness of A Graphical Input Simulation Game for Teaching Business Interrelationships to Undergraduate Students". She held the Governor's Fellowship in 1988-1990.

Research

UVa was designated as a flagship institution by NSF to develop an undergraduate computer science curriculum model, which would have national impact. Jane joined the Computer Science department in July, 1993 to help with the development, implementation and evaluation of the new undergraduate CS curriculum. This project has led the UVa model to be examined by many schools in the United States and several foreign countries. Jane is the contact person and coordinator for curriculum dissemination and adaptation. She also works with graduate and undergraduate Teaching Assistants who form the cornerstone of the new curriculum model.

Selected Publications

- "Laboratory Experience for an Introductory Computer Science Course Oriented Towards Software Engineering," J. Prey and W. Wulf, Proceedings of the 23rd Annual Conference of Frontiers in Education, November 1993.
- "Software Engineering Beginning in the First Computer Science Course," J. Prey, J. Cohoon, and G. Fife, 7th SEI Conference on Software Engineering Education, January 1994.
- "Undergraduate Computer Science Education: A New Curriculum Philosophy and Overview," J. Prey, J. Knight, and W. Wulf, 25th ACM SIGCSE Technical Symposium On Computer Science Education, March 1994.



"Aphorisms, by their very nature, fill a much needed void."

Paul Reynolds, Jr. • Professor of Computer Science

www.cs.virginia.edu/reynolds • (804) 924-1039 • *reynolds@cs.virginia.edu*

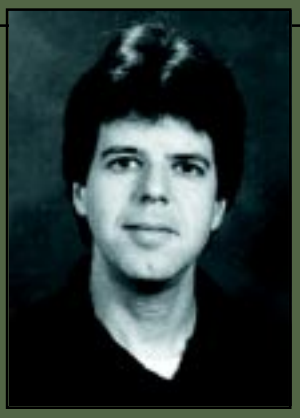
Paul Reynolds received his Ph.D. in Computer Science at the University of Texas at Austin in 1979. He joined the University of Virginia in 1980 as an assistant professor of Computer Science and was promoted to associate professor in 1986 and to professor in 1998. He has directed ten Ph.D. theses with another five in progress. He is editor for ACM Transactions on Modeling and Simulation and editor for ACM SIGSIM Digest. He is the author or co-author of over 40 publications.

Research

Using multiple asynchronous processors on a common problem is the future of computing; it promises to speed up computations and make large computational tasks feasible. However, demands far outstrip current technology. Paul Reynolds' research objective is to make asynchronous computing practical in critical applications. His research areas include parallel computing and distributed interoperable simulation, parallel and distributed language design, and algorithms and architectures for efficient parallel and distributed computation. He has contributed to both the theory and practice of parallel and distributed computing. Professor Reynolds believes that hardware and software research are inseparable: efficient hardware will emerge from a better understanding of software requirements and limitations, while software requirements must be realistically shaped to reflect feasible hardware concepts.

Selected Publications

- "Isotach Networks," P. Reynolds, C. Williams and R. Wagner, IEEE Transactions on Parallel and Distributed Systems, April 1997.
- "Consistency Maintenance in Multiresolution Simulations," P. Reynolds, A. Natrajan, and S. Srinivasan, ACM Transactions on Modeling and Simulation, July 1997.
- "Analysis of Bounded Time Warp and Comparison with YAWNS," P. Reynolds, and J. Duva, ACM Transaction on Modeling and Simulation, October 1996.
- "DISorientation," P. Reynolds, Elecsim (The First Internet Simulation Conference), Roger Smith (editor), Mystech Corp, Falls Church, VA, Best Paper Award, May 1994.



"Sleep is so overrated!"

Gabriel Robins • Walter N. Munster Associate Professor of Computer Science

www.cs.virginia.edu/robins • (804) 982-2207 • *robins@cs.virginia.edu*

Gabriel Robins received his Ph.D. in Computer Science from UCLA in 1992. He then joined UVa as assistant professor of Computer Science, where he received a National Science Foundation Young Investigator award, a Packard Foundation Fellowship, a Distinguished Teaching Award, a Lilly Foundation University Teaching Fellowship, an All-University Outstanding Teacher Award, a Faculty Mentor Award, a Faculty Appreciation Award, a two-year early promotion to associate professor, and the Walter N. Munster Endowed Chair. He is a member of the U.S. Army Science Board, and an alumni of the Defense Science Study Group, an advisory panel to the U.S. Department of Defense. He has created the CS Web Team and founded the UVa Computer Museum. He has directed three Ph.D. students, and co-authored one book, one book chapter, and over 70 refereed papers.

Research

Recent advances in deep-submicron VLSI circuit technology have resulted in new requirements for computer-aided design methodology. With this in mind, Gabriel Robins investigates new directions in VLSI circuit layout, with a focus on high-performance issues. His results include near-optimal approximation algorithms for computationally-difficult problems such as minimum-cost routing, cost-radius trade-offs, and circuit testing. Gabriel Robins also investigates other topics in algorithms and combinatorial optimization, with applications to computational geometry, computational biology, and pattern detection.

Selected Publications

- "Improved Steiner Tree Approximation in Graphs," G. Robins and A. Zelikovsky, SIAM-ACM Symposium on Discrete Algorithms, pp. 770-779, 2000.
- "Generalized Neighbor-Joining: More Reliable Phylogenetic Tree Reconstruction," W. Pearson, G. Robins, and T. Zhang, Journal of Molecular Biology and Evolution, vol. 16, no. 6, pp. 806-816, 1999.
- "On Optimal Interconnections for VLSI," A. Kahng and G. Robins, Kluwer Academic Publishers, 1995.

"Sequentiality is an illusion."

Kevin Skadron • Assistant Professor of Computer Science

www.cs.virginia.edu/skadron • (804) 982-2042 • *skadron@cs.virginia.edu*

Kevin Skadron received his B.S. in Electrical and Computer Engineering and B.A. in Economics from Rice University in 1994 and his Ph.D. in Computer Science from Princeton University in 1999. He joined the University of Virginia as an assistant professor in 1999. Kevin Skadron's areas of interest are computer architecture and simulation methodology.

Research

Kevin Skadron's research in the LAVA laboratory focuses on computer "microarchitecture." Interests include a variety of topics: branch prediction, cache and memory organization, power/performance tradeoffs, and complexity/performance tradeoffs are a few examples. In approaching these topics, Skadron is especially interested in exploring opportunities for cooperation between compiler and hardware approaches. Too often, compiler and hardware research efforts occur independently, and ignore opportunities for synergy. Yet areas like branch prediction and low-power computing are ripe for such collaborative efforts. Because accurate simulation is vital to evaluating new ideas in computer architecture, Skadron also maintains an active interest in finding better simulation techniques.

Selected Publications

- "Branch Prediction, Instruction-Window Size, and Cache Size: Performance Tradeoffs and Simulation Techniques," K. Skadron, P. S. Ahuja, M. Martonosi, and D. W. Clark, IEEE Transactions on Computers, vol. 48, no. 11, pp. 1260-1281, November 1999.
- "Improving Prediction for Procedure Returns with Return-Address-Stack Repair Mechanisms," K. Skadron, P. S. Ahuja, M. Martonosi, and D. W. Clark, 31st Annual ACM/IEEE International Symposium on Microarchitecture, pp. 259-71, December 1998.
- "Multipath Execution: Opportunities and Limits," P. S. Ahuja, K. Skadron, M. Martonosi, and D. W. Clark, 1998 International Conference on Supercomputing, pp. 101-08, July 1998.
- "Design Issues and Tradeoffs for Write Buffers," K. Skadron and D. W. Clark, Third International Symposium on High-Performance Computer Architecture, pp. 144-55, February 1997.

"Timeliness is essential in life and real-time systems are no exception."

Sang Son • Professor of Computer Science

www.cs.virginia.edu/son • (804) 982-2205 • *son@cs.virginia.edu*

Sang Son received his Ph.D. in Computer Science at the University of Maryland in 1986. He then joined the University of Virginia as assistant professor of Computer Science and was promoted to associate professor in 1992, then to full professor in 1999. He is editor of IEEE Transactions on Parallel and Distributed Systems. He has directed three Ph.D. theses, and is the editor of two books and co-author of one book and over 100 papers.

Research

The objective of Sang Son's research is to design and evaluate models and methodologies for the development of robust and responsive computer systems and databases for complex real-time applications. He has been working on supporting multi-dimensional requirements, including real-time, security, and fault-tolerance in distributed multimedia database systems. His current research interests include feedback-based scheduling, adaptive QoS management, consistency in mobile environments, and applying real-time and database technology in web-based systems.

Selected Publications

- "Integrating Security and Real-Time Requirements using Covert Channel Capacity," S. H. Son, R. Mukkamala, and R. David, IEEE Transactions on Knowledge and Data Engineering, to appear.
- "Misconceptions About Real-Time Databases," J. Stankovic, S. H. Son, and J. Hansson, IEEE Computer, vol. 32, no. 6, pp. 29-36, June 1999.
- "On the Performance of Transaction Processing in Broadcast Environments," V. Lee, S. H. Son, and K. Lam, International Conference on Mobile Data Access, Hong Kong, December 1999.
- "Partial Security Policies to Support Timeliness in Secure Real-Time Databases," S. H. Son, C. Chaney, and N. Thomlinson, IEEE Symposium on Security and Privacy, Oakland, CA, May 1998.

"Almost all computer systems of the future will utilize real-time scientific principles and technology."

John A. Stankovic • BP America Professor of Computer Science & Chair

www.cs.virginia.edu/stankovic • (804) 982-2275 • *stankovic@cs.virginia.edu*

Jack Stankovic received his Ph.D. from Brown University in 1979 and then served on the faculty of University of Massachusetts at Amherst. He came to UVa as BP America Professor and Chair of the Department of Computer Science in 1997. Jack Stankovic is a Fellow of the IEEE, a Fellow of the ACM, and serves on the Computing Research Association Board of Directors. He received an Outstanding Scholar Award and serves on the Scientific Advisory Board for the Swedish National Strategic Initiative on Real-Time Computing. He is an editor-in-chief for Real-Time Systems and for IEEE Transactions on Parallel and Distributed Systems.

Research

Jack Stankovic's primary research interests are in the areas of real-time computing, operating systems, and global real-time multimedia databases. He is investigating various approaches to real-time scheduling, including the development of a theory and practice of feedback control real-time scheduling. In the database area, he is currently building BeeHive, a real-time multimedia database that supports properties along the real-time, quality of service, fault tolerance, and security dimensions. He is also developing a component-based operating system and associated analysis tools for embedded systems.

Selected Publications

- "Misconceptions About Real-Time Databases," J. Stankovic, S. Son, and J. Hansson, IEEE Computer, vol. 32, no. 6, pp. 29-36, June 1999.
- "The Spring System: Integrated Support for Complex Real-Time Systems," J. Stankovic, K. Ramamritham, D. Niehaus, M. Humphrey, and G. Wallace, special issue of Real-Time Systems Journal, vol. 16, no. 2/3, May 1999.
- "Predictable Threads for Dynamic, Hard Real-Time Environments," M. Humphrey and J. Stankovic, IEEE Transactions on Parallel and Distributed Systems, vol. 10, no. 3, pp. 281-296, March 1999.
- "The Spring Scheduling Co-Processor," W. Burleson, J. Ko, D. Niehaus, K. Ramamritham, J. Stankovic, G. Wallace, and C. Weems, IEEE Transactions on VLSI, vol. 7, no. 1, pp. 38-47, March 1999.

"Integrate and evolve."

Kevin Sullivan • Associate Professor of Computer Science

www.cs.virginia.edu/sullivan • (804) 982-2206 • *sullivan@cs.virginia.edu*

Kevin Sullivan received his Ph.D. in Computer Science from the University of Washington in Seattle, Washington, in 1994. He then joined the University of Virginia as an assistant professor of Computer Science. He received an NSF Career Award in 1995, the first ACM Computer Science Professor of the Year Award from undergraduate students in 1998, and a University Teaching Fellowship in 1999. Sullivan is the author or co-author of twenty four peer-reviewed journal and conference papers and three book chapters.

Research

Explosive progress in device technology is catalyzing the information revolution, and software is at the center. Software describes the functions to be performed by computing and communications devices, yet it is a complex and still poorly understood new medium in which information about both application domains and computer system architectures is encoded: most importantly in complex, evolving formulae written in unusual and hard to analyze mathematical logic. Sullivan's researches software as a medium, in general, and the design, analysis, and evolution of software-intensive system, in particular. He directs projects on modular structure in software, focusing on component integration and system evolution; the dependability of software-intensive systems; and software economics. He also maintains interdisciplinary collaborations in reliability engineering, finance, international security, and radiation oncology.

Selected Publications

- "Analysis of a conflict between aggregation and interface negotiation in Microsoft's Component-Object Model," K.J. Sullivan, M. Marchukov, and J. Socha, IEEE *Transactions on Software Engineering*, pp. 584–599, July/August 1999.
- "Software economics: A roadmap," B. Boehm and K.J. Sullivan, *International Conference on Software Engineering*, June, 2000 (to appear).
- "Software design as an investment activity: A real options perspective," K.J. Sullivan, P. Chalasani, S. Jha, and V. Sazawal, in *Real Options and Business Strategy: Applications to Decision Making*, L. Trigeorgis, consulting editor, Risk Books, pp. 215–262, December 1999.

"Great engineering is every bit as beautiful as great art."

John Thornley • Assistant Professor of Computer Science

www.cs.virginia.edu/thornley • (804) 982-2200 • *john-t@cs.virginia.edu*

John Thornley received his Ph.D. in Computer Science from the California Institute of Technology in 1996. He then worked at Caltech as a research scientist, before joining the University of Virginia as an assistant professor of Computer Science in 1999. John Thornley's areas of interest are programming languages and systems, algorithms and programming patterns, multithreaded and concurrent programming, commodity multiprocessors, and computational finance.

Research

Thornley's research interests lie in the area of programming systems and computer algorithms, with particular focus on multithreaded programming of commodity multiprocessors. He envisions a near future in which most computers are multiprocessors and most applications are multithreaded. The crucial hurdle there is developing reliable and efficient multithreaded programs. His approach consists of two interrelated parts. First, he is working on a high-level programming system that allows explicitly multithreaded programs to be developed using traditional sequential languages and tools. Second, by developing practical multithreaded applications, he is working to identify algorithmic patterns that can be applied to programs of similar computational structure.

Selected Publications

- "Molecular Dynamics Simulation on Commodity Shared-Memory Multiprocessor Systems with Lightweight Multithreading," J. Thornley, M. Hui, H. Li, T. Cagin, and W. A. Goddard III Proceedings of High Performance Computing, 1999. Advanced Simulation Technologies Conference, San Diego, California, April 11-15, 1999.
- "An Initial Evaluation of the Tera Multithreaded Architecture and Programming System Using the C3I Parallel Benchmark Suite," S. Brunett, J. Thornley, and M. Ellenbecker, Proceedings of SC98, Orlando, Florida, November 7-13, 1998.
- "A System for Structured High-Performance Multithreaded Programming in Windows NT," J. Thornley, K. M. Chandy, and H. Ishii, Proceedings of the 2nd USENIX Windows NT Symposium, Seattle, Washington, pp. 67-76, August 3-5, 1998.

"These gigabit LANs are just not fast enough!"

Alfred Weaver • Professor of Computer Science

www.cs.virginia.edu/weaver • (804) 982-2201 • *weaver@cs.virginia.edu*

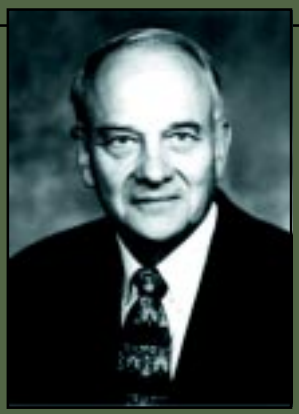
Alf Weaver received his Ph.D. in Computer Science from the University of Illinois in 1976. He joined the University of Virginia in 1977 and is now Director of the department's Computer Networks Laboratory, Director of the University's Internet Commerce Group, and Director of the state's Internet Technology Innovation Center. He is a Fellow of the IEEE, the supervisor of over 50 graduate students, co-author of four books, six book chapters, and over 100 papers.

Research

Weaver and his colleagues developed the Xpress Transport Protocol (supporting multicast and knowledge of the multicast group members) for the U.S. Navy, and then turned XTP into a commercial product. He was a founder of Virginia's Internet Technology Innovation Center, which provides technical and business strategy for e-business, and develops e-commerce software for corporate and government clients. His research focus is secure, available, reliable e-business systems.

Selected Publications

- "Monitoring and Control Using the Internet and Java," A. Weaver, *Proc. IECON*, pp. 1152-1158, 1999.
- "Xpress Transport Protocol," A. Weaver, *Cluster Computing*, Volume 1, Prentice-Hall, pp. 301-316, 1999.
- "Diagnostic Efficacy of Compressed Digitized Real-time Sonography of Uterine Fibroids," G. DeAngelis, B. Dempsey, S. Berr, L. Fajardo, J. Sublett, B. Hillman, A. Weaver, K. Berbaum, and S. Dwyer, *Academic Radiology,* vol. 4, pp. 83-89, 1997.



"I live in mortal fear that someday they'll catch on to the fact that they are paying me to have all this fun."

William Wulf • AT&T Professor of Computer Science & University Professor

www.cs.virginia.edu/wulf • (804) 982-2223 • *wwulf@nae.edu*

Bill Wulf received the first Computer Science Ph.D. ever awarded at the University of Virginia in 1968. He then joined Carnegie-Mellon University as an assistant professor of Computer Science, becoming associate professor in 1973 and professor in 1975. In 1981 he left Carnegie-Mellon and founded and served as chairman of Tartan Laboratories until 1988. He then became the Assistant Director of the National Science Foundation. In 1990 he returned to the University of Virginia as AT&T Professor and later became University Professor. Dr. Wulf is a Fellow of the National Academy of Engineering, a Fellow of the ACM, a Fellow of the IEEE, and a member of the American Academy of Arts and Sciences. In 1997 he was elected President of the National Academy of Engineering. He has directed over 25 Ph.D. theses and is the author or co-author of three books and over 40 papers.

Research

Bill Wulf's research interests revolve around the hardware/software interface, and thus span programming systems and computer architecture. He designed Bliss, a systems-implementation language adopted by DEC, and he was one of the architects of the DEC PDP-11, a highly successful minicomputer. He designed and constructed the C.mmp multiprocessor, and Hydra, one of the first operating systems to explore capability-based protection. He developed PQCC, a technology for the automatic construction of optimizing compilers, and designed the WM pipelined processor. Professor Wulf's recent research has been the design of scalable high performance memory systems, computer security, and hardware/software co-design.

Selected Publications

- "Hydra/C.mmp: An Experimental Computer System," W. Wulf, R. Levin, and S. Harbison, McGraw-Hill Publishing Co., 1980.
- "Access Ordering: Achieving Optimal Effective Memory Bandwidth," S. Moyer and W. Wulf, Journal of Complexity, June 1994.
- "The Codesign of Embedded Systems: A Unified Hardware/Software Representation," S. Kumar, J. Aylor, B. Johnson, and W. Wulf, Kluwer Academic Publishers, 1996.

Personnel

Emeritus Professors:
- Alan Batson
- Avery Catlin
- Bruce Chartres
- Jim Ortega

Office Staff:
- Kim Gregg
- Ginny Hilton
- Brenda Lynch
- Brenda Perkins
- Peggy Reed
- Barbara Spangler

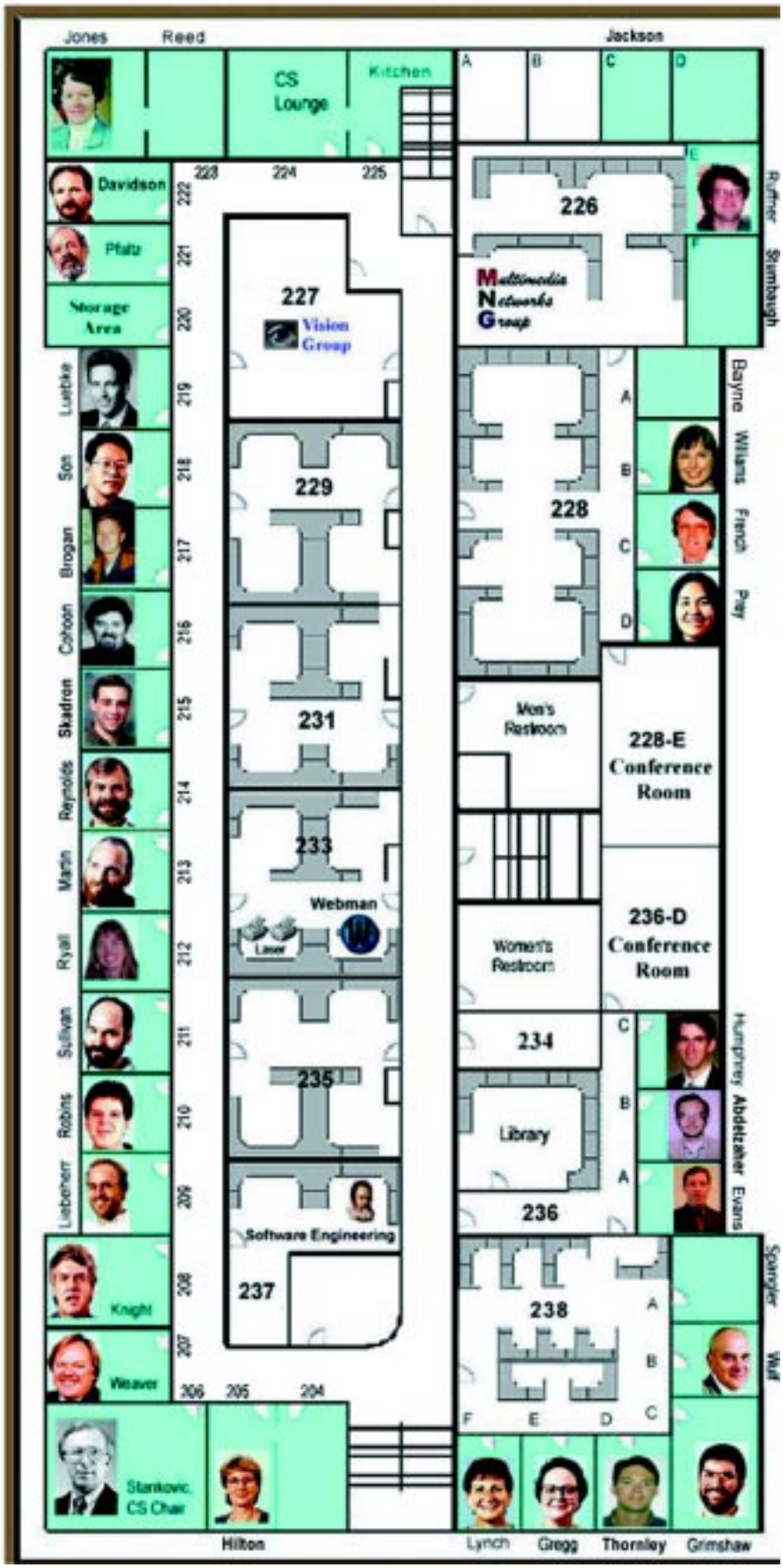
Computer Support Staff:
- Christina Jackson
- David Ladd
- Scott Ruffner

Research & Technical Staff:
- Mike Bayne
- Norm Beekwilder
- Leo Cohen
- Katherine Holcomb
- John Karpovich
- Mark Morgan
- Anand Natrajan
- Ellen Stackpole
- Mary Ann Stumbaugh
- Sarah Wells

Web Team:
- Andrew Fletcher
- Harsh Prakash
- Gabriel Robins
- Doug Ross
- Jason Thompson

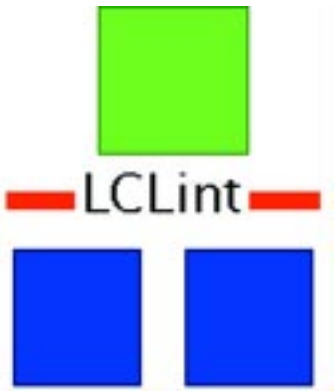
Department. External Advisory Board:
- Al Aho
- John Seely Brown
- Mary Jane Irwin
- Robert Kahn
- Robert Sproull

Olsson Hall, Second Floor



Honors & Awards

Student Awards:
- Harrison Undergraduate Research Award: Benjamin Hallen
- Second Place, ACM Mid-Atlantic Regional Programming Contest, Richard Eppink, Jeff King, and Patrick Reynolds
- Honorable Mention, Computer Research Association Outstanding Undergraduate Competition: Helen Anderson, Benjamin Hallen, James Patten, and Sarah Schwarm
- AAAI 1998 Fall Symposium Series Workshop Chairs, Glenn Wasson and Gabe Ferrer
- Virginia Engineering Foundation Research Prize in Biomimetics, Glenn Wasson, 1998
- Time Magazine "Best 10 Web Sites of 1996" Award, Brett Tjaden and Glenn Wasson
- Best Paper Award: ELECISM 1995, Anand Natrajan and Anh Nguyen-Tuong
- High-Performance Computing Challenge Award, SuperComputing 1995 Mark Hyett, Anh Nguyen-Tuong, Emily West, and Mike Lewis



LCLint: Annotation-Assisted Static Checking
lclint.cs.virginia.edu
PI: David Evans

Tarek Abdelzaher:
- Distinguished Achievement Award in CS and Engineering, University of Michigan, 1999
- Keynote Speaker, 1st Annual Workshop on Performance-Critical Applications for Multiprocessors (PAMP), Ore, Sweden, 1999
- Best Student Paper Award, RTAS 1996

Jim Cohoon:
- Chair, ACM-SIGDA, 1993-1997
- Fulbright Fellow, 1993
- ACM-SIGDA Outstanding Member, 1991
- ACM-SIGDA Leadership Award, 1997
- Most Successful New Title Award, McGraw-Hill, 1997
- Best Teacher Award, UVa Department of Computer Science, 1998
- NSF Research Initiation Award

Beehive: Global Multimedia Database Support for Dependable Real-Time Applications
www.cs.virginia.edu/beehive
PI's: Stankovic, Son, and Liebeherr

Jack Davidson:
- Most Successful New Title Award, McGraw-Hill, 1997
- Undergraduate Outstanding Faculty Award, 2000

Andrew Grimshaw:
- High-Performance Computing Challenge Award, SuperComputing, 1995

Anita Jones:
- Lawrence R. Quarles Endowed Chair
- University Professor
- Member: National Academy of Engineering
- Member: National Science Board, Defense Science Board
- IEEE Fellow, ACM Fellow
- DoD Distinguished Public Service Award
- Tribute in the U.S. Congressional Record by Senator Chuck Robb
- U.S. Air Force Meritorious Civilian Service Award
- CRA Distinguished Service Award, 1997
- Monticello Memoirs Fellow, 1997
- Doctorate of Science (honorary), Carnegie-Mellon University

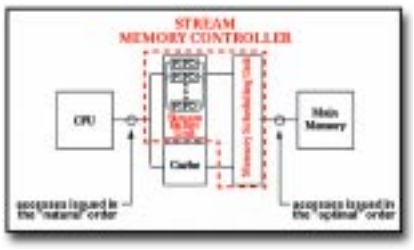
Multimedia and Web QoS Lab:
www.cs.virginia.edu/qos
PI: Tarek Abdelzaher

Jörg Liebeherr:
- NSF Career Award, 1996
- Teaching-and-Technology Fellowship, UVa, 1995
- NSF Research Initiation Award, 1993

David Luebke:
- ACM Undergraduate Teaching Award, 1998-1999
- Faculty Senate Teaching Initiative Award
- University Teaching Fellowship, 2000

Paul Reynolds:

- Best Paper Award, ELECSIM 1994
- Special Guest, Mimanshu Jyothi Kala Peetha School, 1997



Computer Architecture:
Stream Memory Controller;
Weird Machine (WM)
www.cs.virginia.edu/wm
PI: Bill Wulf

Gabe Robins:

- Walter N. Munster Endowed Chair, 1997
- Packard Foundation Fellowship, 1995
- NSF Young Investigator Award (NYI), 1994
- University Teaching Fellowship, 1995
- All-University Outstanding Teaching Award, 1994
- Distinguished Teaching Award, 1989
- Faculty Mentor Award, UVa School of Engineering, 1997
- Two-year early promotion to Associate Professor, 1996
- Faculty Appreciation Award, Virginia Engineering Foundation, 1998
- Distinguished Paper Award, International Conference on Computer Aided Design, 1990
- Nomination for Best Paper Award, Asia and South Pacific Design Automation Conference, 1999
- National Science Foundation Research Initiation Award, 1994

Jack Stankovic:

- BP America Endowed Chair
- Fellow of the IEEE
- Fellow of the ACM
- IEEE Golden Core Award, Charter Member
- Computer Research Association - Board of Directors
- IEEE Computer Society Meritorious Service Award, 1991
- Outstanding Scholar Award, School of Engineering, University of Massachusetts, 1983
- Recent Distinguished Lecture Series Speaker, University of Southwestern Louisiana 1997, Purdue 1998, Pittsburg 1999, Florida Atlantic 2000
- Keynote Speaker, Second ARTES Conference, Sweden, 2000
- Keynote Speaker, Conference on Parallel and Distributed Real-Time Systems, Cancun, 2000

UVa Student Chapter of the **ACM:**
Association for Computing Machinery
acm.cs.virginia.edu

Kevin Sullivan:

- NSF Career Award, 1995
- ACM CS Undergraduate Teaching Award, 1998
- University Teaching Fellowship, 1998-1999
- Howard Morton, Jr. Teaching Award, 2000

Alf Weaver:

- IEEE Third Millennium Medal, 2000
- CIT Best New Product or Service
- Fellow of the IEEE
- Keynote Speaker, IECON'96; IEEE Industrial Electronics Society Annual Conference, 1996
- American Men and Women in Science
- Past President, IEEE Industrial Electronics Society

Bill Wulf:

- AT&T Endowed Chair
- University Professor
- Engineering Achievement Award, Virginia Engineering Foundation, 1997
- President, National Academy of Engineering (1997-2001)
- Member, National Academy of Engineering
- Fellow, American Academy of Arts and Sciences
- Member at Large, Council of ACM
- Fellow, Association of Women in Science
- ACM SIGCSE Award for Outstanding Contributions to CS Education, 1998
- Fellow of the American Association for the Advancement of Science
- Fellow of the ACM
- Doctorate of Science (honorary), Carnegie-Mellon University

Survey Suite: Automated Electronic Surveys
intercom.virginia.edu/SurveySuite
PI: Alf Weaver

Editorships, Boards & Panels

Tarek Abdelzaher:

- NSF Panel, Parallel and Distributed Systems, Arlington, VA, Jan 2000
- Guest Editor for Computer Communications, 2000

Jim Cohoon:

- SIG Governing Board Executive Committee, 1996-
- ACM SIG Governing Board Chair nominee, 2000
- Chair, ACM SIG Discretionary Fund Committee, 1995-1997
- Fulbright Fellowship Review Committee, 1993
- SF Panel, Parallel and Distributed Systems, Arlington, VA, Jan 2000
- Chair, ACM –IEEE Design Automation Conference Scholarship Committee 1998-

Zephyr: National Compiler Infrastructure
www.cs.virginia.edu/zephyr
PI: Jack Davidson

Jack Davidson:

- Editor, Transactions on Programming Languages and Systems
- SIGPLAN Executive Council, 1999
- NSF Next-Generation Software, 1999
- NSF Compiler and Operating Systems, 1998
- NSF Research Instrumentation Awards, 1995
- NSF Research Initiation Awards Panel, 1994
- NSF Small Business Innovative Research Awards, 1992
- NSF Young Investigator Awards Panel, 1989, 1990

Jim French:

- Guest Editor, Statistics and Computing
- SIGIR Electronic Information Director, 1993-
- Category Editor, Computing Reviews, 1997-
- Intel Concurrent I/O Special Interest Group, Co-chairman, 1990-1993
- NASA Proposal Review Panel, 1993, 1996
- Atmospheric Radiation Measurement (ARM) Program Data System Panel, Oak Ridge National Laboratory, 1994

PIE: Personal Information Environments
www.cs.virginia.edu/pie
PI: Jim French

Andrew Grimshaw:

- NSF Academic Research Information Panel, Arlington, VA, June, 1996
- PetaFLOPS 2: Applications and Algorithm Challenges for PetaFLOPS Computing, NASA, DOE, ARPA, 1995
- Associate Editor, IEEE Transactions on Parallel and Distributed Systems, 1997
- System Software and Tools for High-Performance Computing Environments, NASA, DOE, ARPA, 1995
- NRC Review Panel for Information Technology, Board on Assessment of NIST Programs, 1995
- Health Care and High Performance Computing, Washington, DC, NSF, ARPA, NLM, Dec. 1994
- NSF Postdoctoral Fellowship Panel, NSF-CISE-ASC, 1993
- NIST ITL review panel
- NASA CESDIS review panel
- NSF vBNS Workshop, Washington, DC, June, 1995
- Air Force CRDA, on Parallel Software Engineering, Rome Labs, 1991-1993
- Editorial board of IEEE Transactions on Parallel and Distributed Computing
- Professional Panels and Working Groups
- NSF Career Awards Panel, Arlington, VA, December, 1996

Legion: a World-Wide Virtual Computer
legion.virginia.edu
PI: Andrew Grimshaw

Anita Jones:

- National Science Board
- Virginia 2020 Strategic Planning Committee
- State of Virginia Research and Technology Advisory Commission
- Editor-in-Chief, ACM Transactions on Computer Systems, 1982-1992
- Council on Foreign Relations, 1997-
- Policy Division Advisory Council, National Academy Complex, 1997-
- Visiting Committee, Cornell School of Engineering, 1997-

- Member of the Corporation, Charles Stark Draper Laboratory, 1997-
- National Computational Science Alliance External Advisory Council, 1997-
- Defense Science Board, 1985-1993, 1998-
- Board of Directors, SAIC Corporation, 1987-1993, 1998-

Real Time Systems: Scheduling, databases, and multimedia
www.cs.virginia.edu/vadb
PIs: Jack Stankovic & Sang Son

John Knight:
- Editorial board, IEEE Transactions on Software Engineering, 1993-1997
- Member, National Research Council committee on Information System Trustworthiness
- Guest editor, IEEE Software, 1994
- National Science Foundation NYI Panel, 1994

Jörg Liebeherr:
- IEEE Communications Society Educational Services, Board of Directors, 1996-1997
- Editor-in-Chief of IEEE Network, 1999-
- US Editor of Computer Communications, 1999-
- Editorial board of ACM/IEEE Transactions on Networking, 1999-
- Technology Advisory Board of Association for Investment, Management and Research (AIMR), 1998-1999
- Steering Committee for the IEEE Interactive Magazines, IEEE Communications Society, 1999-
- Editorial board of Real-Time Systems Journal, 1997-
- Editorial board of Cluster Computing, 1998-
- Board of Magazines, IEEE Communications Society, 1999-
- NSF Review Panel (1996, 1997, 1999)

Worthy Martin:
- Editorial Board, Evolutionary Computation
- IEEE TC for Pattern Analyses and Machine Intelligence, 1994-1996
- NIH Special Study Section 3(6), 1994
- NSF Grants Panel: Computer Vision, 1996

Brainpower for Business:
Winner of Virginia's Center for Innovative Technology's "Best New Product or Service" Award
www.brainpower.org
PI: Alf Weaver

William Pearson:
- Bioinformatics, 1987
- Analytical Biochemistry, 1998 -
- National Institutes of Health Genome Study Section

Jane Prey:
- Board of Trustees, Blue Ridge Community College
- IEEE Educational Curriculum Board
- NSF Performance Effectiveness Review Board
- NSF ILI proposal Review Board

Paul Reynolds:
- NSF Medical Computing Proposal Review Panel, 1994
- DoD Common High Level Simulation Architecture Panel, 1994-1998

Gabe Robins:
- Editorial Board Member, IEEE Book Series
- Defense Science Study Group, Department of Defense, 1994-1996
- Navy Future Study Panel, National Academy of Sciences, 1996-1997
- U.S. Army Science Board, 1998-
- NSF Design Automation Panel, 1998

Sang Son:
- Associate Editor: IEEE Transactions on Parallel and Distributed Systems
- Guest Editor: NETNOMICS
- Guest Editor: Journal of Integrated Computer-Aided Engineering
- NSF Review Panel: Database and Information Systems (1996), CAREER (1998)
- Guest Editor: IEEE Transactions on Software Engineering

InterCom: Promoting Electronic Commerce
intercom.virginia.edu
PI: Alf Weaver

Jack Stankovic:

- Editor-in-chief, Real-Time Systems Journal
- Editor-in-chief, IEEE Transaction on Parallel and Distributed Systems
- Associate Editor - Design, Automation for Embedded Systems
- Book Series Editor, Real-Time Computing, Kluwer Publishing Company
- Book Series Editor, Distributed Computing, Kluwer Publishing Company
- NSF Post Doc panel in Experimental Computer Science, January 1996
- NSF Infrastructure Awards Panel, December 1997
- Embedded Technology Leadership Awards Panel, 1998
- Chair, Awards Committee, CRA, 1997
- CRA Board of Directors
- Scientific Advisory Board, Swedish National Initiative in Real-Time Computing

Dynamically Simulated Characters
in Graphical Environments
www.cs.virginia.edu/dbrogan
PI: Dave Brogan

Kevin Sullivan:

- Award Panel, National Science Foundation, Software Engineering and Languages, January 2000
- Invited Panelist, NSF Software Engineering Research Strategies Workshop, August, 1999
- Invited Panelist, National Science Foundations Workshop on Scalable Enterprise Systems, 1999
- Invited Panelist, National Science Foundation Workshop on Empirical Software Engineering, 1998
- Award Panel, National Science Foundation, Small Business Innovative Research, Spring 1998
- Award Panel, National Science Foundation, Software Engineering and Languages, 1996, 1997

Alf Weaver:

- Editor, IEEE Transactions on Industrial Electronics
- Associate Editor, World Wide Web Journal
- President, IEEE Industrial Electronics Society, 1994-1996
- Associate Editor, CRC Handbook on Industrial Electronics

Bill Wulf:

- Visiting Committees: U. Washington, U. Texas, UC Irvine, American U., Purdue, Duke
- IEEE von Neumann Medal Committee
- Associate Editor, Acta Informatica
- Editorial Board, Addison-Wesley/SEI Series on Software Engineering
- Board of Directors, National Action Council of Minority Engineers
- Board of Directors, Charles Stark Draper Laboratory
- Industrial Advisory Board, Duke University
- Area Editor, Science Magazine
- Board of Visitors, Software Engineering Institute

Virginia Internet Engineering Laboratory:
www.cs.virginia.edu/vintlab
PI: Jorg Liebeherr

Our Department's T-shirt logo and winner
of our student-run T-shirt design Contest
www.cs.virginia.edu/Tshirt

Program Committees & Workshops

Tarek Abdelzaher:

- Program committee for the Real-Time Technology and Applications Symposium, 2000
- Program committee for the Workshop of Parallel and Distributed Real-Time Systems, 2000
- Publicity Chair for the Real-Time Systems Symposium, 2000

Jim Cohoon:

- Committee member, Sponsor's Coordinating Committee ACM-IEEE Design Automation Conference, 1994 - 1998
- Program and Executive Committees, International Asia-Pacific Conference on Design Automation, 1995
- Program Committee, IEEE International Conferences on Computer Aided Design, 1989-1993
- Programming committee, International Workshop for Layout Synthesis, 1990, 1992
- Co-chair, SIGDA International Workshop on Computer-Aided Design in Moscow, 1993
- Program Committee, ACM-IEEE Design Automation Conference, 1993
- Executive Committee, ACM-IEEE Design Automation Conference, 1995-1998
- Chair, ACM-IEEE Design Automation Conference Scholarship Committee
- Chair, ACM-SIGDA Discretionary Fund Committee, 1995-Present
- Executive committee member for Date Conference, 1998
- EuroDAC and ASP-DAC, 1995-1997
- ACM International Symposium on Physical Design, 1997
- Program committee for the 1996 Physical Design Workshop
- IEEE Great Lakes Symposium on VLSI, 1992, 1993
- SIGDA conference and workshop coordinator, 1996-
- Fulbright Fellowship Review Committee, 1993

VLSI CAD: Physical Design of High-Performance Circuits
www.cs.virginia.edu/vlsicad
PIs: Gabe Robins & Jim Cohoon

Jack Davidson:

- Program Co-Chair, Languages, Compilers, and Tools for Embedded Systems, 2000
- Parallel Architectures and Compiler Techniques, 2000
- Languages, Compilers, and Tools for Embedded Systems, 2000
- General Chair, Programming Language Design and Implementation, 1998
- Programing Language Design and Implementation, 1998
- SIGPLAN Design and Implementation of Programming Languages Conference, 1997
- SIGPLAN Conference on Design and Implementation of Programming Languages, 1993

David Evans:

- Infosec Research Council Malicious Code Science and Technology Study Group

Jim French:

- Program Committee, Seventeenth National Conference on Artificial Intelligence (AAAI-2000), Austin, TX, 2000
- Vice Program Chair (Intelligent Information Retrieval), 11th International Conference on Tools with AI (ICTAI'99), 1999
- Program Committee, Fifth International Computer Science Conference (ICSC '99), Hong Kong, 1999
- Program Committee, 22nd International Conference on Research and Development in Information Retrieval, 1999
- ACM International Conference on Research and Development in Digital Libraries, 1998, 1996
- Program Committee, Fourth ACM International Conference on Digital Libraries, (DL'99), 1999
- General Chair, 7th International Conference on Scientific and Statistical Database Management, 1994
- Program Committee co-chairman, 6th International Conference on Scientific and Statistical Database Management, 1992, 1996
- International Conference on Scientific and Statistical Database Management, 1992, 1998, 2000
- Program Committee co-chair, Seventh International Conference on Information and Knowledge Management, 1998
- International Conference on Research and Development in Information Retrieval, 1998, 1997
- Publicity Chair, Fourth ACM International Conference on Digital Libraries, (DL'99), 1999
- International Conference on Scientific and Statistical Database Management, 1997
- International Conference on Information and Knowledge Management, 1997, 1999
- ACM Computing Classification System Update Committee, 1996 - 1997
- Intel Supercomputer Users Group (ISUG) Conference Committee, 1995
- Organizing Committee, NSF Scientific Database Workshop, 1990
- Chair, ACM SIGIR'97 Best Paper Committee, 1997
- 12th International Conference on Data Engineering, 1995
- Panel Chair, AIPR Workshop, 1994

Internet Technology Innovation Center:
www.cs.virginia.edu
PIs: Alf Weaver

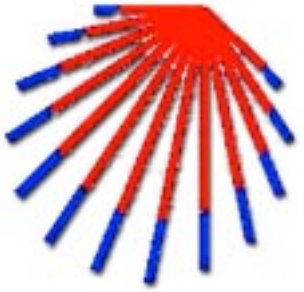
Andrew Grimshaw:

- Heterogeneous Computing Workshop Program Committee (HCW), 1996, 1997
- Frontiers of Massively Parallel Computation Program Committee, 1996, 1997
- International Conference on Configurable Distributed Systems 1996
- Program Chair, Symposium on High Performance Distributed Computing (HPDC), 1992, 1995
- Program Vice-chair, 15th International Conference on Distributed Computing Systems, 1995
- Seventh Scalable High Performance Computing Conference, 1992
- Minnowbrook Workshop on Software Engineering for Parallel Computing, 1992
- 11th International Conference on Distributed Computing Systems, 1991
- 11th Real-Time Systems Symposium, 1990
- Workshop on Enabling Technologies for Peta(FL)ops Computing Systems, 1994
- ARPA Parallel C++ Workshop, Los Angeles, CA, 1993
- Symposium on High Performance Distributed Computing, 1992-
- NPACI executive committee
- DoD HPCMOD PET executive committee
- San Diego Supercomputer Center Executive Committee, 1996-
- Delphi 2010 Working Group, MIT, April, 1996

Computer Vision:
image processing, robotics, & AI
www.cs.virginia.edu/vision
PI: Worthy Martin

Marty Humphrey:

- 12th Euromicro Conference on Real-Time Systems (ECRTS'00)
- IEEE Real-Time Technology and Applications Symposium, 1999, 2000
- 1999 Workshop on QoS Support for Real-Time Internet Applications
- Sixth International Conference on Real-Time Computing Systems and Applications (RTCSA'99)
- 18th International Conference on Distributed Computing Systems (ICDCS'98)



Isotach Networks: Concurrency control without locks or barriers
www.cs.virginia.edu/isotach
PI: Paul Reynolds

Anita Jones:

- ACM 97 50th Anniversary Honorary Committee and Program Committee, 1997
- Workshop Chair, NSF Workshop on Scientific Databases, 1990
- NRC Intellectual Property Issues in Software: A Strategic Forum, 1989
- 12th International Conference on Software Engineering, 1985
- ACM SIGPLAN 9th Symposium on the Principles of Programming Languages, 1982
- Program Chair, ACM SIGOPS 7th Symposium on Operating Systems Principles, 1979
- ACM SIGOPS/SIGPLAN Workshop on Fundamental Issues in Distributed Computing, 1979

John Knight:

- 3rd International Conference on Software Reuse, 1994
- General chair, Eighth International Symposium on the Foundations of Software Engineering
- LFM2000: Fifth NASA Langley Research Center Formal Methods Workshop
- IEEE International Computer Performance and Dependability Symposium, 2000
- International Workshop on Software and Performance (WOSP'2000)
- Program chair, 1998 Information Survivability Workshop
- IEEE International Computer Performance and Dependability Symposium, 1998
- IEEE International Conference on Software Engineering, 1998
- Workshop on Formal Methods in Software Practice, 1998
- Third IEEE International Conference on Engineering of Complex Computer Systems
- Annual Conference on Computer Assurance, 1997

Naccio: Policy-Directed Code Safety
naccio.cs.virginia.edu
PI: Dave Evans

Jörg Liebeherr:

- ACM Sigmetrics 2000, Santa Clara, 2000
- High-Speed Networks Symposium at Globecom 2000
- 8th International Workshop on Quality of Service (IWQoS 2000), 2000
- 9th Heterogeneous Computing Workshop (HCW 2000), Cancun, Mexico, 2000
- 10th IEEE International Symposium on High Performance Distributed Computing (HPDC-5), Pittsburgh, 2000
- Second International Workshop on Networked Group Communication (NGC 2000), Palo Alto, November 2000
- 14th IEEE Computer Communications Workshop, Estes Park, Colorado, 1999
- Fifth International Workshop on Multimedia Information Systems (MIS'99), Palm Springs, 1999
- First Multicast Workshop (Protokolle und Anwendungen), Braunschweig, May 1999, Braunschweig, Germany
- 13th IEEE Computer Communications Workshop, Oxford, Mississippi, 1998
- IEEE Conference on Protocols for Multimedia Systems - Multimedia Networking (PROMSMmNet'97), Santiago, Chile, 1997
- 6th IEEE International Symposium on High Performance Distributed Computing (HPDC-6), Portland, 1997

- Analytical and Numerical Modeling Techniques with the Application to Quality of Service (QoS) Modeling, Singapore, 1997
- HPDC Focus Workshop on Multimedia and Collaborative Environments August 6-9, 1996, Syracuse, New York (Co-Chair)
- 9th International Conference on Parallel and Distributed Computing Systems (PDCS'96), Dijon, France, 1996
- 17th IEEE Real-Time Systems Symposium (RTSS'96), Washington, DC, 1996
- 5th IEEE International Symposium on High Performance Distributed Computing (HPDC-5), Syracuse, 1996
- IEEE Infocom Computer Communication Conference, 1995-1998
- 9th International Symposium on Computer and Information Sciences, Antalya, Turkey, 1994
- 2nd International Workshop on Advanced Teleservices and High-Speed Communication Architectures, Heidelberg, Germany, 1994

Worthy Martin:

- IEEE TC for Pattern Analyses and Machine Intelligence, 1994-1996
- Chair, IAPR Workshop on Visual Behaviors
- Chair, 1994 IAPR Workshop on Visual Behaviors
- IEEE Conference on Evolutionary Computation, 1994
- Foundations of Genetic Algorithms, 1994, 1996, 1998
- Parallel Problem Solving from Nature III (1994)
- SPIE Applications of Artificial Intelligence X: Machine Vision and Robotics
- Evolutionary Computation Section of the World Congress on Computing, 1994
- International Conference on Genetic Algorithms: 1995, 1997
- Vision Interface, 1994, 1997
- IEEE Workshop on Nonrigid and Articulated Motion, 1997
- Session Chair, 23rd AIPR Workshop on Motion of Non-Rigid and Articulated Objects, 1994
- Second International Conference on Multisensor Fusion and Integration for Intelligent Systems, 1996
- Co-Chair, International Association for Pattern Recognition Technical Committee on Image Understanding, 1994-1996

Web Design Contest:
www.cs.virginia.edu/contest
Organizer: Gabe Robins

William Pearson:

- Co-Director, Cold Spring Harbor Computational Genomics Course, 1994 -
- Course Director, Computational Genomics, Sao Paulo Brazil, January 1999

Jane Prey:

- Symposium Chair, ACM SIGCSE, 1999
- Program Chair, ACM SIGCSE, 1998
- Program Committee, IEEE Computer Society Web Media Workshop, 2000
- Program Committee, IFIP World Congress, 2000
- Program Committee, IEEE Computer Society Workshop on Internet-Supported Education
- IEEE Computer Society Frontiers in Education Program co-Chair, 2000

Multimedia Networks Group:
network protocol design and multimedia applications
mng.cs.virginia.edu
PI: Jörg Liebeherr

Paul Reynolds:

- ACM/IEEE Workshops on Parallel and Distributed Simulation, 1993-1995
- ELECSIM: Electronic Distributed Simulation Conference on the Internet, 1995
- Program Co-Chair, Distributed Interactive Simulations Conference, Montreal, 1998
- Member Program Committee, Simulation Interoperability Workshop, 1997, 1998

Gabe Robins:

- Co-Organizer, German-American Frontiers of Engineering Symposium, Germany, 2000
- General Chair, ACM/SIGDA Physical Design Workshop, 1996
- Co-Founder, ACM/SIGDA International Symposium on Physical Design, 1997
- IEEE International ASIC Conferences, 1994-2000
- Great Lakes Symposium on VLSI, 1996-1997
- Canadian Workshop on Field-Programmable Devices, 1996-1998
- Co-chairman of VLSI track, IEEE International Symposium on Circuits and Systems, 1996
- Session Chair, International Symposium on Physical Design, 1998

Survivability Architectures
www.cs.virginia.edu/survive
PIs: John Knight and Kevin Sullivan

Kevin Skadron:

- International Conference on Parallel Architectures and Compilation Techniques, 2000

Sang Son:

- General Chair, Workshop on Advanced Issues on Electronic Commerce and Web-based Information Systems, 2000
- Program Co-Chair, IEEE Workshop on Parallel and Distributed Real-Time Systems, 2000
- Program Co-Chair, 3rd Workshop on Active Real-Time Database Systems, 1999
- Program Chair, Workshop on Advanced Issues of Electronic Commerce and Web-based Information Systems, 1999

- General Chair, 18th IEEE Real-Time Systems Symposium, 1997
- Program Co-Chair, 4th International Conference on Real-Time Computing Systems and Applications, 1997
- General Co-Chair, 2nd International Workshop on Real-Time Database Systems, 1997
- Program Chair, 17th IEEE Real-Time Systems Symposium, 1996
- Program Co-Chair, International Workshop on Real-Time Database Systems, 1996
- Tutorial Chair, 3rd International Conference on Real-Time Computing Systems and Applications, 1996
- Steering Committee, Workshop on Advanced Issues of Electronic Commerce and Web-based Information Systems, since 1999
- Steering Committee, International Conference on Real-Time Computing Systems and Applications, since 1995
- Advisory and Publicity Committee, IEEE Symposium on Object-Oriented Real-Time Distributed Computing, 1998
- First ACM Workshop on Security and Privacy in E-Commerce, 2000
- IEEE Workshop on Distributed Real-Time Systems, 2000
- IEEE Symposium on Security and Privacy, 1999
- International Conference on Telecommunications and Electronic Commerce, 1999
- International Conference on Distributed Computing Systems, 1999, 2000
- IEEE Symposium on Object-oriented Real-time Distributed Computing, 1999
- IEEE Workshop on Dependable and Real-Time E-Commerce Systems, 1998
- IEEE International Parallel Processing Symposium, 1998
- IEEE Real-Time Technology and Applications Symposium, 1997, 1998
- IEEE Workshop on Parallel and Distributed Real-Time Systems, 1994-1999

Galileo: A Fault Tree Tool based on Package-Oriented Programming (POP)
www.cs.virginia.edu/ftree
PI: Kevin Sullivan

Jack Stankovic:

- Program Co-Chair, Snowbird 2000, Snowbird, Utah, July 2000
- Program Committee, ISORC 2000, Newport Beach, CA, March 2000
- Program Committee, RTAS 2000, Washington D.C., May 2000
- Program Committee, EuroMicro 2000, Sweden, June 2000
- Program Committee, RTCSA '99, Hong Kong, 1999
- Program Committee, Workshop on QoS Support for Real-Time Internet Applications, Vancouver, June 1999
- Program Committee, ACM International Conference on Metalevel Architectures and Reflection, France, July 1999
- Program Committee, Seventh International Workshop on Parallel and Distributed Real-Time Systems, April, 1999
- Steering Committee, International Workshop on Parallel and Distributed Real-Time Systems, April 1999
- Program Committee, ACM SOSP, May 1999
- Program Committee, ARTDB-99, Germany, June 1999
- Program Committee, IEEE Real-Time Applications Symposium, 1999
- Program Committee, EuroMicro '99, England, 1999

Kevin Sullivan:

- Workshop Chair, International Workshop on Economics-Driven Software Engineering Research, International Conference on Software Engineering, 1999, 2000
- Executive Committee, 24th International Conference on Software Engineering, 2002
- Program Committee, 23rd International Conference on Software Engineering, 2001
- Program Committee, ACM/SIGSOFT Foundations of Software Engineering, FSE 2000
- Program Committee, 21st International Conference on Software Engineering, 1999
- Program Committee, Information Survivability Workshop, 1998
- Program Committee, Fifth International Conference on Software Reuse, 1998

Very **L**arge **S**cale **I**nteractive **R**endering:
www.cs.virginia.edu/vlsir
PI: David Luebke

Alf Weaver:

- Organizing Committee, IECON 1994-2001
- Emerging Technologies, Chair, ISIE, 2000
- Tutorials Chairman, IECON 1995
- Organizing Committee, ISIE 1994, 1995
- Co-Chairman, ETFA 1994, 1995
- Co-Chairman, IWACA 1994, 1996
- Organizing Committee, 20th, 21st LCN
- Program Committee, ICIE'98
- Advisor, ICIT, 1994, 1998
- Co-Chairman, Emerging Technologies and Factory Communications, 1995
- Program Chair, Workshop on Factory Communication Systems, 1995
- Co-Chair, Workshop on Factory Communications, 1997, 1999
- Technical Program Chairman, IECON 1999

LAVA: Laboratory for Computer Architecture at Virginia
lava.cs.virginia.edu
PI: Kevin Skadron

Selected Recent Research Funding

PI	Source	Dates	Amount	Co-PI's
Cohoon	NSF	6/96 - 6/00	329,000	Davidson, Prey
	AFRO	1/00 - 1/02	400,000	
	AFRO	6/99 - 5/00	45,000	
	CIT	6/99 - 6/00	36,000	
Davidson	NSF	10/96 - 11/00	611,000	
	Panasonic	1/00 - 9/00	90,000	
French	DARPA	6/97 - 6/00	627,899	Grimshaw
	CIT	6/98 - 5/00	110,000	Weaver
	NASA	7/99 - 6/00	153,917	Martin
Grimshaw	NSF	10/99 - 7/02	999,930	
	NPACI	10/99 - 9/02	1,365,565	
	Grumman Corp.	10/99 - 9/02	460,000	
Jones	DARPA	5/9 - 4/02	1,702,292	Grimshaw
Knight	DARPA	10/96 - 7/99	1,750,000	Davidson, Sullivan
	NSF	6/00 - 5/01	75,000	Horton
	Microsoft	2/00 - 1/01	250,000	Grimashaw, Jones, Sullivan
Liebeherr	NSF (CAREER)	8/96 - 7/00	200,000	
	NSF	8/98 - 7/01	1,200,000	Zhang, Knightly, Wilder, Song
	NSF	9/98 - 8/01	240,000	
	NSF	9/99 - 8/02	250,000	Patek
Pearson	NIH	8/00- 7/05	1,800,000	Robins
Robins	Packard Fellowship	9/95 - 9/02	550,000	
	NSF Young Investigator	7/94 - 7/00	312,500	
	NSF/REU	7/94 - 7/00	30,000	
Stankovic	NSF	8/99 - 10/00	99,969	Son, Gang Tao
	Unisys	6/98 - 5/00	50,000	Son
	Kyung Hee University	1/99 - 12/00	130,000	Son
	Microsoft	1/99 - 12/00	80,000	
	NSF	8/99 - 9/02	433,573	Son
Sullivan	NSF	8/98 - 7/01	200,000	
	NASA (co-PI)	5/99 - 1/01	675,643	Dugan (PI)
Weaver	CIT	9/95 - 6/03	2,829,252	

Keeping Up With Anita Jones

Reprinted from PRISM

Anita Jones is one of those people you just have to ask: “What’s your secret?" A powerhouse of science and technology with an impossibly long list of credentials, Jones works at the highest echelons in a field long dominated by men - simultaneously playing key roles in academia, industry, and government - and she makes it all look easy. That's because, she explains, she followed her father's advice: "Choose something to do in life that you love more than fishing."

What Jones loves more than anything is the idea of creating something out of nothing. That passion propelled her to become one of the first female PhD's in computer science, and later to become the federal director of defense research and engineering, the highest Defense Department job ever held by a woman. These days, she divides her time between teaching computer science at the University of Virginia, holding board positions with computing industry corporations, and serving on a dizzying array of top advisory boards for national security and high technology matters. Through it all, the born-and-bred Texan keeps everything in a characteristically understated perspective. "I see my life as a series of creeks running alongside one another," Jones explains. "There's my national security work, my teaching life, my industry life, and my private time with my husband and in the garden. I just hop back and forth between the creeks."

Early Encouragement, Early Success: When Jones was growing up in Houston in the 1950s, a young woman was expected to go to college mainly to round out her education before marrying and becoming a housewife. But Jones' father, a petroleum engineer, always encouraged her to devote herself to something -what that thing was didn't matter so much, the idea was to do it. He taught her to play chess, helped her work on geometry problems, and on weekends took her and her younger brother fishing for catfish, red snapper, and trout on Galveston Bay. Jones' mother, who had trained as a ballerina and danced in several Hollywood films, taught her daughter a love of painting.

But when Anita graduated as valedictorian of her high school class in 1960, it was the lure of the burgeoning computer science revolution that most captivated her. "It was a whole new area then, and it was going to change the world," Jones recalls. "You would be able to build things that would do a piece of what human beings do." The field was so new, in fact, that Rice University did not yet have a computer science department; Jones majored in mathematics. With bachelor's degree in hand, Jones did not get married, nor did she rush into a career. Remembering the advice to have fun, Jones decided to round out her education with a master's in English literature from the University of Texas. As graduate school drew to a close, Jones thought "long and hard" about what fields would be most important in shaping the world to come. She considered biology and psychology, but in the end could not resist computer science. Just before graduation, she quickly took a short class in FORTRAN programming, one of the only computing courses offered at UT, in order to win a job with IBM. A few years there convinced Jones that computing was for her, but she longed to be more in control of what she did and decided to head back to graduate school again--first at MIT, then at Carnegie-Mellon University in Pittsburgh - for a computer science Ph.D.

It was at Carnegie-Mellon that Jones first got the sense that she was parting company with traditionally raised Texan women and setting off on an unorthodox adventure. Jones' collegiality and curiosity soon helped her form close ties with fellow students, who all felt like early pioneers at a special time in history. Soon, an informal gang known as the "brownie plate group" emerged; every day at lunch, these students would turn over the thick brown pieces of cardboard that their brownies were served on in order to jot down notes from their brainstorming sessions on a problem from class or some especially challenging part of one member's thesis. (Jones' thesis was, precociously, on the importance of security for computer networks.) When not in the cafeteria, Jones networked with students at CMU and 50 other universities through ARPANET, the first incarnation of the Internet. The computer science community was so tight-knit that when Jones earned her Ph.D., the logical thing to do was to continue research within the academic world, so Jones began teaching computer science at Carnegie-Mellon.

A Formidable Team: Within a few years she met and married fellow professor Bill Wulf. Together they would soon make a formidable team, and over the years they have come to be known as the ultimate power couple of engineering. Right away, the two started talking about launching a software firm, and in 1981 they founded Tartan Laboratories, which specialized in research for optimizing compilers. By the end of the decade they sold the company to Texas Instruments, and each took teaching positions at the University of Virginia - Wulf as an engineering professor and Jones as head of the computer science department. They set about

building a beautiful home in the horse country hills outside of Charlottesville, but just as it was finished, Jones was called to Washington, D.C., to serve as the defense director of research and engineering, controlling a budget of nearly $17 billion.

For four years she commuted back and forth between Washington, D.C., and Charlottesville, sometimes making the five-hour round trip drive in one day and other times staying at a one-bedroom apartment near the Pentagon. Just as her post was ending, her husband was elected president of the National Academy of Engineering, also in D.C. Jones says the commuting life is "just barely tolerable" and is made easier by the fact that Wulf is also a workaholic. "It helps to have a spouse who is supportive of a demanding schedule," she emphasizes. Even more valuable, she says, is Wulf's ability to discuss work matters with her and give her valuable insights. "I've learned more from Bill than from anyone else in my life," she says.

Help From Her Friends: Jones emphasizes that she would not be where she is today without the help of several colleagues and mentors all along the way. "Every woman encounters some obstacles," she says, "But my experience was never one of trying to break through glass ceilings. Rather, doors were opened for me everywhere I went. And when I walked through one, two more would open." That's probably because she has always earned tremendous respect among her peers. John Seely Brown, the chief scientist for Xerox Corporation and a longtime associate of Jones, says that she has "the amazing talent of knowing how to support radical efforts on the one hand and knowing what it takes to make them pay off in the global economy on the other." Another longtime colleague, Vint Cerf, a senior vice president at MCI WorldCom, adds that Jones is especially gifted at consensus building, and has been a great role model for other women seeking to make their mark in the field. Most of all, Jones is known as a down-to-earth, kind person. "Every Monday during the summer, my desk is full of gorgeous, colorful flowers," says Peggy Reed, Jones' assistant at UVA. (The flowers are from Jones' extensive gardens. Sometimes they are accompanied by vegetables, grown by Wulf.) "I don't know too many bosses who bring their employees gifts every week."

Eager to Learn, Quick to Fit In: Jones attributes most of her success to her willingness to branch out in all directions and to continually learn new things. When she was a young professor at CMU, an associate asked her to be part of the U.S. Air Force Scientific Advisory Board. She knew nothing about the Air Force, but accepted anyway. "I was 20 years younger than everyone else, and by learning from some of the brightest minds in the country, my understanding of technology issues expanded far beyond what I was even capable of comprehending before." Jones never saw such moves as risky or threatening. "It may sound trite, but I always thought that if you shoot for the moon and fail, you still land among the stars," she says. Her venture on the Air Force Advisory Board would not only land her on the board of directors of several other organizations, but would ultimately lead her to be appointed by Clinton as the top-ranked woman in the Defense Department, just two Positions below the Secretary of Defense. "The first week I took the job I read a graduate text on radar," Jones remembers. "And every week after that I learned something else that was new."

Today's Challenges: Jones says that her DoD experience has led her to broaden the perspective she passes on to her students. Now back at UVA, she emphasizes the myriad ways in which science influences every aspect of life, from global warming, to improvements in treating health problems, to the impact of the Internet on commerce. She has just launched a course in science technology policy, in which students must put together a good explanation of the scientific basis for a public policy proposal. She also reminds them that technology is only valuable when it benefits people. One thing she is "just passionate about" these days is the challenge of building "survivable systems" with information technology embedded in them. The infrastructure of a company, emergency government services, telephone systems, and electricity power grids are all too fragile, she warns, vulnerable to natural hazards, errors in the system, and enemies.

Even though she is busy teaching, Jones still travels every week, commuting to D.C. to consult at the Pentagon and throughout the country to meet with task forces that tackle questions like "What part can the DoD play against narcotic traffickers?" and "How can we use science to protect peacekeeping forces?" She says she doesn't have any desire to slow down her pace, because, "The best that life can give you is the opportunity to try to do something that is worthwhile." In her book, that's far better than fishing.

Tribute to Dr. Anita Jones by U.S. Senator Chuck Robb

Reprinted from the U.S. Congressional Record (CRS3463)

"Mr. ROBB: Mr. President, I rise today to recognize the professional dedication, vision and public service of Dr. Anita K. Jones who is completing her appointment, after 4 years, as the Director of Defense Research and Engineering [DDR&E]. A native of Texas, and longtime Virginia resident, Dr. Jones is one of this country's preeminent information technology experts and a pioneer for women in science and engineering career fields everywhere. Prior to coming to the Department of Defense, she was the chair of the department of computer science at the University of Virginia. As DDR&E, she serves in one of the Nation's top technical positions and oversees the largest defense research and development organization in the world.

Her strong support for, and oversight of, the multibillion-dollar Defense Science and Technology [S&T] Program dramatically improved the warfighting capabilities and readiness of our Nation's military forces both today and well into the future. Dr. Jones spearheaded the

implementation of a new structured planning process which aligns technology research and development more directly with critical warfighting and national security priorities. Through strong leadership, she brought the technology and operational military communities together to design detailed plans to sustain U.S. dominance on the battlefield into the next century.

In addition, Dr. Jones focused the Department of Defense S&T Program to ensure military and national preeminence in several strategic technologies with both military and commercial application such as information technology, high-performance computing, advanced electronics, materials and modeling and simulation. Her active outreach within the Department of Defense expanded greatly the scope of the Defense S&T Program and the speed and ease at which technology is developed and transitioned into our warfighting arsenal and support infrastructure. Furthermore, her direct support of pervasive technologies such as high-end computing and semiconductors resulted in breakthroughs across a wide spectrum of applications, both military and civilian, such as modeling of geophysical phenomenon, aerodynamics and process flow, which contributed directly to our Nation's ability to execute a record number of peacekeeping and military operations without the loss of a single life due to combat.

Dr. Jones' awards include the Department of Defense Award for Distinguished Public Service and the Meritorious Civilian Service Award. She has served on several Government advisory boards and scientific review panels such as the Defense Science Board, Air Force Scientific Advisory Board, the National Research Council, and the National Science Foundation. She is a member of the National Academy of Engineers and is a fellow of the Association of Computing Machinery and the Institute of Electrical and Electronics Engineers. I know that Dr. Jones' husband, William A. Wulf, and her daughters, Karin and Ellen, are proud of her many accomplishments, and so is the Nation. Her distinguished service will be genuinely missed in the Department of Defense, and all of us who know her wish her every success as she returns to the University of Virginia."

Technology, Society, and the National Academy of Engineering

Reprinted from Opportunities

UVa's William Wulf Heads NAE - Questions of science, technology and health underlie many critical policy issues confronting the nation today. Recognizing, already 100 years ago, that our nation's leaders need analysis and advice from scientific and engineering experts to make informed decisions, Congress established the National Academy of Sciences (NAS) in 1863. To keep pace with the growing importance and complexity of science and technology, the National Research Council (NRC) was formed in 1916, the National Academy of Engineering (NAE) in 1964, and the Institute of Medicine (IOM) in 1970. Known collectively as the Academy Complex, all are private, independent, non-profit organizations operating under the 1863 charter. NRC is the jointly administered operating arm of the three honorific professional societies, NAS, NAE and IOM, whose members represent the best in their fields. From among the nation's most distinguished engineers, UVa's own William Wulf was elected President of NAE, a position he will hold for at least the next four years. Wulf, an internationally-known expert on computer architecture, programming languages and systems, has been a professor of Computer Science in the School of Engineering and Applied Science at the University of Virginia since 1988.

UVa Faculty Well Represented in NAE - In recognition of significant achievement and contribution to their professions, new members are elected annually to NAS, NAE, and IOM by their respective memberships. Such recognition by ones peers is a very high honor indeed. Election to membership in NAE is the highest professional honor an engineer can receive, recognizing personal engineering achievement in business or academic management; in technical positions; as university faculty or as leaders in government and private engineering organizations. While there are two million engineers nationwide, fewer than 2,000 (0.1%) are members of NAE. At UVa among 150 engineering faculty, five (3.3%) are members of NAE and a sixth is in the Department of Environmental Sciences. That speaks very highly of the quality of engineering at UVa.

Policy Studies - To provide the nation with information and advice on matters of science, technology and medicine, NRC forms special study committees whose members represent a cross-section of the scientific and technological community. The intense work of these well-balanced study committees results in consensus reports that often produce influential recommendations that are "hard for the government to ignore," says Wulf. He advises researchers to keep abreast of these reports since they often harbinger new directions in governmental funding.

Participation on Study Committees - Because of the volume of work and because special information or experience often is required, only 10% of study committee experts are drawn from the membership of NAS, NAE, and IOM. Wulf encourages UVa faculty who wish to become involved to "contact the appropriate Board director to make it known they wish to volunteer on a committee." Wulf believes that "study committees need balance" to study complex issues requiring interdisciplinary analysis. Commitment to this study design has earned NRC its reputation for being "absolutely authoritative and unbiased."

NAE Needs Additional Endowment - While the majority of the studies are requested and funded by the federal government, each unit of the Academy Complex also undertakes self-initiated endowment-supported studies. Wulf sees NAE leading the way by "answering questions the government hasn't even thought to ask." During his presidency, Wulf hopes to increase NAE's endowment significantly so NAE can continue to study important issues, questions and problems on the edge of the future through self-initiated studies.

The Changing Nature of Engineering - Whoever has sped to distant locations by airplane, sent a FAX or enjoyed the benefits of hip

replacement understands the impact of technology on society. NAE president William Wulf believes "the nature of engineering practice is changing dramatically" and points to the "explosion in the variety of materials" expanding design options. He is excited about the prospect of "smart materials," fully expecting "computer chips to be imbedded in the most mundane of products" — like bridges that monitor their own stress and corrosion. One of the outcomes of the acceleration of technological change is the diminishing half-life of engineering knowledge — in the case of computers, already to as little as two years. The impact of this reality on engineering education is substantial and Wulf proposes that "life-long learning needs to be built into the culture of engineering." He believes "NAE as a body has a responsibility to understand...the implication (of technological changes) on policy, education and the engineering profession."

Technology Literacy is Essential - It is fairly well accepted that the ability to use technology will be increasingly central to effective performance in the work place, in school and at home. But beyond usage, Wulf believes that it is essential for all members of society to have an appreciation for, and a broad understanding of technology, including the underlying scientific, mathematical, design and problem-solving principles. Just imagine lawmakers of the future passing laws about air quality and power grids or juries considering ground water measurements and product failure tests without the requisite technological background to understand expert reports. NAE takes seriously its role as the nation's engineering advisor and under Wulf's leadership, is poised to play a pivotal role in promoting technology literacy.

Excerpts from an Interview with Dr. William A. Wulf,

Reprinted from Computing Research (CRA) News

Computer pioneers Gordon Bell (left) and Bill Wulf (right), during Gordon Bell's visit to UVa in 1996 (Bill and Gordon co-designed the PDP-11 for DEC in the early 1970's)

Over the summer, CRN interviewed Dr. William A. Wulf, President, National Academy of Engineering (NAE), Vice-Chair, National Research Council (the principal operating arm of the NAE) and AT&T Professor of Engineering and Applied Sciences at the University of Virginia, Charlottesville. Dr. Wulf also served as assistant director of the National Science Foundation (NSF), was chair and chief executive officer of Tartan Laboratories, Inc., Pittsburgh and was Professor of Computer Science at Carnegie Mellon University. Prior to his election as NAE President in 1996, Dr. Wulf was chair of the NRC's Computer Science and Telecommunications Board (CSTB).

Summary: During the CRN interview, Dr. Wulf reflected on his first year as NAE President, and in response to CRN questions, discussed his views on a range of subjects including continuing education for engineers and government funding for computing research vis a vis other scientific disciplines. He also urged those in the computing research community to serve a few years in government. In commenting on the community's presentation of the proposed NGI initiative, Dr. Wulf noted it was a good example of why having additional government-savvy folks is important to future initiatives. Dr. Wulf also emphasized the need for coordinated leadership among computing research groups, and cited CRA's previous summit meetings as particularly helpful in this regard.

CRN: What is it like being the first computer scientist to occupy the top position at the NAE? How do you see your role?

WULF: I have a couple of responses to that. The first one is that-except for other computer scientists-nobody has mentioned the fact. I find that fascinating. I take that as an indication that the discipline has achieved a degree of maturity and recognition that apparently doesn't strike any body as unusual that would be the case. On the contrary - and we can see this in the context of CSTB as well - the centrality of the discipline to almost everything else makes it seem like a good idea to have a computer scientist in a position like this.

The other half of the response relates to what another computer scientist said: "Have you had any reaction to being a computer scientist" (emphasis on scientist) "and heading the National Academy of Engineering?" Two years ago, I wrote an article for Computing Surveys in which I tried to tackle the question of whether we're scientists or engineers. We happen to carry the name computer scientist, but there's obviously also a lot of the character of engineering in what we actually do. I came down firmly on the position that we are neither and we are both. The fact that we happen to be called computer scientists should not be confused with the wonderfully broad spectrum that this discipline embraces; a spectrum of everything from profoundly deep mathematics to crafty programming and everything in between. That's a strength that we should celebrate, and not something that we should worry about. So, I'm trying to fit into your question the fact that I feel strongly about the fact that I am an engineer and I am a scientist, and I'm a hybrid that's not quite either, and I'm very proud of what I am.

CRN: What areas of study would you like to see NAE-through the NRC-take on in the coming years? Do you have a particular agenda, or certain areas that you'd like to see tackled more than others?

WULF: There are two kinds of answers to that question. There's a generic answer, and there's specific content.

The generic answer is that I think there are a host of ways in which the NAE can more completely fulfill our 1863 Congressional charter. I suppose that everybody who reads Computing Research News understands that the Academy is a private corporation that operates

under a Congressional charter. That charter calls on it to answer questions on science and technology for the government. We also have this honorific character, but the reason for existence is the 1863 charter and providing advice to the government. I feel strongly that engineering is the activity that creates artifacts and processes that improve people's lives. The importance of engineering to the country is not as well understood as it might be. And so, a lot of what I want to accomplish in the next four years has to do with more completely fulfilling the charter. I've got some tools at my disposal. I've got a fabulous membership, for example; the most accomplished engineers in the country. I've got a convening capability. And I've got a bully pulpit. I intend to use all of those tools.

As for specific content, let me focus on two topics: education and the changing nature of engineering. I think there are things that the Academy of Engineering needs to say about engineering education. Generally speaking, engineering education is the responsibility of the professional societies. For example, the specific curricula for electrical engineering or civil engineering are not issues that NAE should deal with. But there are more generic issues I think we must tackle. For example, the question of the baccalaureate being the first professional degree. Engineering is the only profession for which the baccalaureate is a professional degree. Given the amount of information that one needs to successfully practice engineering, I think that's a question that we have to reopen.

Professor Bill Wulf (currently President of the National Academy of Engineering) using the back-hoe on his tractor to dig an asparagus bed in his garden.

Another issue is career-long education for engineers. We don't have culture in engineering that demands that we continually renew ourselves like, for example, physicians do. Yet, there are estimates on the "half life" of engineering knowledge that are in the 2 1/2 to 7 1/2 year range. I think we need to change the culture of engineering-and computing-to one in which it is expected, and it is the responsibility, of individual engineers to continually re-educate themselves. I believe that the nature of engineering practice is changing fairly dramatically right now. Part of that is induced by computers, by new materials, by a variety of things that increase the "design space" in which an engineer has to operate. My definition of engineering is "design under constraint," and there are also a large number of new constraints. Functionality and cost were the primary constraints in the past, but now we have to be concerned with environmental qualities, safety and reliability, maintainability, ergonomic concerns-a whole long list of such things.

There are also the results of the restructuring of industry, the use of teams, for example, which puts engineers in a different context than they used to be. They have to be able to converse with marketers, with lawyers, with financial people; so that is another dimension of the change. There's another dimension of the change simply having to do with the globalization of the industry. So, I see engineering as in flux at the moment and I think the Academy has a responsibility to understand that change and to put in place whatever mechanisms we have the wisdom to identify; not only to help engineers, but to help the country get the most out of engineers.

Viable Telemedicine Technology for Ultrasound

Reprinted from Explorations

In a time of rising health care costs, telemedicine offers the promise of delivering high-quality medical care over great distances. While most telemedicine schemes involve elaborate teleconferencing systems, requiring expensive, high-bandwidth telephone lines or satellite connections, the system being developed by Alfred Weaver, a professor of computer science, is more utilitarian, but no less effective. By harnessing the power of personal computers and modems, Weaver and his colleagues Spencer Gay and Samuel Dwyer, in the department of radiology, have developed a system that transmits clinically acceptable ultra-sound images.

"Our goal is to give radiologists a tool for boosting their productivity, while improving the level of health care services available to people in their own communities," Weaver declares. His teleultrasound system is capable of quickly compressing and sending full-color, full-motion video clips as well as still images from outlying clinics to radiologists at a central hospital, who can read them just minutes after they are taken.

"One of the first hurdles we faced was cost," Weaver recalls. "When we first embarked on this project, the technology was too expensive. With personal computer prices dropping, we can now offer a system for well under $10,000, a price that would be affordable for most hospital systems. It consists of a Pentium PC platform on each side of the line, equipped with a modem or other communications device and a dedicated hardware board to compress images.

As Weaver envisions it, technicians at local clinics would take ultrasound images much as they do today using the same equipment. Then, instead of being recorded on analog devices like radiographic film or Super VHS videotape, these images would be translated into digital computer files. The technicians would then transmit these files to the radiologists' computer, who would pull them up to read.

One advantage of the system is what Weaver calls "its scalable architecture." In other words, it adjusts to the quality of the phone link between hospital and clinic, whether it is a state-of-the-art ATM fiber optic line or a conventional ISDN connection over ordinary phone lines. The only difference is speed. Over an ATM network, it takes just 0.1 second to transmit a 30-second video clip; over an ISDN line, it takes two minutes. Another advantage of Weaver's system is that the technology used for recording and displaying video clips is identical to that used for still images, making it easier for radiologists to conduct more extensive evaluations of blood flow or fetal health.

One hurdle was finding compression technology that could be used to send these very large files in acceptable times without losing valuable diagnostic information. Weaver and graduate student Arvind Visawanthan took a variety of typical ultrasound images, from uterine fibroid masses to deep venous thromboses, and processed them using the MPEG compression standard. They asked radiologists attending a meeting of the Radiological Society of North American to identify the resulting images and rate their quality. Most radiologists thought the images were at least acceptable and many thought they were excellent.

Weaver's group is looking for a commercial partner to help bring the system to market. "The trend is for hospitals like ours to provide health care to an ever-widening area," Weaver says. "Our teleultrasound system allows hospitals to expand their base while dramatically increasing the speed of routine diagnoses."

R&D Gems

Reprinted from Computer World

Companies are already lining up to adopt some of the coolest technologies from university research labs.

You can almost hear the paradigms shifting way up in those ivory towers. At the University of Virginia (Computer Science Department), they're inventing a "worldwide virtual computer." At the University of California (Computer Science Department), it's a "planet-scale, self-organizing" system. And at Carnegie Mellon University (Computer Science Department), they call it an "invisible halo of computing." While researchers at each of these universities are pursuing their visions in very different ways, at a fundamental level, they all are dreaming the same dream for the 21st century. They say that computers will disappear yet be everywhere, that virtually every person and thing will have digital connections to every other person and thing and that the pain and risks of computer use will greatly diminish. They say the impact on computer managers and users will be profound.

The vision stretches far into the future by information technology standards -- 10 years at the University of California at Berkeley -- but some capabilities are scheduled for prototyping in the next year or so. And the University of Virginia has already found real-world users for Legion, its virtual computer. "This research is moving us in the right direction," says Leonard Kleinrock, a computer scientist at the University of California at Los Angeles (UCLA) and one of the fathers of the Internet. "We are going to have distributed intelligence, distributed knowledge. Internet services will be everywhere, always available, always on, but most of all, invisible, just like electricity is."

Legion: A Worldwide Virtual Computer at the University of Virginia

"We need vast amounts of computer power, and there are problems we won't even touch unless we know the computer power is there, says Michael Crowley, a scientist at The Scripps Research Institute in La Jolla, Calif. For example, a job that models protein-folding can run for 12 hours on a supercomputer, so Scripps asks Legion to roam the country sniffing out spare computer cycles. "We just say, 'Legion, run it,' and it finds machines that are open, finds the correct executable, gets all the input files over there, runs the job and brings the output back," Crowley says.

Legion is a highly flexible, wide-area operating system designed to build a virtual computer from millions of distributed hosts and trillions of objects -- while presenting the image of a single computer to the user. Originally developed for U.S. government scientists, it is now finding use in private labs and will eventually move to mainstream commercial use, says Legion architect Andrew Grimshaw, director of the Institute for Parallel Computation at the University of Virginia in Charlottesville.

Legion applies many of the object-based interoperability principles in the Common Object Request Broker Architecture. It finds and schedules resources and handles security issues among disparate operating systems and objects written in different languages. That frees users from the need to negotiate with outside systems and administrators. Grimshaw says Legion is more robust than today's commercial systems because it's based on a "good, clean conceptual model" that considered basic services such as security from the outset, not as an afterthought.

"The concept of Legion is something I've been calling for for years," says Kenneth Neves, director of computer science research at The Boeing Company in Seattle, which is evaluating Legion. "If you're a company like Boeing and you're going to invest millions of dollars to develop something like a new fluid dynamics program, you'd like to have some consistency in the model of the program, and we are not getting that from the individual vendors."

Legion gets its consistency from interoperability standards that mask the incompatibilities among lower-level components. Neves says Legion possibly could run Boeing's highly complex and distributed product data management and manufacturing resource control systems. "The technology came out of the scientific computing world, but it will probably have its greatest impact in other areas," he says. For example, Neves says, Legion could prove ideal for the large, distributed transaction processing applications employed by big financial institutions. "With its virtual file system, one could write unlimited-size database applications."

Computer Whiz and Then Some

Reprinted from Virginia Engineering

Gabriel Robins, associate professor of computer science, loves puzzles. His mind grasps hold and won't quit. He expects the same from his students, and he gets it. "Sleep is so overrated," he shrugs. It's his slogan, stretched above his name on his striking Internet home page (see www.cs.virginia.edu/robins). "I've trained myself over the years to do with less sleep and to organize my life to allow time for the things that are important to me. I usually work very late into the night, and I picked a place to live that's within easy walking distance of school." Yet Robins is no sober-faced workhorse. One of his favorite T-shirts is emblazoned with the words, "Have you hugged your nerd today?" A collection of puzzles nestles on his bookshelf, among the textbooks and reference volumes. It's the most visible of his hobbies, which also include roller skating, photography, collecting comic books, and raising tropical fish.

"Work brings out the best in me" - Organization and energy have allowed Robins to enjoy what he is doing, and meanwhile, just a few years beyond his doctorate, post a string of impressive credentials. These include a Packard Fellowship, one of the nation's most prestigious grants to young science and engineering faculty; a National Science Foundation Young Investigator Award; a Lilly Foundation University Teaching Fellowship; and an All University Outstanding Teacher Award, among other honors. Equally prideworthy is his membership in the Defense Science Study Group (DSSG), an advisory board to the U.S. Department of Defense. As a member of the board, Robins has consulted with U.S. Secretary of Defense, Chairman of the Joint Chiefs of Staff, and other high-ranking military officials. This assignment has also taken him into the world of action: aboard a nuclear missile submarine, visiting the 82nd Airborne Division at Fort Bragg, refueling a B-1 bomber in mid-air, and reviewing flight operations from the bridge of the aircraft carrier U.S.S. Eisenhower (left).

"I don't recommend my schedule to everyone and I certainly don't advocate that people work themselves to death," he says. "We all should do the things that we enjoy doing, the things that bring out the best in us. What I do is perfect for me." As close as the nearest computer, Robins' primary research and teaching interests include very large scale integrated (VLSI) circuits and the use of algorithms in the computer-aided design of cutting-edge VLSI technologies, such as multi-chip modules and field-programmable gate arrays. Robins gets excited when he talks about the challenges of science and technology, and his enthusiasm is contagious among students and colleagues alike. Although he credits the quality of SEAS students for his classroom success, his awards tell another story. "I see teaching and research as synergistic," he says. "Sometimes a student asks a question that we don't have an answer for, an open-ended inquiry. We investigate together."

His students are his partners - When Robins goes out of town for meetings and conferences, his students communicate by e-mail. "I pledge to my students that a reply from me is never more than a few hours away, no matter where I am in the world," he says with a grin. "They never have an excuse." Scientific theory fascinates him, but practical application is Robins's favorite game. "My work is optimization," he says. "I use algorithmic techniques to lay out very large integrated circuits. It's a nice meld of theory and practice. When I can find a solution to a challenging open problem, and then assist industry in applying our results to actual products, that's very gratifying." The puzzles on his bookshelf combine theory and practice, too: elegant structures designed to challenge the player. "Having these puzzles around keeps me sharp," he says. "I use them in class projects. My students write computer programs to solve them, and then we test their solutions together."

Through computers into all realms - As an avid Isaac Asimov fan in childhood, Robins saw computing as a gateway to amazing advances. “Being in computer science, I can step into other fields of science for a few weeks or months at a time,” he says. “For example, I’m collaborating with biochemists on problems related to the human genome project, mapping out billions of DNA nucleotides, which requires trillions of computations. I help the biochemists, and they teach me some biology.” Advising the Defense Department, Robins visits another field of study. “By applying pattern recognition techniques to infrared images, we’re developing better ways to detect land mines,” he explains. “There are a hundred million buried around the world, and the number is steadily growing. Unless these mines are detected and removed they’ll continue to kill thousands of civilians each year.”

Colleagues make all the difference - With his Ph.D. in computer science from UCLA, Robins’s credentials already include one book, more than sixty articles, and a string of major awards and fellowships. “I’ve tried to pull out all the stops in my professional development,” he says. “Before grants were available, I used my own money for books, travel, software, equipment. But more importantly, my department has been very supportive. Our Chair and senior faculty are visionary. They are generous in helping junior faculty attend conferences, buy equipment, and hire graduate research assistants. We’re grateful, and we respond by producing quality work. Young faculty are in their formative years, and short-changing them on professional support is like depriving a child of the proper dietary nutrients.”

Professor Gabe Robins at the periscope of the nuclear Trident missile submarine USS Nebraska. For more information, see www.cs.virginia.edu/dssg

Yet Robins also thinks American scientists should count their blessings. “Recently I corresponded with Alexander Zelikovsky, a top-notch researcher from Moldovia, a republic of the former Soviet Union,” he says. “I found out that Zelikovsky’s institute had a single workstation that was shared by its entire faculty! Moreover, faculty members were forced to pay in order to a receive e-mail and they earned less than $200 a month.” Robins soon helped Zelikovsky improve his lot. He arranged for his Moldovian colleague to join UVa as a postdoctoral fellow in computer science, and now they work together. How would Gabriel Robins sum up his view of a good life’s work? He answers by quoting not a scholar but a warrior, General George S. Patton: “If a man does his best, what else is there?”

Engineering 10100101

Reprinted from Government Technology

The University of Virginia has a reputation for being progressive when it comes to technology. For years the school has gone out of its way to obtain the best equipment, teach high-level technology courses and employ technology-proficient professors. That fact hasn't escaped the attention of technology businesses, who wait with baited breath for students to emerge from the college with the skills necessary to fill many vacant high-tech positions.

Cisco Systems and MCI donated 12 routers to the University of Virginia to encourage it to continue preparing students for high-tech careers. Not only is the school doing so, but it has gone one step further, using the gift to fuel a national pilot project designed to teach students about Internet technology. "The University of Virginia has had a focus on computer technology for many years," said Jim Massa, director of Global Government Alliances for Cisco. "Over the last two decades, the focus has changed from hardware to software to specializations within those areas. Now they're leading the way with a specialization in Internet technology, and are one of the first universities to do so." The equipment Cisco and MCI donated -- worth more than $1 million -- has been installed in the Virginia Internet Teaching Lab, making the university one of the top facilities of its kind in the country. In the lab, students learn to set up networking hardware and software, take and interpret traffic measurements, learn how Internet protocols interact and become proficient at setting up and managing Internet networks.

"The idea is to create a whole suite of courses and develop an Internet engineering curriculum," said Jörg Liebeherr, the University's Internet engineering professor. "Basically, it's going to be a new subspecialty of engineering -- a hybrid of computer science, systems engineering and electrical engineering with added instruction in the information infrastructure of the Internet." Liebeherr said the new curriculum will be the model for other universities who want to form their own Internet engineering programs. "It's a growing field, there are jobs out there, the demand is there," he said. "The time is right for it to be its own field of study."

Liebeherr, who was instrumental in integrating the equipment donated by Cisco and MCI into the lab, uses his Internet engineering course to teach students about the protocols and algorithms used on the Internet. Students then go into the lab once a week to apply the knowledge they've gained by conducting exercises on actual Internet equipment. "Students go from absorbing the information to

applying it in an almost real-world context in the lab," said Liebeherr. "A lot of schools offer networking courses," Massa said, "but this is the first to look at what's under the hood as far as the Internet -- from the scaleable algorithms that allow large networks to grow, to new technologies that may allow for certain things to be done more efficiently." According to Liebeherr, students who go through the Internet engineering curriculum will be qualified to get a job in just about any area of IT. That prospect is making Internet engineering a very popular course at the university. "Three years ago, I was offering the first computer networks course for undergrads," he said. "Each year, the enrollment level of 70 to 80 students was reached. This year, demand was so high that we offered two courses, and they are both already full. Right now we have approximately 150 students taking computer networking. The demand has been overwhelming."

Ironically, that demand comes at the same time organizations like the American Electronics Association (AEA) are reporting declines in the number of students pursuing high-tech degrees. AEA's CyberEducation report, released in late April, found that high-tech degrees - including engineering, math, physics and computer science - dropped by 5 percent between 1990 and 1996. But Liebeherr doesn't agree with that assessment. "My impression is completely the opposite. All fields that relate to computer technology have experienced a surge in the number of students. We've seen a doubling of the students who want to major in computer science every two years."

For Liebeherr and other faculty at the university, those increases actually pose a challenge. "Since this is a hands-on course, the availability of space in the lab itself limits the number of students we can take," he said. "I could only allow 35 students to take the course, but I had around 100 people trying to get in. There are so many positions open in the IT field, and these positions carry such promise for excellent careers with high salaries, that there is great demand from students to get into these fields."

The key to helping schools handle this demand may lie in industry/education collaborations like the one between the University of Virginia, MCI and Cisco. "Education drives new areas of research. We'd like to see universities domestically as well as internationally working together to push the envelope on the Internet," said Massa. "We understand that if we don't support education, not only will it be harder for them to do that, but our workforces will suffer in the future."

"Collaboration between industry and education is always a win-win situation," said Liebeherr. "Cisco and MCI have donated equipment which would be too expensive for us to buy. Now we're using this equipment to teach courses that better prepare students for the workforce. If we can do a better job teaching students in state-of-the-art technology, we prepare them better for industry."

The university has been busy preparing to expand its networking courses, including the Internet engineering course. Liebeherr and his assistants developed new lab exercises using the Cisco equipment, and the university hired new networking faculty. It's all part of a continuing plan to make the university one of the nation's premiere institutions for technology education.

"Information technology is one of the four key areas of excellence identified in our school's strategic plan," said Richard W. Miksad, dean of the university's School of Engineering and Applied Science. "We are developing programs in computer science and engineering that will be crucial to the advancement of society in the 21st century. Internet engineering is clearly one of these."

ACM Mid-Atlantic Regional Programming Contest

The 1998 ACM Mid-Atlantic Regional Programming Contest took place on Saturday, November 14th. The five hour long contest consisted of eight questions and 139 competing teams, two of which were from UVa. Richard Eppink, Jeff King, and Patrick Reynolds made up one of the University of Virginia teams, which placed second in the region by finishing seven of the eight problems. They next advanced to the world-wide contest, The ACM 23rd International Collegiate Programming Contest, held in Eindhoven, The Netherlands on April 8-12, 1999. The other University of Virginia team made up of Scott Gorman, T. J. Highley, and Chris Rude completed five of the eight problems and finished sixth. By this demonstration of their outstanding abilties, the members of our two programming teams served to represent, both regionally and world-wide, the quality of the UVa Computer Science students. For more more information on the UVa Chapter of the Association of Computing Machinery, please visit the ACM web site at acm.cs.virginia.edu or contact our Department.

Alf Weaver Wins IEEE Third Millenium Medal

The "IEEE Third Millennium Medal" was established by IEEE to recognize members who have contributed significantly to one or more of the IEEE societies. Professor Alf Weaver is an inaugural winner of this prestigious honor in recognition of his achievements within the Industrial Electronics Society, most notably for the design, development, and commercialization of the Xpress Transport Protocol for use in military and national security applications. IES is vitally interested in networked command/control systems, and XTP's reliable transport multicast and its multicast group management functionality remain unique in the transport protocol space.

Distinguished Lecture Series

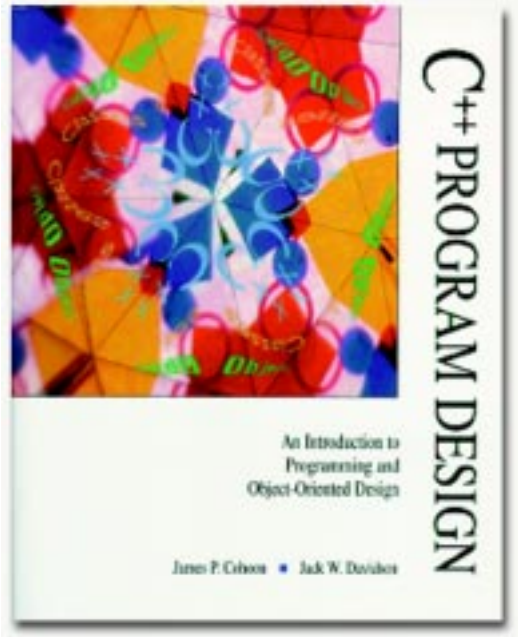
Our "Top Gun" Distinguished Lecturers Series recognizes faculty on a trajectory to be the research leaders of the coming decades.

The 1999-2000 "Top Gun" lineup included:

- Daphne Koller, Stanford, "Reasoning Under Uncertainty: Scaling Up"
- Joseph Hellerstein, Berkeley, "Interactive Data Analysis On Our Ever-Slower Computers"
- Nick McKeown, Stanford, "Architectures for High-Performance Packet Switches"
- Margaret Martonosi, Princeton, "Hardware and Software Techniques for Program Customization"
- Chris Diorio, University of Washington, "Neurobiology as Inspiration for Computer Engineering"

The 1998-1999 "Top Gun" Distinguished Speakers included: Daniel Jackson (MIT), Gerg Morrisett (Cornell), Mendel Rosenblum (Stanford), Daniela Rus (Dartmouth), Hui Zhang (CMU).

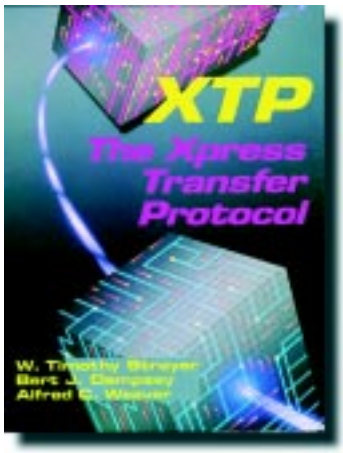
Past Distinguished Visitors include: Ashok Agrawala, Al Aho, Gordon Bell, Barry Boehm, Fred Brooks, Mani Chandy, David Clark, Edmund Clarke, Seymour Cray, Domenico Ferrari, Jay Forrester, Hector Garcia-Molina, Jim Gray, David Gries, Frank Harary, Juris Hartmanis, John Hopcroft, Ken Kennedy, Len Kleinrock, Butler Lampson, Richard Lipton, Barbara Liskov, Dave Liu, Jane Liu, Bob Metcalf, Gordon Moore, Allen Newell, David Patterson, Franco Preparata, M. Satyanarayana, Robert Sedgewick, Chuck Seitz, Carlo Sequin, Bob Sproul, Ivan Sutherland, Steven Tanimoto, Don Towsley, Maurice Wilkes, and Niklaus Wirth.



"C++ Programming Design", McGraw-Hill,
by Jim Cohoon and Jack Davidson, 1997
This best-selling C++ textbook was already
adopted by over 175 universities
www.cs.virginia.edu/c++programdesign

"Most Succesful New Title Award", 1997
presented by McGraw-Hill to Cohoon and Davidson
for their best-selling C++ textbook

Oracle of Bacon at Virginia
Named "Best 10 Web Sites of 1996" by Time Magazine
and still attracts over ten thousand "hits" per day
www.cs.virginia.edu/oracle



"XTP: The Xpress Transfer Protocol"
by Strayer, Dempsey, and Weaver
Addison Wesley, 1992
(The XTP protocol is now a DoD standard)

UVa Computer Museum

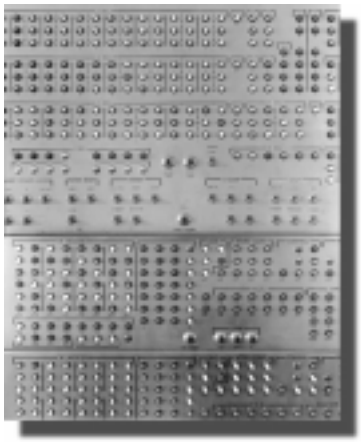
UVa's first computer - a Burroughs B205 (1960).

UVa's Burroughs B5000/5500 (1964-1973).

A single digit from the accumulator of a Burroughs 205, circa 1954. The 205 was a decimal machine with a magnetic drum for primary memory. This device, about the size of a modern laptop, stored one decimal digit (i.e., 4 bits!)

The marginal filament voltage control panel for the vacuum tube -based B205. A specific section of the machine (selected with the toggle switches) would be run with lowered filament voltage (using the rheostat) to find the tubes which had a low transconductance. These tubes would be replaced, as they were the components most likely to cause faults during normal operation.

One of the original DEC "flip chip" modules. Before they began making computers, DEC made these modules which could be wired together to build special-purpose laboratory instrument controllers.



The register display panel of a B5000. This was the first machine to have its displays "hidden" from the casual viewer – architects prior to this delighted in displaying the flashing lights!

Manual card punch from Wright Line. Numeric digits could be inserted directly from the keys. Alphabetic and special characters required 2 or 3 holes obtained by pressing all needed keys while holding down the 'S' key at bottom until finished. This was the "laptop" version of a keypunch machine!

Power triode: similar in size to power tubes used on the early computers, but this particular tube type is brand-new. It can be compared with a power transistor of comparable power rating.

Acoustic coupler - a 10 characters/second "modem". In use, the telephone handset was place in the rubber cups. Communication was established through audio tones with no electrical connection between computer and telephone line. Such connections were generally limited to <300 bits per second and were often favored since prior approval of the carrier was (assumed) not necessary.

A core memory plane from a CDC 6600, a computer designed by Seymour Cray in the 60's, before he started his own company, and the earliest successful "supercomputer".

Fan-folded paper tape for a DEC PDP-9 optical reader, circa 1968. The software for this computer was distributed and used in this format. The reader operated at 300 characters per second. The '8 level' tape has an additional smaller 9th hole to engage a drive gear. The system software shown here includes a FORTRAN IV compiler, and a MACRO-9 Assembler.

A gift from Cray Computer Inc., containing three GaAS chips that were to be part of the Cray 3 computer. The large brownish item in the center is a miniature "printed circuit board" — the idea was to bind the chips directly to this board (rather than to first package them in individual carriers) — this allowed smaller, denser packaging.

A "DEC tape" - a magnetic tape used on several early DEC computers. It was notable in that it was addressable: one could move forward or backward to a specified tape block. This particular tape contains the source code for the first Pascal Compiler, written by the inventor of Pascal, Nicklaus Wirth.

e-summit at the University of Virginia

The E-Summit@virginia conference was held at UVa at the turn of the Millennium, and was led by University of Virginia alumni who have helped pioneer the Digital Age and are virtually directing its future. In the spirit of UVa's founder Thomas Jefferson, these visionaries imagined the future, examined our assumptions, and weighed the challenges to serving the common good. This public forum engaged people in lively discussions on theoretical and practical implications of Internet technology and the rights and responsibilities of business leaders and private citizens. Participants included dozens of Internet companies CEO's, all of which are UVa alumni, including Tim Koogle (Yahoo!), Halsey Minor (CNET), Bertram Ellis (iXL), and many others. The E-Summit was broadcast live by Yahoo!Broadcast and was watched by thousands of people around the world.

Some of the UVa E-Summit Participants

Tim Koogle
CEO, Yahoo!

Halsey Minor
CEO, CNET

Allison Abraham
COO, iVilage

Mark Templeton
CEO, Citrix Systems

Jeffrey Walker
Managing Partner
Chase Capital Partners

Lawton Fitt
Goldman Sachs &Company

Bertram Ellis
CEO, iXL Enterprises

Jefferey Neuchterlein
Managing Director
National Gypsum Company

"Hey, who needs Stanford? Check out this list of University of Virginia grads who are bigtime Internet players: Timothy Koogle, CEO of Yahoo (or is that Wahoo?); Harry Motro, CEO of Infoseek; Todd Wagner, CEO of Broadcast.com; Halsey Minor, CEO of CNET; Shelby Bonnie, COO of CNET; Bertram Ellis, CEO of iXL; Michael McQuary, COO of MindSpring; and Allison Abraham, COO of iVillage. Unbelievable, huh? And that's just a partial list. So what's in the water down in Charlottesville? "

- Fortune Magazine, April 12, 1999

Contacting the Department

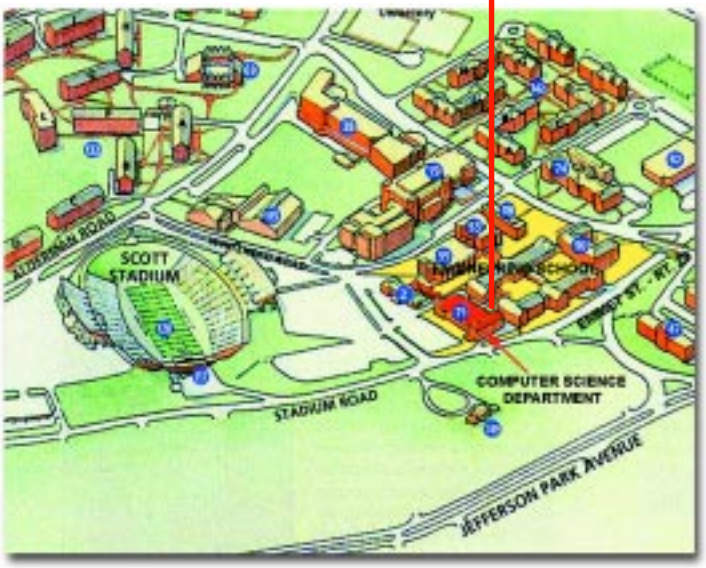
Further information on the department, its faculty, and its programs may be found on the web:

www.cs.virginia.edu

Inquiries may be directed to:

Department of Computer Science
School of Engineering and Applied Science
University of Virginia
151 Engineer's Way, P.O. Box 400740
Charlottesville, Virginia 22904-4740
(804) 982-2200
inquiry@cs.virginia.edu
www.virginia.edu/contact

Computer Science Chair Jack Stankovic conducting the Computer Science graduation ceremony in Darden Court.



Department of Computer Science
UVa School of Enginnering
www.seas.virginia.edu

Charlottesville, Virginia
www.virginia.edu/cville.html

Driving Directions

From Washington National Airport (DCA): take Highway 1 north, then Interstate 66 west, then Route 29 south. The driving distance is about 130 miles, and the driving time is about 2.5 hours, depending upon Washington traffic.

From Washington Dulles Airport (IAD): exit Dulles on the Dulles access road; take the first exit onto Route 28 south. At the intersection with Interstate 66 take I-66 west, then Route 29 south at Gainesville. The driving distance is about 110 miles, and the driving time is about 2.0 hours, depending upon traffic.

From Charlottesville Airport (CHO): exit the airport and continue straight ahead on Airport Road for 0.8 miles. At the traffic light turn right onto Route 29 South. Proceed south on Route 29 to all hotels and the University.

The Lighter Side of Computer Science at UVa

Emeritus Professor Alan Batson discovers the hard way that water is an incompressible fluid: while driving through a large puddle, his engine sucked in rainwater through the air intake and literally blew apart on the compression cycle (the headlights then kept blinking on and off - an interesting failure mode of the electrical system)

Several UVa Computer Science faculty braving the river wild during a departmental whitewater rafting trip

The UVa Computer Science basketball team, called "The Gigaflops" (plus Epsilon - bottom right)

Professor Gabe Robins aiming to solve a tough problem during a field trip of DoD's Defense Study Science Group; for details, see www.cs.virginia.edu/dssg

Professor Kevin Sullivan (right) explaining "Moore's Law" to Intel co-founder & CEO Gordon Moore (left), during Moore's 1996 visit to UVa.

Professor Anita Jones (left) at the Earth's South Pole, with John Hopcroft (right) and others

Professor Bill Wulf with his Ph.D. student Brett Tjaden, AKA "The Oracle of Bacon at Virginia"

UVa Department of Computer Science faculty, graduate students, and undergraduates square-off in the Jeopardy-style Computer Bowl.

UVa CS "Robot Games": Student-programmed robots competing against each other.

Summer Workshop on the New UVa Computer Science Curriculum: participants in this National Science Foundation - sponsored event included teachers from across the country for more details, please see:
www.cs.virginia.edu/workshop-ufe/

Supercomputing pioneer Seymour Cray (center) with two of UVa's Department of Computer Science faculty, Gabriel Robins (left) and Andrew Grimshaw (right).

Admissions

University-provided academic information, including admission requirements, course offering directories, and the academic calendar, may be found at:

Undergraduate Catalog:	**www.cs.virginia.edu/ugrad-catalog**
Graduate Catalog:	**www.cs.virginia.edu/grad-catalog**

Admission application materials for the Department of Computer Science may be obtained from:

Undergraduate Admissions	Graduate Admissions
Office of Admissions University of Virginia Miller Hall P.O. Box 9017 Charlottesville, VA 22906 (804) 982-3200 (804) 924-3587 (FAX) undergrad-admission@virginia.edu **www.cs.virginia.edu/ugrad-admissions**	Department of Computer Science School of Engineering and Applied Science University of Virginia 151 Engineer's Way, P.O. Box 400740 Charlottesville, VA 22904-4740 (804) 982-2200 csadmissions@cs.virginia.edu **www.cs.virginia.edu/grad-admissions** **(CS graduate applications only)**