Next Generation Solutions for Tomorrow's Potential Computing Needs

Imagine a business traveler who learns she needs to fly from Washington, D.C to Cincinnati to solve a critical problem on a client site. In addition to a time sensitive airline flight, she needs to book a hotel, and rent a car. To make matters more complicated, she has to stay within the project budget. Her first resource is mostly the web and a travel service such as Expedia, Orbitz, or Kayak. In her haste to solve her problem, she makes selections that appear to fit her needs and then she just hopes for the best.

This scenario is not far-fetched and represents consumer driven needs to access services from the Internet. As the number of service oriented websites increase, and the ways that people can access the Internet increase, there is a growing need to find more efficient software-driven service solutions. This need is being researched in the lab by Mason researchers, Daniel Menascé, Hassan Gomaa, Sam Malek, and João Sousa through a model-driven framework called SASSY – Self-Architecting Service Oriented Software Systems.

Daniel Menascé explains that the SASSY project came from a National Science Foundation proposal request for next gener-
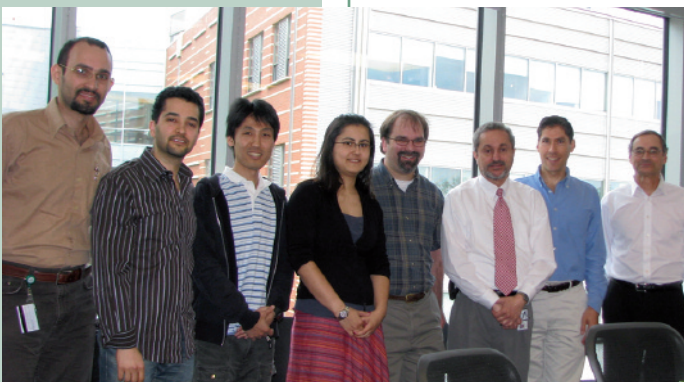

SASSY Research Team-Faculty and Students

ation software systems. The Mason team explored the real world problem of Internet service providers being unable to efficiently analyze everything available for a user.

The team's solution is a self-architecting program that once designed by a human is selfoperating. SASSY represents a paradigm shift in architecting software systems that exhibit characteristics similar to the Internet. It provides mechanisms for self-architecting and rearchitecting that determine the near-optimal architecture for satisfying functional and Quality of Service (QoS) requirements. The quality of a given architecture is expressed by a utility function provided by end-users and represents one or more desirable system objectives.

The program is based on a theoretical assumption that service providers would include the code and it would be accessed through web services. One of SASSY strengths is that it adapts and self-architects to new solutions when performance degrades or providers fail, SASSY generates the best software architecture along with the best selection of service providers at design time and at adaptation time without performing an exhaustive search of all possible solutions.

The current working prototype is able to evaluate about 3,000 software architectures in less than two seconds. The team has an additional year to work on the system. To date they have published over two-dozen papers to positive reviews.

To learn more visit the project website: www.cs.gmu.edu/~menasce/sassy/

Smart Phones Need to Get Smarter About Virus Protection

In 1965, Americans got an imaginative look at technology and a laugh when actor Don Adams, who played Agent 86 on the television comedy Get Smart, took off his shoe to make a phone call. Fifty years ago, the United States was in the midst of the Cold War and the idea of cloak and dagger spies fed our imagination about how technology would become commonplace. Now imagine if the shoe phone were in production today and that there was a security flaw in the laces. As silly as this sounds chances are you have a phone. It's not in your shoe but it maybe clipped to your belt or briefcase. Your Blackberry, Android, or iPhone also has a "lace" in the form of a USB cable. Your lace may have a problem.

George Mason University's CS Department's Angelos Stavrou and his graduate student Zhaohui Wang have successfully exploited this potential security program through a software program that compromises a USB cable. Stavrou explains, "It's a viral compromise that can work on any computing device that uses USB.

The exploit can work between two smartphones or from a smartphone to a computer." And like all viruses, it can spread from machine to machine.

The original virus can be downloaded from the web. Currently there are over 350,000 apps available for the iPhone and 120,000 apps for Android with more available daily. These programs from free to just a few dollars cover a wide-range of everyday

> "The exploit can work between two smartphones or from a smartphone to a computer."

activities from cooking to banking. Add this number to the apps available for the Blackberry and Symbian phones and it's easy to see that consumers are more concerned about the latest hot game than an entire system compromise. Recently, DARPA, the research arm of the army took an interest in building mobile software applications ("apps") that end up in the hands of warfighters.

Stavrou and Wang's original compromise was designed for an Android platform but Stavrou says that it could work for other smart phones and devices just as easily.

The problem is also virtually impossible to detect. When you connect a USB cable to either a Windows or Mac machine you'll see

Dr. Angelos Stavrou

a quick acknowledgement that the machine has detected the cable. There's no need to type in a command to continue with the installation. If you are running a Linux machine, you won't even see this simple message. When the virus is running, the hacker can then take over keyboard and mouse commands. The user never knows. The problem is made worse because the user has innocently connected a USB cable and there is currently no security software available that could detect the problem.

"There's nothing we can do to protect our machines right now," says Stavrou. But it is clear that industry, programmers, and consumers need to get smarter about our technology.

▾ Spotlight

Software Engineering

In keeping with George Mason University's designation as the "university of diversity," the Department of Computer Science offers four Masters of Science degrees and over 100 lecture-based MS-level courses; an accomplishment no other university in the country can claim. One of our most popular programs in the department is software engineering (SWE). As a result of the growth of

> "Computer software engineers are among the occupations projected to grow the fastest and add the most new jobs..."

apps for iPods, tablets, smartphones and other devices, software engineering has been ranked as the hottest job in the United States, according to a new study reported by CBS News. The 2011 Jobs Rated Methodology conducted by CareerCast.com - which factors in environment, income, hiring outlook, stress and physical demands - has placed software engineers and computer systems analysts, in the top 30 best careers of the year. Software Architect was reported by CNN Money to be America's top job in 2010 offering great pay, work that's satisfying, and big growth opportunities. Software engineers are in demand in every segment of society affected by computing technology. According to the Bureau of Labor Statistics, "Computer software engineers are among the occupations projected to grow the fastest and add the most

new jobs... ." This is proving to be true for Mason SWE graduates.

The SWE program trains students in the theory and practice of software engineering. Students graduate with an understanding of how to integrate computer science and software engineering to produce software that is usable, reliable, maintainable, secure, scalable and efficient. Upon graduation, students are ready to enter the workforce as software engineers. Many of the courses emphasize teamwork, one of the most sought-after skills in the job market today.

Jeff Offutt, a Mason professor and one of the most recognized names in software testing says, "All of our students get jobs. Eighty percent of our students are working full-time while taking classes and this allows for a lot of networking. Every class meeting is a sort of mini job fair." This blend of professionals also pushes the CS department to keep courses current within the industry to maintain its leading status.

Five distinguished professors, Paul Ammann, Hassan Gomaa, Sam Malek, Jeff Offutt, and João Sousa who are all world-renowned researchers and industry experts, oversee the program. In the software engineering program specifically, two professors—Paul Ammann and Jeff Offutt—wrote the most widely used textbook in software testing, *Introduction to Software Testing*. Additionally, Hassan Gomaa has just released his new book, *Software Modeling and Design* available from Cambridge University Press. Mason's professors also have an international voice. Offutt is the editor-in-chief of *Software Testing, Verification, and Reliability*, the premier research

journal in testing. The faculty's credentials also include leading the creation of the major research conference in testing.

Students can pursue BS, MS, and PhD studies as well as a minor in Software Engineering. The graduate program also offers two graduate certificates in Software Engineering and Software Architecture.

The popular program speaks for itself. Student exit surveys show that Mason graduates are extremely satisfied with our program. The majority of MS SWE students polled found the skills and concepts they learned from the program prepared them well for work in industry. Seventy percent of the exiting MS SWE students would encourage others to enroll in this program.

Welcome Dr. Kinga Dobolyi

Dr. Kinga Dobolyi

Dr. Kinga Dobolyi will be joining the CS faculty as a Term Assistant Professor this fall after working with the department this past year. Dr. Dobolyi received her PhD from the University of Virginia in 2010, and her BS from the University of Maryland, College Park, in 2004. Dr. Dobolyi's research focus is software engineering, testing, and web applications.

▼ CS Accolades

George Mason University has an international reputation of excellence. We congratulate our CS members for their success in both teaching and research.

Students

Beenish Jamil BS Applied Computer Science student received an Honorable Mention at the Computing Research Association's 2010 Undergraduate Researchers Awards competition.

Nick Kitten, BS Applied Computer Science student received the Volgenau School of Engineering Outstanding Undergraduate Student Award.

Computer Science graduate students **Brian Olson** and **Kevin Molloy** received the Best Student Paper Award at the BIONETICS Conference for "Enhancing Sampling of the Conformational Space Near the Protein Native State."

Swapnil Shinde MS Computer Science student and **Jonathan Medefind** MS Information Security and Assurance student, received an Honorable Mention at the 2010 IBM Master the Mainframe Contest. They both ranked in the top 30 out of over 3,500 competitors.

MS Computer Science student **Sheri Williamson** is a recent winner of a Google Anita Borg scholarship. She received a $10,000 scholarship, attended the Annual Google Scholars' Retreat in Mountain View, California, and attended the Grace Hopper Celebration of Women in Computing Conference. She also received the Volgenau School of Engineering Outstanding Graduate Student award.

Faculty

Dr. Alex Brodsky and PhD student **Nathan Egge** received the Best Paper Award at the 2011 Hawaii International Conference on System Sciences (HICSS), Decision Technology, Mobile Technologies and Service Science track for their paper "Reusing Relational Queries for Intuitive Decision Optimization."

Dr. Jim Chen was keynote speaker at the VRCAI (Virtual-Reality Continuum and Its Applications in Industry) on Dec 12 in Seoul, South Korea.

Dr. Hassan Gomaa was keynote speaker at the IEEE Computer Software and Applications Conference (COMPSAC) held July 2010 in Seoul, South Korea. His topic was "Software Variability, Evolution, and Adaptation".

Dr. Jeff Offutt was keynote speaker at the Software Testing Conference 2010, in Kuala Lumpur, Malaysia. His topic was "The Model-Driven Test Design Process". He was also the keynote speaker at the Google Test Automation Conference in Hyderabad, India. His topic was "Automatically Generating Test Data for Web Applications".

Dr. Gheorghe Tecuci was the keynote speaker at the 2nd International Symposium on Intelligent Decision Technologies 28 KES IDT 2010 in Baltimore, Maryland. His topic was "Intelligence Analysis as Agent-Assisted Discovery of Evidence, Hypotheses and Arguments". He was also the keynote speaker at The 9th International Conference on Machine Learning and Applications, ICMLA 2010 held in Washington DC. His topic was "Cognitive Agents that Learn, Tutor, and Assist in Problem Solving"

Dr. Dana Richards was interviewed by Michele Norris, host of NPR's "All Things Considered," about the legacy of the late Martin Gardner who wrote the column "Mathematical Games" for *Scientific American*.

Dr. Angelos Stavrou and PhD student **Zhaohui Wang** were featured at the Black Hat Technical DC Conference for their study "Exploiting Smart-Phone USB Connectivity For Fun And Profit."

Recent Faculty Book Publications

Dr. Hassan Gomaa. *Software Modeling and Design: UML, Use Cases, Patterns, and Software Architectures*. Cambridge University Press, 2011. Discusses modeling and design of software applications from use cases to software architectures in UML and shows how to apply the COMET UML-based modeling and design method to real-world problems.

Dr. Sean Luke. *Essentials of Metaheuristics*. Free Online Text, 2009. Also available in print at Lulu.com. An open set of lecture notes on meta-heuristics algorithms, intended for undergrads, practitioners, program-mers, and other non-experts. Notes are short and light and are best when complementing other texts.

Dr. Huzefa Rangwala and Dr. George Karypis, eds. *Introduction to Protein Structure Prediction: Methods and Algorithms*. Wiley, 2010. An analysis of the methods used for protein structure prediction and key applications of modeled structures, and unravels the relationship between pure sequence information and 3D structure.
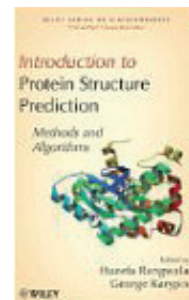
Twenty-Seven Years of Outstanding Education

The CS Department extends a fond farewell to Dr. Edgar Sibley who will be retiring at the end of spring 2011, after 27 years of teaching and researching at George Mason University.

Dr. Sibley has been a pioneer in all areas of large scale information systems design for government agencies and business organizations, including the IRS, Department of Defense, and Department of Energy, as well as joint contract efforts with

"He inspires me with his exuberance, his strategic vision, and his boundless energy."

the Boeing Corporation, Batelle, and SAIC, and many small businesses in the Washington, DC area.

Dr. Sibley has been the Chairman of the Board of Editors of Information and Management (the North Holland Journal) since its inception in 1977 and is an associate editor of several other journals. Colleague and friend Dr. Larry Kerschberg says, " I value Edgar as a loyal friend. He has strong opinions and is not afraid to express them! He is a consummate editor whose skill in wielding his red pen to a manuscript is legendary. He inspires me with his exuberance, his strategic vision, and his boundless energy."

Dr. Sibley holds an ScD in Mechanical Engineering which he earned in 1967 from MIT. Additionally he was a member of a National

Dr. Edgar Sibley

Research Council (NAS) board of the National Academy of Science charged to consider the strategic plans of the Social Security Agency for large scale transaction processing in distributed environments for the year 2000 onwards. He has also acted as an expert witness for four law firms. He has over a hundred papers and has made significant contributions to the fields of Database Management Systems, Information Systems, and Information Security. The entire department wishes him well as he enjoys his well-earned retirement.

Programming for Competition

Computer science at George Mason University is more than a course of study, it is also a competitive sport. The Mason student chapter of the ACM, the oldest computing organization in the world, is the most active CS related club on campus. Throughout the year, students led by faculty member Jyh-Ming Lien and graduate student advisor Christopher Vo, prepare for ACM competitions.

The ACM hosts a yearly global university competition. Teams of student programmers compete against each other in regional meets. Teams are presented with eight to twelve programs that they have to solve collaboratively within a five-hour period. Winners from the regional meets can move on to the world competition.

During the practices and mock competitions, students learn strategies to identify the categories and types of algorithms needed to solve the problems that will be given during competition," says Lien. "More importantly, the students learn how to solve a problem with time constraints. Since each team has three members and only one computer, the students need to learn how to cooperate and coordinate."

Lien was charged with starting the initial teams in 2008. The Mason chapter began with three teams and now has between five and six teams each year. Teams meet weekly and under the guidance of Chris Vo, they learn how to solve problems and become self-organized. Vo selects problems and sets up mock competitions.

Lien is quick to point out that competition questions are not designed for any particular level of student but that most Mason teams are either juniors or seniors.

Mason teams have performed well in the past and Lien expects them to continue. And while Mason doesn't have a direct rival, "we always want to beat Virginia Tech," says Lien. All five teams participating in the 2010 Mid Atlantic USA Competition received an Honorable Mention and also ranked second of the participating Universities.

More information on the Mason ACM chapter can be found at http://ite.gmu.edu/~acm/
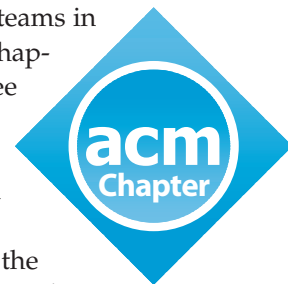
CS Education Really Goes the Distance

For many students, the shortest path between starting a degree and actually completing one is via the Internet. The Volgenau School of Engineering's distance education program is proving to be a popular option for working students in the Washington, D.C. area. Working professionals who are concerned about commuting to Fairfax for graduate classes in the evening rush hour or who travel for work can choose from a full online degree option— MS in Computer Science,— and graduate certificates in Computer Networking, Software Architecture and Software Engineering.

"We have 140 students taking classes online this semester," says Mark Pullen, faculty coordinator of the Department of Computer Science distance education program. Pullen is a champion of distance education and his expertise in developing the standards and overseeing the program is a reason for the program's success. Pullen specializes in computer networking and networking virtual environments. He is also the director of the C4I Center, which specializes in military use of information technology. Prior to teaching at Mason, Pullen spent seven years working for the Defense Advanced Research Projects Agency (DARPA)

> "We have 140 students taking classes online this semester,"

where he managed development of the earliest worldwide military network for education and training. Pullen says that he approached the Volgenau School's distance education program with the experience and firsthand knowledge of how effective a distance education program can really be for both students and instructors.

"Many schools offer distance education classes," say Pullen, "but in some cases those classes are designed for online education and the curriculum is different for students attending classes on a campus. Our online classes provide students with the same instructors, material, and assignments as our campus classes because they are the same."

Pullen explains the program runs over the Internet on the open source Moodle platform along with the department's own open-source MIST/C software. Moodle is a recognized and reliable platform with over 50,000 registered sites in over 200 countries; MIST/C works with Moodle to provide live Internet class delivery.

The CS Department uses a synchronous model. Students can connect online while the class is running and even ask questions during class. The class runs like a traditional course and feels comfortable for students. If a student is unable to attend while the class is running, he or she has access to a recording made as the class was delivered. Online students can go back and re-watch lectures as many times as they want, when they want. They also have the option of coming to campus and attending lectures in person.

Dr. Mark Pullen

Students may also enroll in asynchronous DE summer classes using recently recorded lectures. The course archives allow the department to offer more classes over the summer, which can help students finish sooner. But Pullen is quick to point out: Behind each class and recording is an active instructor and many times a teaching assistant who interacts with students, grades assignments, and even holds online office hours.

To learn more about Volgenau School's distance learning programs, visit: http://distance.gmu.ed

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Accolades, from page 4

Pu Wang PhD CS co-wins Best Student Paper at the prestigious 2011 SIAM International Conference on Data Mining. The paper was titled: *Nonparametric Bayesian Co-clustering Ensembles*, and was co-authored by Pu Wang, Kathryn Laskey, Carlotta Domeniconi, and Michael Jordan.

Dr. Huzefa Rangwala and **PhD Student Zeehasham Rasheed** win Best Paper Award at the 3rd ISCA BiCOB 2011 conference held in New Orleans, LA from March 23-25, 2011. Their paper was titled "TAC-ELM: Metagenomic Taxonomic Classification with Extreme Learning Machines".

Department of Computer Science Awards 2011

Graduates of Bachelor of Science Program

Distinguished Academic Achievement

BS Computer Science
Mary Greer
David Jacobson
Mohammad Chaudry

Outstanding Academic Achievement

BS Computer Science
Mark Henrickson-Mattson
Maryam Jeiran
Jonathan McMahon
James Pancoast

BS Applied Computer Science
Beenish Jamil
Nick Kitten
Joseph Zelibor

Graduates of Masters of Science Programs

Distinguished Academic Achievement

MS Computer Science
Sheri Williamson

MS Information Security and Assurance
Charalampos Andrianakis

MS Information Systems
Michael Murray

MS Software Engineering
Thomas Essig
Xin Meng

Outstanding Academic Achievement

MS Computer Science
Jeffrey Chiang
Yun Guo
Michael Mason
Kevin Molloy
Thien Nguyen
Gregory Sadosuk
Tanwishtha Saha

MS Information Security and Assurance
Brendan Fitzpatrick
Lian Chen
Richard Matias
Chris Van Buskirk

MS Information Systems
Dharini Ganesh
Nancy Zoller

MS Software Engineering
Justin Donnelly
Lucas Jessee
Mong Ngoc Le
Linda McCants
Maricel Medina Mora
Mario Pereira

Graduates with Doctoral Degrees

PhD COMPUTER SCIENCE

Gerald S. Doyle
Director: Elizabeth L. White, PhD

Daniel P. Fleck
Director: Zoran Duric, PhD

Wallace E. Lawson
Director: Zoran Duric, PhD

Lei Liu
Director: Songqing Chen, PhD

Pu Wang
Director: Carlotta Domeniconi, PhD

PhD INFORMATION TECHNOLOGY

Eiman Al-Shammari
Director: Jessica Lin, PhD

Hanjo Jeong
Director: Larry Kerschberg, PhD

Garrett K. Kaminski
Director: Paul Ammann, PhD

James P. Rogers
Co-Director: Daniel Barbará, PhD
Co-Director: Carlotta Domeniconi, PhD

Lei Zhang
Co-Director: Sushil Jajodia, PhD
Co-Director: Alexander Brodsky, PhD

Departmental Awards

Excellence in Undergraduate Writing in Computer Science Award
Mary Greer
Jonathan McMahon

Distinguished Undergraduate Teaching Assistant Awards
Joshua Essex
Tianchen Yu

Outstanding Undergraduate Teaching Assistant Awards
Aaron Foltz
Rachel Galang

Distinguished Graduate Teaching Assistant Awards
Sheri Williamson

Outstanding Graduate Teaching Assistant Awards
Ayeswarya Anandan
Kshitiz Bhattarai
Chola Chhetri
Dawei Du
Changwei Liu
Mohammed Hassan
Saurabh Singh

Outstanding Young Research Faculty Award
Sam Malek, PhD
Huzefa Rangwala, PhD

Outstanding Faculty Research Award
Daniel Barbara, PhD

Outstanding Faculty Teaching Award
David Nordstrom, PhD

Outstanding Adjunct Faculty Award
Fred Geldon
Gregory Martin

Outstanding Faculty Service Award
Paul Ammann, PhD

Faculty Advisor of the Year
Pearl Wang, PhD

Outstanding Staff Award
Therese Michael

▾ Chair's Message

Dr. Hassan Gomaa

Welcome to our spring 2011 issue of *Computing News*. It is two years since we moved into our new state-of-the-art home in the Volgenau School, which is based in the Long and Kimmy Nguyen Engineering building. There have been many developments in the Department of Computer Science since our last issue. This issue describes several achievements by our faculty and students.

Our students have performed very well in the ACM programming contest, to add to their achievements in the RoboCup competition, as described in our last newsletter. Our faculty continue to publish books and research papers, give keynote presentations at conferences, and be awarded research grants. Two of our junior faculty, Drs. Songqing Chen and Frank Wang (both recipients of the prestigious NSF CAREER award) were granted tenure and promoted to Associate Professor. Dr Chen was also the recipient of the Mason Emerging Researcher/Scholar award.

In this issue, we also report on our growing distance education offerings as well as our software engineering programs. This coincides with software engineering being "ranked the hottest job in America". Our research articles describe the innovative SASSY project for Self-Architecting Service Oriented Software Systems and a fascinating analysis of security flaws in smart phones.

I will be stepping down as Chair of the Department of Computer Science in August 2011. By the time I step down, I will have served for nine years as a Department Chair. It has been both challenging and stimulating to be Chair of the CS Department after the merger and during very bleak budgetary times. However, there is no doubt that the CS Department has come a long way and has a very bright future. We are nationally ranked and are one of the largest CS Departments in Virginia. We have outstanding faculty and students, and have strong undergraduate and graduate programs. Our research funding has grown and our faculty recruiting has been very successful.

My successor as Chair of the Department of Computer Science is my friend and colleague, Dr. Sanjeev Setia. He and I worked closely to plan the merger of the CS and ISE Departments, and have since worked together on many projects. Dr. Setia

Dr. Sanjeev Setia

previously served as Interim Chair of the pre-merger CS Department and as Associate Chair for Graduate Studies in the merged CS Department. We share a commitment to the CS Department and pride at the quality and achievements of the faculty working with us. There will undoubtedly be changes as Dr. Setia settles into this challenging task. I look forward to seeing the Department continue to thrive and to offering my support to help Dr. Setia's ideas and goals come to fruition.

Hassan Gomaa
hgomaa@gmu.edu
http://cs.gmu.edu/

Graduates
By the Numbers:

59	BS degrees in Computer Science
5	BS degrees in Applied Computer Science
54	MS degrees in Computer Science
22	MS degrees in Information Security and Assurance
52	MS degrees in Information Systems
36	MS degrees in Software Engineering
14	PhD CS and PhD IT degrees

Computing News