



The

UTAH TEAPOT

Summer 2001

A QUARTERLY NEWSLETTER FOR THE ALUMNI AND FRIENDS
OF THE UNIVERSITY OF UTAH SCHOOL OF COMPUTING

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The teapot was one of the first free-form models used in computer graphics. Since it was created at the University of Utah (by Martin Newell) in 1975, the teapot has become a favorite computer graphics benchmark. The teapot symbolizes Utah's distinguished leadership in computer graphics.

KaffeOS: A Robust Java Virtual Machine

By Wilson Hsieh

Single-language runtime systems, in the form of Java virtual machines, have become widely deployed platforms for executing untrusted mobile code. You have probably used Java virtual machines to execute Web applets, which can provide live stock quotes and sports scores, and perform sundry other tasks. However, what happens if one of these applets has a bug, and loops forever? Unfortunately, the only effective way to stop it is to restart your browser.

Type-safe languages such as Java provide much more safety than languages like C or C++: they provide inter-application memory protection, so that one program cannot directly crash another program.

Unfortunately, type-safe language runtimes are not yet good enough at isolating programs from each other. Even though one Java program cannot directly crash another one, it could crash the Java virtual machine on which they both run. They also do not provide any mechanisms to limit a program's resource consumption. As a result, one program can effectively deny service to other programs on the same virtual machine.

The ability to isolate programs from each other (both in terms of their safety and resource usage) is necessary to allow Java virtual machines to execute untrusted code, which may be buggy or outright malicious. My PhD student, Godmar Back, has designed and built a prototype Java virtual machine called KaffeOS, which provides this functionality for a Java runtime. The design and implemen-

tation of KaffeOS is the basis for his dissertation, which he successfully defended in June 2001.

KaffeOS supports the OS abstraction of a process in a Java virtual machine. Each process executes as if it were run in its own virtual machine, and each process's heap is separately garbage-collected. KaffeOS's ability to isolate processes from each other enables it to thwart resource-based denial-of-service attacks. That is,



Godmar Back and Wilson Hsieh

programs cannot acquire arbitrary amounts of memory or CPU time and prevent other programs from executing. Although KaffeOS shows relatively poor performance on logic benchmarks, because it is based on the public domain

Kaffe JVM, it can deliver better performance than IBM's commercial JVM in the presence of malicious code.

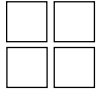
Our performance results demonstrate that resource-based denial-of-service attacks can be stopped effectively on KaffeOS. Untrusted processes can be terminated safely, without affecting unrelated processes. Programs that run on KaffeOS can have accurate memory limits and CPU limits placed on them. Finally, usage of system services (in particular, garbage collection costs) are accurately accounted for in KaffeOS so that the ability of a process to consume unaccounted resources is limited.

KaffeOS demonstrates that Java can become a robust platform for executing untrusted mobile code. More broadly, the KaffeOS prototype demonstrates that there is value in applying operating systems principles to building language runtimes. In addition, it demonstrates

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ALUMNUS PROFILE



By Greg Jones

This summer PDI/Dreamworks released its Computer Graphics-animated comedy *Shrek*, which is enjoying a warm reception by moviegoers everywhere. The Meyers and Murphy-voiced laffer grossed \$28.4 million in its third week of release. Assuming that *Shrek* continues at its early summer pace, the film should beat *Saving Private Ryan* to become DreamWorks' highest-grossing film ever.

What do *Shrek* and PDI/Dreamworks have in common with the University of Utah? Well, the University supplied a few talented individuals to PDI's staff, one of which is David Hart, a recent Utah graduate (BS '97). David is part of the effects department at PDI.

He gave us a general description of the workings within PDI:

"At PDI, we categorize objects into characters, props, environments, matte paintings and effects. Characters are the actors in a scene; they are the focus; they do the talking. Characters are mostly hand-animated. Props are objects that move and interact with the characters, for example, furniture. Environments are nearby objects that make up the scenery, like buildings or trees, these elements are animated procedurally. Matte paintings make up the background scenery, like clouds in the sky or far away mountains, often with large amounts of complexity but only simple animation. There are also many effects, consisting of the animated objects, that don't fall neatly into one of the above categories. Examples of these effects include liquids, fire, smoke, dust, clothing, crowds and foliage. Almost all effects require a specialized simulation of some kind.

"When I first arrived at PDI, I spent almost two months in training, taking classes, learning and exploring PDI's software. Soon I started using particle systems to make dust for *Shrek*. I was responsible for prepping shots, creating a simulation using physical behaviors (collisions, gravity, turbulence), rendering, color balancing and composing dust into the shot. Since then I've done dragon fire simulations, procedural crowds, rendering plug-ins (shaders), liquid debris, volume rendering of fire and dust, symbolic computation for filter-

ing simulation data, and a collision avoidance system for procedural worms."

David received his bachelors degree from the University of Utah and then pursued his Master's degree at Cornell University, where he graduated in 2000.

After a year with the Scientific Computing and Imaging Institute at the University of Utah, David landed a position at PDI. What classes does David remember as being influential in his current work? "I think I've reused more information from Joe Zachary's classes on data structures, compilers and programming languages than any other class. Certainly, in part, it was because those are core CS topics, but I think a big reason those classes really stuck is because Joe has a way of teaching that really motivates the subject and makes it more fun and interesting. Peter Shirley's graphics course had a significant impact on the way I think about computer graphics and my decision to pursue graphics academically and professionally."

So next time you watch a PDI/Dreamworks movie, go ahead and sit through the credits, look for David's

name and know that the University of Utah has done its part in helping make that movie.

Contact David at dhart@pdi.com

If you want to suggest an alum for a future profile please email Ann Torrence at torrence@cs.utah.edu.



David Hart PDI/Dreamworks

SIGGRAPH

The University of Utah School of Computing and the Wasatch Front Professional ACM/SIGGRAPH Chapter is pleased to present the: Second Annual University of Utah Alumni Birds of a Feather Meeting at SIGGRAPH 2001 in Los Angeles.

Wednesday, August 15, 2001
Hotel Figueroa Pool
Beginning at 8 p.m.

Address questions to Amy Gooch
gooch@cs.utah.edu.



Cohen Wins Research Award

Elaine Cohen was honored with the University of Utah's highest award for research at Commencement ceremonies on May 4. She is one of three professors from the University to be honored this year, and the third recipient of the Distinguished Research Award in the history of the School of Computing. Rich Riesenfeld (1988) and Frank Stenger (1998) were previously recognized.

Her leadership in the fields of computer graphics and computer-aided geometric design was acknowledged in her nomination, as one colleague wrote that Cohen "helped revolutionize the creation and dissemination of complex geometric models for visualization and manufacturing."

Cohen's national and international stature was also recognized. She currently serves on the National Research Council, Computer Science and Telecommunications Board. She was selected as one of 50 Computer Graphics Pioneers by ACM SIGGRAPH Society on its 25th anniversary and as one of 15 speakers for the First Grace Hopper Celebration of Women in Computing in 1994.

According to Director Tom Henderson, "Scholarship is the foundation of a successful academic career, and Elaine is the quintessential scholar. She has produced a steady flow of significant work helping advance many fields. In addition, she has been a mentor for quite a number of M.S. and Ph.D. students. She is devoted to high-quality, careful work of significant impact and instills that in her students. We are delighted that she is being recognized within our academic community for her work."



Elaine Cohen

Visiting Salt Lake City? Let us set up a visit for you! Contact Ann Torrence at (801) 581-7631, torrence@cs.utah.edu so we can show you the great things we are doing.

Tempest in a Teapot

Reflections on the School's First Year

By Tom Henderson

Director, School of Computing

Living life to the fullest involves some amount of risk taking and exploration of the unknown. This is also intrinsic to the creative process. Our change from the Department of Computer Science to the School of Computing is an example of leaving the security of well-established identity and well-focused mission to attempt to create a new enterprise to meet the current and future needs of computing education. The first products of this change are starting to emerge!

At the graduate level, there is now an M.S. program in Computational Engineering and Science with six enrolled students for the fall semester. We believe that this kind of interdisciplinary activity (the program is jointly run with faculty from the colleges of Engineering, Mines and Science) is the future of education and expect steady growth and impact over the next few years. The School of Computing will also deliver courses for students in the new Bioinformatics Track which is part of the Department of Medical Informatics PhD program. Programs in this field are in high demand around the country.

We are creating an undergraduate Honors program, designed to offer students exceptional access to the research aspects of our program as well as permit them to take graduate level classes. We have just launched a Computer Graphics and Visualization track as a specialization area in the BS degree program and will offer a new sequence of courses. During the next year, we hope to extend this track to become a BS/MS program, and we intend to recruit nationally into it.

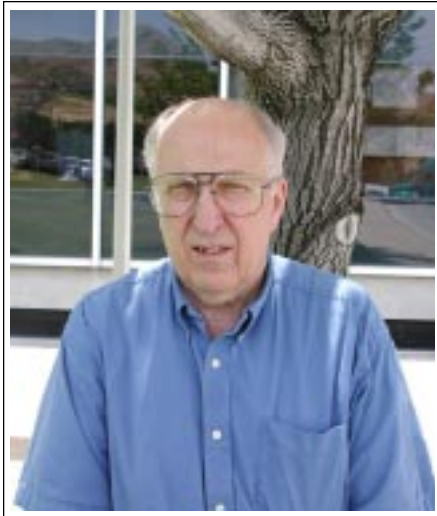
With regard to our industrial community, we are in the process of creating an Industrial Relations Program. The major goals are to foster strategic research relationships, and to facilitate industrial recruiting efforts, including internships, summer jobs, co-op programs, etc.

We have brainstormed and considered many possible directions for the School of Computing, and we have elected those that seem most promising in terms of payoff for the investment. We believe that the risk of this journey is well worth the effort, and we encourage you to help out. This can take many forms, from participation in our programs to providing feedback.

We look forward to hearing from you!

Email Tom Henderson at director@cs.utah.edu.

Kent Smith Retires, Lead LDS Mission



Kent Smith “retired” on June 25, 2001, after 23 years on the faculty at the University of Utah. He has accepted the responsibility of being a Mission President for the Church of Jesus of Christ of Latter Day Saints in Jacksonville, Florida. His wife Colleen joins him as a full-time missionary.

Kent would like to keep in touch with his friends and associates. His address is 8651 Baypine Road, Suite 105, Jacksonville, Florida 32256. His telephone number is 904-636-0604. A reception in his honor was held on April 25.

Continued from page 1

KaffeOS: A Robust Java Virtual Machine

that software mechanisms can be used to support operating systems functionality in language runtimes at relatively low cost. We plan to make a public release of KaffeOS in the near future. Our work on KaffeOS has been supported by DARPA.

Following the completion of his doctorate, Godmar will be working in a postdoctoral position at Stanford University with Professor Dawson Engler. Contact Wilson Hsieh at wilson@cs.utah.edu.

In the Real World: One Undergrad’s Internship

by Jason Morgan

When I first became an intern, it was just a way to balance my academic and professional goals. But my internships have been better experiences for my employers and me than I expected.

Working while attending school is stressful, especially when a lot rides on one’s performance. When I worked at Avaltus and the Lawrence Livermore National Laboratory, I didn’t need to juggle work and school, enhancing my enjoyment. This enhanced enjoyment has benefited them. When I chat with peers about careers and internships, we talk about where we’ve been and about the companies we’ve worked for. All this career talk forges a relationship between our former employers and potential recruits.

Today’s competitive software engineering market makes these relationships vital to a company’s success. Finding employees who match a company’s environment is perhaps more important than their talent.

I’ve worked at different organizations specifically to experience the variety in environments. These organizations have required me to learn and use different skills too. While education provides a good foundation for one’s career, it requires real-world application to build practical skills necessary for success.

My supervisors also developed skills. For most of the internships, I interviewed with the same people I worked with. This allowed them to exercise hiring skills and test instincts with little risk. \$12,000-\$20,000 would have been the maximum loss, compared to the \$100,000 minimum it would cost to keep an unproductive full-time employee for a year.

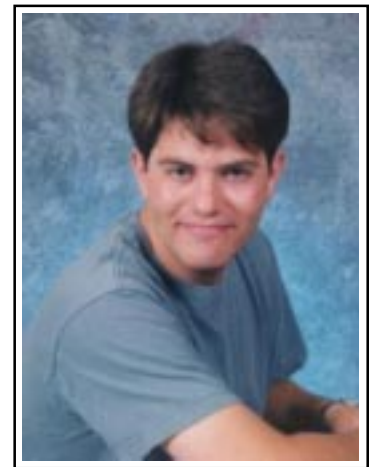
Of course, no mistake was made in hiring me. At Avaltus I developed a new product to analyze customers’ computers. I re-engineered a research application and developed features at Livermore. Even my part-time work with the Scientific Computing and Imaging Institute produced software to access databases and a user interface to assist developers. These were useful tasks, giving me valuable real-world experience, and also providing the people I worked with insights about me that no interview could provide. This has left me with a larger pool of potential employers.

My internships were an excellent way to try out the real world, and they enhanced my employers’ recruiting efforts. The experiences made them worthwhile.

I would like to thank Terence Critchlow, who received his masters and his doctorate (1997) from the School of Computing, for his input into this article and for being a great supervisor at Lawrence Livermore.

Jason V. Morgan is a Senior in the School of Computing. He currently is an intern at Microsoft Corporation in Redmond, Washington.

Interested in creating internship opportunities at your company for UofU students? Contact Chris Coleman for more information. coleman@cs.utah.edu



Jason Morgan

2001-02 Undergraduate Scholarship Recipients

Tuition Waiver for 1 year

- William Bentley (CS)
- Jason Morgan (CS)
- Andy Wakefield (CS)
- Sam Wakefield (CE)
- Jennifer Welch (CS)
- Jeremy Wright (CS)

Novell Tuition Scholarship

- Landon Hall (CS)
- Richard Whitney Johnson (CS)
- Nathan Lovell (CS)
- Jian Zhou (CS)

Women's Scholarship

- Deboshmita Ghosh (CS)
- Barbara Iannucci (CS)

School of Computing Faculty Scholarship

- Darby Brown (CS)

Eccles Scholarship

- Brian Budge (CS)
- Jarom Jones (CS)
- Michael Madsen (CE)

Unisys Scholarship

- Bryce Lembke (CE)

Whitaker Scholarship

- Gregory Hill (CE)

High School Computing Institute

- Evans & Sutherland Scholarship

- Benjamin Newton (CS)
- Tavish Robinson (CS)
- Daniel Perry (CS)

High School Computing In

- Novell Scholarship

- Heballa Al-Zahawi (CS)

Goldwater Scholarship

- Reshma Shetty (CS)

Kennecott Scholarship

- Jason Crouch (CS)

Arel Berrier Scholarship

- Scott Little (CE)



Darby Brown

First recipient of the School of Computing Faculty Scholarship, funded by the School of Computing faculty.

Undergraduate scholarships for School of Computing students totaled over \$60,000.

Graduate Students Fellowships 2001-2002

COLLEGE OF ENGINEERING BROWN FELLOWSHIPS

For new entering graduate students Fall 2001. Stipend for first year and includes a full tuition waiver.

- Justin A. Polchlopek, entering from Univ. of Connecticut
- Betty J. Mohler, entering from Millersville University
- Margarita Bratkova, entering from Mt. Holyoke College

SCHOOL OF COMPUTING FELLOWSHIP

For graduate student Fall 2001. Stipend for first year and includes a full tuition waiver.

- Sarah Taylor Erickson, entering from Mt. Holyoke College

NATIONAL SCIENCE FOUNDATION (NSF) GRADUATE RESEARCH FELLOWSHIP

Stipend for three years, tuition and other educational costs.

- Bruce Gooch, current PhD student

The value of these graduate fellowships, providing support for these students to pursue their research at an early phase in their programs, exceeded \$100,000.

Save the Date! New Major Day

The School of Computing will welcome its newest group of Computer Science majors to the program on August 28 with tours, demos, orientation and a welcome reception. Alums are welcome! We are also looking for industry participants who want to meet students early in their career path. To get involved, contact Ann Torrence at (801) 581-7631 or torrence@cs.utah.edu.



ALUMNI

On March 3, 2001 **Ed Catmull** (PhD'74) and colleagues Rob Cook and Loren Carpenter won an Oscar for "their significant advancements to the field of motion picture rendering as exemplified in Pixar's 'RenderMan.'" While at the University of Utah Catmull's research included the Z-buffer, texture mapping and subdivision algorithms.

Amy Gooch (BS'96, MS'99) and **Bruce Gooch's** (PhD student) book, *Non-photorealistic Rendering*, will be published this summer and will be available through

FACULTY

Elaine Cohen and **Rich Riesenfeld** will have a book published this summer, *Geometric Modeling with Splines: An Introduction*, available through AK Peters.

Greg Jones, Associate Director of the SCI Institute, was appointed Adjunct Assistant Professor of Radiology.

John Carter, Sally McKee, Wilson Hsieh and Bharat Chandramouli (M.S. candidate) recently had a paper accepted at the IEEE Parallel Architecture and Compilation Techniques Conference to be held in Barcelona, Spain, this September.

Chris Johnson (MS'84, PhD'90) and **Kris Sikorski** both received promotion to full professor.

On May 26th **Steve Parker** (PhD 2000) and Meriann Freeman (BYU alum) were married.

STUDENTS

Mike Jones (PhD candidate) recently accepted a position at Brigham Young University as an Assistant Professor in their Computer Science department.

Lambert Schaelicke (PhD candidate) recently accepted a position at Notre Dame as an Assistant Professor in their Computer Science and Engineering department.

Michael Ashikhmin (PhD candidate) accepted a position at SUNY Stony Brook as an Visiting Assistant Professor in their Computer Science department.



Konrad Slind joined the School of Computing in June 2001 as an Assistant Professor. His research and teaching interests include logic, higher order logic, and Functional Programming.

Konrad joins us from University of Cambridge where he worked as a senior research associate. While at Cambridge he worked on two projects, one of which was a focus on middle ware for systems that use theorem proving. His educational background includes an BS (1984) and MS (1990) in Computer Science from the University of Calgary. And then later went on and received his PhD (1999) in Computer Science from the Technical University of Munich.

He looks forward to spending time in the Utah mountains doing some back country camping. He also enjoys hockey and a good game of squash.



Chris Coleman joined the School of Computing in June 2001. As a Public Relations Associate, he will be working on the school's publications, Industrial Relations Program and alumni services.

Chris recently graduated from the University of Utah with a degree in Photography and Digital Imaging. His interests include photography, art, movies and a passion for all kinds of music. He looks forward to getting to know everyone in the school.

Babies, babies, babies...

These lucky folks are proud new parents!

- Youjia (Helen) Fang was born on May 15 to Xiaojuan Wang and Zhen Fang (PhD candidate).
- Indri Lambert Schaelicke was born on March 27 to Rita and Lambert Schaelicke (PhD candidate).
- Nicholas Hartner was born on April 21 to Ashley and Mark Hartner (Research/Developer in the SCI Institute).

Send news items to teapot@cs.utah.edu.



Undergraduate Graphics Research Team

By Bruce Gooch

Graduate students who pursue academic careers face challenges far different than students who find jobs in industry. One key difference is the teaching component of the university professor's job. Serving as teaching assistants helps develop classroom lecturing skills. However, the mentoring and leadership skills needed to head a research group and to mentor the next generation of graduate students are rarely part of the formal doctoral training.

A unique program in the School of Computing offers graduate students an opportunity to enhance their mentoring skills, while at the same time providing undergraduates research experience. The Under-Graduate Graphics Research Team (UGRT) links undergraduates and graduate students in research activities. Four faculty members, Richard Riesenfeld, Charles Hansen, Elaine Cohen, and Peter Shirley, are working as mentors for the team. Kristi Potter and Bruce Gooch currently serve as co-leaders of the team.

UGRT undergrads perform background research, write software, and develop computer algorithms. Students then take part in writing papers for submission to leading computer graphics conferences and journals. Students are also required to give oral presentations of their work to the computer graphics community at the University of Utah. Mentoring these research efforts provides training for

graduate students, the team leaders, in the job of leading a research project.

In the first year of the program, two research papers were submitted to the SIGGRAPH conference in the area of non-photorealistic rendering.



Bruce Gooch modified this image with a technique pioneered by Erik Reinhard at the University of Utah. The technique maps the color space of an image to another image. Bruce used Van Gogh's painting iCafe Terrace on the Place du Forum to create a unique self-portrait.

In addition, two undergrad students in the program, Greg Coombe and Samir Naik, have been accepted into the doctoral program at the University of North Carolina at Chapel Hill.

The undergraduate graphics research team was also selected by the Committee on the Status of Women in Computing Research as a host site for their distributed mentor project. The CRA Distributed Mentor Project works to increase the number of women entering graduate school in computer science and

computer engineering. Universities are usually matched with two students for summer internships, but because of our existing infrastructure and organization, the CRA allowed our program four students.

This year we will double the number of undergraduate students and graduate student team leaders participating in the program. With a larger team, we will work on additional research projects, including solid modeling and virtual reality.

Bruce S. Gooch is one of 55 recipients of the National Science Foundation Graduate Research Fellowships in Computer Science for 2001.



A quarterly newsletter for alumni and friends of the University of Utah School of Computing.

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Pardon Our Dust

Remodeling of Merrill Engineering space for the School of Computing began June 25. The first phase includes a new faculty office, expanding the computer machine room, and creating a state-of-the-art undergraduate software teaching lab. Remodeling funds were appropriated by the state legislature as part of Governor Michael Leavitt's initiative to double the number of engineering majors in five years. All three projects are expected to be completed before the start of the Fall semester.

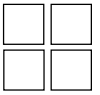


Remodeling by Interior Construction Specialists, one of the Layton companies.

photo by Chris Coleman



CALENDAR



June 18 -July 19, 2001

High School Computing Institute

August 22, 2001

Fall semester begins

August 28, 2001

New Major day

September 24-29, 2000

Homecoming Week

September 27, 2001

Evans & Sutherland Distinguished Lecture
Ron Kikinis, Brigham & Women's Hospital
Title: "HPC for IGT: High performance
computing for image guided therapy"

December 4, 2001

Evans & Sutherland Distinguished Lecture
Doug Lea, University of new York at Oswego
Title: "Building scalable systems in Java"

December 6, 2001

Evans & Sutherland Distinguished Lecture
Michael McCool, University of Waterloo
Title: "Reconfigurable Hardware/Software
Codesign of Advanced Graphics
Accelerators"

December 17, 2001-January 3, 2002

Winter Break

January 22, 2002

Evans & Sutherland Distinguished Lecture
Simon Peyton Jones, Microsoft Research
at Cambridge
Title: "Composing contracts: an adventure
in financial engineering"

February 2-February 26, 2002

Semester Break
XIX Olympic Winter Games



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