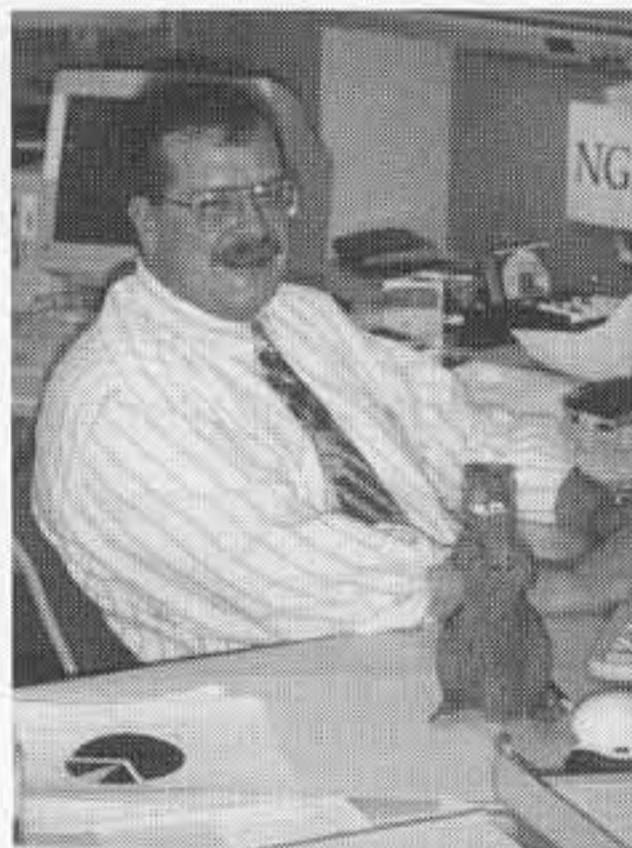# From the corner office

We pride ourselves on delivering the highest quality education possible. You might have seen the latest U.S. News report on colleges and departments across the country. In this study, we were ranked fifth nationally (behind Berkeley, MIT, Stanford and CMU—mostly private schools, I hasten to point out). While the U.S. News result might be arguable, it confirms in my mind that we are doing what we set out to do. And yes, we are working on moving up in the ranking.

The good news and the bad news: Enrollments, which have been flat or declining in the past few years, have increased for the second year in a row. The 1994–95 enrollment in the CS-Engineering program is up almost 40 percent over the past two years. Clearly the popularity of computing as a profession is up significantly, and we are struggling to handle the additional load. Many of you may recall the early 1980s when our enrollment was more than three times the 1992 enrollment. (And we had 33 percent fewer faculty then as well.) I am determined that we not repeat the mistakes we made then when we let enrollment get out of hand and interfere with our desire to deliver the highest quality education to our graduates. We are working with the dean to investigate

Welcome new board members

The Computer Science Alumni Association has elected five new board members: Richard Cheng (PhD'71), chairman of ECI, Virgina Beach; Jim Cupec (BS'72, MS'77), vice president of First Chicago Bank; Newenka Du Mont (BS'83), associate partner with Andersen Consulting in Chicago; Jeff Glickman (BS'82), president of Glickman Associates in Champaign; and Brad Goodman (PhD'84), lead scientist at the AI Center of MITRE Corporation in Bedford, Massachusetts. We are honored that they have agreed to serve.

Results are in:
Undergrad curriculum survey

The Computer Science Alumni Association advisory committee recently surveyed a third of undergraduate CS alumni to get their ideas on how the undergraduate curriculum could be improved. The survey gathered information on course offerings, credit hour requirements, instructional quality, the type of work alumni do, and the skills those positions require. By the time we compiled the data, we had received 157 survey responses from our target audience. Another 37 responses in letter format or from graduate alumni (contacted accidentally) yielded some rather valuable comments.

Results were presented to the faculty at their March meeting and helped influence the new CS-Engineering curriculum. The faculty were especially appreciative that so many alumni took the time to share their ideas. Results were discussed with the student ACM chapter, who helped conduct the survey, and will be used in undergraduate advising. Some of the major points are covered inside.

Potential Illini fill DCL at this year's Engineering Open House. Over 70 ACM members took part, and the event was attended by about 20,000. This was the 75th anniversary of EOH. Story on page 16.

Curriculum survey: Summary of major points

by Tom Burke and Chuck Boyle

CS majors need stronger communication skills

Computer scientists spend a substantial amount of time communicating with other people. They need to gather user requirements, discuss alternative solutions, coordinate their efforts, and document their work. It seems, however, that many of today's "undergraduates have lousy oral and written communication skills." Composition courses can help with the "grammar and spelling" issue, but CS courses need to teach students how to present complex ideas clearly.

CS majors need better interpersonal skills

Computer scientists need to be effective on a team and "get along well with others. In most positions, "you're always working with somebody and you always have a customer." Many employers find, however, that "interpersonal skills are in general lacking among CS grads." Requiring a group project in at least one upper-level CS class would give students some experience with teamwork. Improving social skills is more difficult, though we could have more social activities within the department.

CS majors need better project management skills

Computer scientists need the ability to plan a project, gather the resources, and drive it to completion. As they assume more responsibility, they will be expected "to grasp broad system concepts without being unduly concerned about implementation specific issues." They will also need some exposure to "the commercial aspects of product development and deployment." Faculty plan most academic exercises, so students should be encouraged to take at least one course with an independent project. It would also be beneficial to offer a "course that deals with project management."

CS majors need the full product lifecycle

In hardware or software development, you need to gather requirements for, design, implement, test, and support your product. You need to use tools for simulation, debugging, error tracking, and version control. You also need to make localized changes to large, existing products, and to build on existing work. Academic projects tend to abbreviate the development process, because their goal is to illustrate algorithms from a particular field. Students should be encouraged to take a course like Software Engineering that will "expose them to the entire development cycle" and allow them to do a project "from start to finish using real world tools." Other software courses should also include a project where students modify a component of an existing system.

CS department should offer a pure CS degree

A number of alumni feel the Engineering/LAS distinction is arbitrary and they would prefer a pure CS degree which builds on the common elements of both programs (56 percent of Engineering respondents want less physics and chemistry, 48 percent of LAS respondents want less foreign language). They would like more free electives and more opportunity to specialize within CS. Some are also interested in "a program that concentrates on software development as a full discipline."

CS department should emphasize software and communications

"Most CS graduates get jobs working in software development," and most areas of rapid innovation our alumni identified are software or communications related. CS departments have traditionally covered system programming well, but are going to be expected to provide significantly more support to areas like application development and software quality. Our department also needs to look at how effectively it serves the large telecommunications industry in the Chicago area.

CS department should strengthen advising

The alumni would like to see less reassignment, more familiarity with program requirements, and "more career direction from advisers." They feel the department "needs to provide a more supportive environment." Given the breadth of the CS field, it may also be appropriate to seek alumni help with career advising.

CS department needs more dynamic curriculum

Given the pace of change in the CS field, the department needs a mechanism for continuously incorporating new technology into the curriculum. Traditional subjects

need to be compressed to make room for new topics. Faculty need to retrain for new fields. Administrators need to streamline the course update process. One alumnus expressed concern that "things have changed dramatically in this area over the last ten years, but I see few changes in curricula."

Tom Burke (MCS'86) and Chuck Boyle (BS'84) are co-chairs of the CSAA advisory committee.

Survey: Vital statistics

Top five lists

Where respondents live

Illinois	54%
California	9%
Other midwest	8%
Virginia/Maryland/DC	7%
Massachusetts	6%

Where respondents work

Computer products	20%
Communications	18%
Consulting	14%
Financial services	7%
Research/development	5%

What respondents do

Commercial software dev.	23%
Systems analyst	9%
Project manager	8%
Consultant	7%
System software dev.	6%

Found introductory courses relevant to career

Software	88%
Architecture	59%
Theory	40%
Hardware	36%
Numerical analysis	21%

Found these advanced courses relevant to career

Software engineering	93%
Computer networks	78%
Database systems	74%
Programming languages	74%
Operating systems	68%

Most common application sequences

Business administration	22%
Psychology	20%
Accountancy	17%
Mathematics	9%
Economics	6%

Found these CS skills important

Testing	78%
Project management	77%
Networks/telecomm.	69%
Development methodologies	65%
Obj-oriented programming	65%

What employers seek

Team/people skills
Communication skills
Technical skills
Initiative
Ability to learn

New course ideas

Simulation
Information systems
Telecommunications
User interfaces
Software quality

Hot fields

Object-oriented
Networks
Database
Client/server
Software engineering

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the possibility of more resources, but I think it is also clear we will have to raise our entrance requirements and reduce the number of students admitted to our program.

Some might think computing is just another fad. Let me tell you about a statistic I recently ran across. (I guess we call these "factoids" now.) UI engineering college graduates are polled every few years by the placement office. One question they ask is, "What was the most beneficial course in your undergraduate program?" The result? The 1972 graduates polled in 1992 cited CS courses as more beneficial than any others, including math and physics—in fact almost as many as math and physics combined. I think it says that even though to some we may appear to be a new discipline with little of fundamental and lasting value—more glitter than substance—in fact we deliver the meat, educationally.

One way we do that is by continually renewing our courses and curricula. Last year I asked our alumni group to help by surveying our graduates to determine what we are doing right and wrong. I was amazed by both the effort that our alumni board members put into the survey, and by the number of our graduates who took the time to respond. This data serves us well in our current redesign of the curriculum. See Bill Kubitz's column for more details on what we are doing. And thanks for helping!

Elsewhere in this newsletter, you will learn about some new labs we will be installing for the fall semester, part of our program to continually update our facilities to provide the most up-to-date equipment for our students, and some other exciting events that are taking place here and elsewhere. I hope you will read through the entire newsletter and learn what your alma mater and former classmates are up to.

—*Duncan Lawrie, department head*

Where we're headed: the *new* curriculum

While computer science continues to evolve rapidly as it always has, the basic structure of our curriculum has changed little for the past ten years. This is not to say that course *content* has remained the same; it hasn't. In fact it changes almost every semester as the field evolves. Of course many obvious things have changed. In the early 1970s, courses were taught on an IBM System/360 Model 75. Data and program entry was by punched cards. There was no timesharing; all programs were submitted for batch processing using decks of cards. From the mid-70s to the mid-80s our computing used a UNIX timesharing environment. Since the mid-80s we have had a networked, client-server, distributed UNIX workstation operation. These kinds of changes have been integrated into both our research and instructional programs as a matter of course, but have fundamentally changed the way we do computing. Now we are about to make a fundamental change in our CS-Engineering program.

Our proposed new program encompasses several changes that break with our tradition as well as with some traditions of the college. A great deal of thought has gone into these changes, and we think it will move us toward a program that better addresses the current and future needs of the computing community. These changes allow our students to become more specialized, albeit at the expense of some breadth. We feel that there is little choice if the program is to remain a four-year program that attempts to address the very diverse needs of our graduates. Our graduates go out into an incredibly broad range of careers. Our program must be such that it can produce a wide variety of expertises. Our curriculum committee has been working toward this goal for more than a year. Simultaneously, our alumni board advisory committee has been gathering information from our alumni and from other universities. This information was provided to the department's curriculum committee as the process evolved. Now, what have we done?

Our first move was implemented a year ago. We worked with departments across the campus to come up with a list of pre-approved "application sequences."

This is the new version of the old "goal directed sequence." We changed the name to better reflect its purpose and to call attention to the change. Students must choose from the approved list or make a good case to follow their own proposed sequence. The application sequence is really an application minor (computer science is for the most part an entirely applied field, at least at the BS level), but we cannot call it a minor because minor is a "reserved word" for the higher education community, requiring approval all the way up the educational bureaucracy. The approved list of application sequences is intended to contain "substantive," related fields for computing. They range from biotechnology to business. In hours they range from 12 to 16 of more hours. For example, those in biological fields require chemistry through organic as well as several biology courses, a tough but very valuable and well-paying (!) application.

The other recent change was to the introductory software courses for majors. The sequence now begins with an introductory course on general concepts in computer science, but we no longer introduce one of the "conventional" programming languages in this course. Instead we use Scheme, a LISP-like, non-procedural language, to illustrate the concepts. This course is followed by a C++ programming laboratory where C/C++ syntax and concepts are taught and some programming tools are introduced. This is followed by the data structures course which is accompanied by a laboratory where the students apply their knowledge of C++, use of tools, and concepts in object-oriented design. We have taught this sequence for several semesters now and it seems to be a reasonable approach but is probably cramming too much in too little time. We will look into this more next year. The other courses are much the same ones conceptually as we have used recently but with the updated content as observed above. These are a discrete mathematics course, an introductory theory course, an introductory architecture course, a follow-on course presenting the programmer's view of computer architecture, an introductory numerical computing course, and an introductory circuits course (see d).

The major new changes proposed this year are:
a. We added a new introductory course for freshmen that covers what computer science is all about, features talks by alumni and others about their careers in CS, and provides information about our own program. The goal is to get students excited about the field and to let them hear from real practitioners. If you would like to come and give a talk, contact Mike Faiman!

b. We propose to drop the requirement of the second semester of chemistry, leaving only the one-semester requirement. Those needing more (e.g., for an application sequence) will of course need to take more, not less, chemistry, but one of the nice features of our application sequence is that it allows one to "fill in holes" that might otherwise occur.

c. A course in differential equations will now be required. Lack of this material has always been a bit of a problem in later courses involving hardware, numerical computing, networking, and now multimedia. Having this background will allow our students to take the new hardware course offered by the electrical and computer engineering (ECE) department (see d) as well as a follow-on signal processing course, one which students interested in multimedia will likely need to take.

d. Our department has largely gotten out of the low-level (circuit) hardware business. With the cooperation of ECE, we have developed a new introductory hardware course which ECE will offer starting this fall. This course will also be taken by other engineering majors. (We did the other engineering departments a favor by getting a more modern course started for their majors!)

e. We have merged the most important material in the programming language and the compiler courses into a single, new course. This allows us to incorporate new and more advanced material into the existing, follow-on courses. This new course is required of all majors. Thus, no student can graduate without knowing something about both compilers and languages.

f. At the 300-level we continue to require 18 hours of CS courses. One of these is described in e, and a second is the operating systems course. The only other required courses are one in architecture and one in theory. This means that students must select two more 300-level courses in an area of specialization. Our area committees are currently working on suggested course sequences for specializations of various kinds.

g. We have not changed the physics requirement yet because the college is working with the physics department to develop a sequence that will reduce the required physics from 12 hours to something less. At the moment it looks like it will be 8 hours with an option of one or two 2-hour courses. We will likely reduce our requirement if there is a sensible way to do it. This might free up 2–4 hours for use in some other way.

h. We have added two new courses, a senior project (design) course and a senior thesis course. The former is intended for students who plan to go into an industrial/business career, and the latter is intended for students who plan to go on to graduate school. The project is implemented with the cooperation of industries and businesses who sponsor the projects. We charge a small fee for this which ensures that the businesses take the project seriously. This has proven to be a tremendous experience for students who participate. The thesis is done by working with a faculty member in their research area. We would very much like to require all students to do one or the other of these, but we simply do not have the person power to deal with it, especially when enrollments are again rapidly on the increase. These projects also satisfy the university writing/speaking requirement thereby exempting the students from having to satisfy the requirement in some other way. And they provide the group experience that every employer wants to see!

These are the basic changes now proposed for our curriculum. I expect more changes almost immediately. I think that it may make sense to develop a single, unified theory, and perhaps architecture, course at the 300-level rather than offering a choice from two as we do now. This would be analogous to what was done in software. This has the advantage of having a first, 300-level course for undergraduates which is free from those pesky graduate students. Then the existing courses could, as with the software ones, become more advanced, but the undergraduates would be better prepared to compete in them. We will see. I think we will likely respond to any changes in the physics courses. I believe that this new program is flexible enough for our students to obtain a strong education of sufficient breadth while still allowing them to specialize in the myriad of opportunities available to the contemporary computer science graduate. This is computer U and we want our CS graduates to be the best educated and prepared in the world!

Thanks to our board members Ira Cohen, Tom Burke, Chuck Boyle and Doug Heuer for doing an exceptional amount of work in collecting data, surveying, and presenting the results of the survey to the faculty this past March, and to the board itself for its continuing input, chiding, and pressure to improve our curriculum. I'd also like to thank the student members of the curriculum committee, Amy Ryan and Joe Gross, who provided us with a lot of student opinion and occasionally "socked it to us."

—Bill Kubitz, chair, curriculum committee

Greg Chesson: Godfather of Networking

Greg Chesson, PhD'77, brought UNIX to Illinois and became a UNIX and networking expert. He went on to become one of the fathers of Silicon Graphics, where he remains today.

G reg Chesson describes himself as a "multidisciplinary guy." The term "quintessential Renaissance man" is more like it. Constantly working in areas where a broad spectrum of ideas and technology intersect is a theme that runs throughout his life. Chesson's many contributions to computer science over the years, particularly in networking, have earned him recognition among his peers. And he continues to be a creative and vital force in computing technology as chief scientist at Silicon Graphics, where he has been since its early days and where he is sometimes called the Godfather of Networking.

Chesson grew up in Stamford, Connecticut, and cannot remember a time when he wasn't taking things apart and putting things together. He was also always involved in music, having played the piano and percussion instruments at an early age. In 1962, his interest in machines and electronics led him to study physics at Union College in Schenectady, New York. After a year and a half, Chesson took a differ-

ent turn: he joined the U.S. Air Force and wound up playing drums in a field band. This led, upon his return to civilian life, to his playing drums and sometimes organ in various rhythm and blues groups around the country. While touring in the late 1960s with Wayne Cochran and the C.C. Riders, he met jazz great Woody Herman in Las Vegas, joined his band on drums, and performed with the jazz greats in Woody Herman's band at that time: bassist Monk Montgomery, pianist John Hicks, tenor Sal Nistico, and trumpet Bill Chase. "Greg is also a pretty good pianist," said Professor Denny Mickunas. "The entire programming language community got to witness this during a POPL (Principles of Programming Languages Conference) reception in San Francisco in 1975. The reception seemed to be dragging, so Greg sat down at the grand piano and played for about thirty minutes."

Eventually, he went back to Union and completed a math degree. When it was time to apply to graduate school, Illinois was receiving a lot of attention for its innovations in computer science, including the Illiac machines. "At that time, as now, Illinois was a standout. I chose Illinois because there I could do software *and* math *and* hardware...." But, as is often the case for out-of-staters seeing the midwest for the first time, Chesson was decidedly disappointed when he first arrived. "It was too flat. There was nothing to do. I drove out there in my Volkswagen, checked into the dorm and decided to drive around town. I drove for five minutes and hit cornfields," he recalled. Eventually, he became immersed in the academic environment and the scenery no longer mattered. "I was building software, operating systems, and doing compiler work." He was doing what he came to do.

One of the first things he did at Illinois that was to have a profound impact not only on computing at Illinois but on his later contributions to the field was to bring UNIX to campus. He got his first taste of UNIX in the R&D department at General Electric in Schenectady, New York, where he worked summers while at Union. Colleagues there had attended the first

presentation of UNIX given by authors Ken Thompson and Dennis Ritchie at the Fourth Association for Computing Machinery Symposium on Operating Systems Principles at IBM, Yorktown Heights, in October 1973. Looking for something else to do at Illinois and excited about UNIX, Chesson asked those around him if they had heard about UNIX and was met with a less than enthusiastic response. (No one from Illinois attended that historic UNIX presentation.) Convinced that UNIX was the way to go, he made it his mission to convince anyone who would listen that UNIX was worth getting into. "The computer science department didn't give a fig about UNIX and operating systems," Chesson recalled. "They didn't care about programming. They cared about theoretical computer science and building machines. Operating systems were not a respected discipline." (Oh, how times have changed!) Through letters and phone calls to Thompson and Ritchie, Chesson found out all he could about UNIX and how to obtain a university license to use it.

The UNIX license was finally obtained, but Chesson was to find out that the hardware at Illinois was inadequate for running UNIX. No way was that going to halt the mission. A search led by Chesson uncovered and claimed an unused PDP-11 sitting around the Center for Advanced Computation. Together with staff programmer Steve Holmgren, Chesson brought UNIX up (version 5).

"I recall the period of time when Greg had discovered a wonderful new operating system for the PDP-11s," said Mickunas, "something that his friend Ken Thompson made available to him, called UNIX. Greg would drag anyone and everyone into his office to demo the neat features of UNIX, including piping, background tasks, sniff, and job control. By the time that the department had installed its first 'CRL machine'—a PDP-11/45 with 64 KB of memory, and a pair of 29 MB 'washing machine' disk drives, Greg had convinced everyone that UNIX was the right choice as the operating system, rather than RSTS-11 or RSX-11, which were the standards at the time."

"Greg would drag anyone and everyone into his office to demo the neat features of UNIX . . . ."

Chesson became the first person at Illinois to produce a dissertation, which was on optimizing compilers, using UNIX software. "This was circa 1975," explained Mickunas, "and the only printing facilities available in the department were line printers. Greg wasn't satisfied with typed text and handwritten Greek letters, so he dug up a Diablo daisy-wheel printer that was being discarded by the Center for Advanced Computation (Slotnick's Illiac IV group) and refurbished it. Then he performed surgery on one of the old daisy wheels, filing away at various striking surfaces. Finally Greg wrote a little UNIX filter which allowed him to print each page in two passes: Pass 1 for standard text and, after switching to his 'handmade' wheel, pass 2 for Greek letters formed with various overstrikes."

At the Center for Advanced Computation, Chesson became heavily involved in all aspects of UNIX. When he found an extra instruction in the first UNIX chess program, written in assembly language, he pointed this out to its authors at Bell Labs, who were surprised and impressed. For Chesson, this almost symbolic event legitimized all the toil he had undergone—he had connected with the mothership of the UNIX world. "When I finally graduated," said Chesson, "that's who I wanted to work with. It was clear to me that that's where the best work in systems was going on." Chesson received his PhD in 1977.

At Bell Labs in Murray Hill, New Jersey, Chesson worked on "just about everything that comes
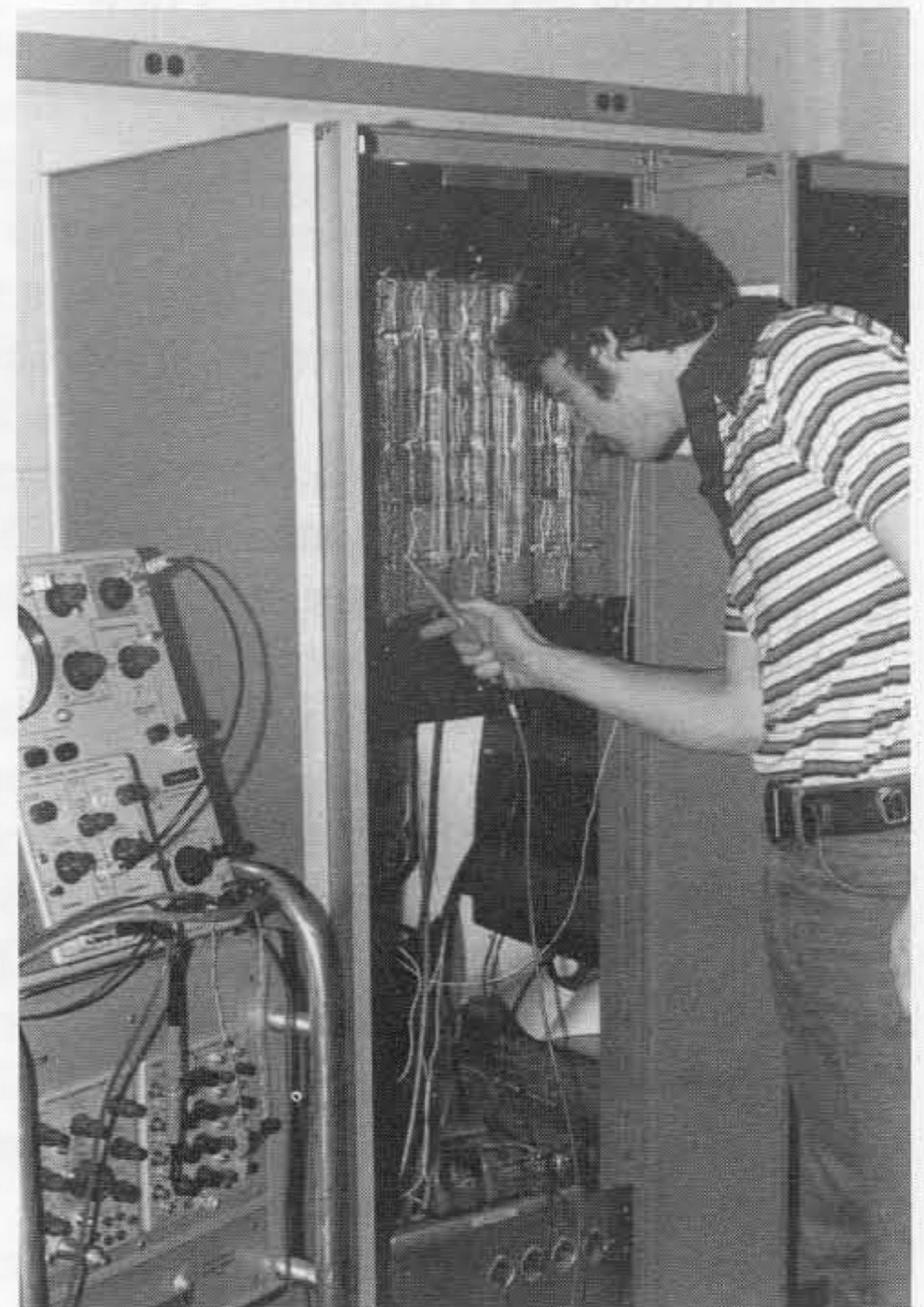
Al Whaley, PhD '84, working on his homemade multiplexer, which permitted some 24 terminals around the department to connect to the first departmental machine, a PDP-11/45. It was on this machine that Chesson installed UNIX.

under the heading of systems," from contributing to early versions of UNIX to designed protocols, processor architectures, and even building chips. "I had fine mentors at Illinois and a good preparation," Chesson said. "If I hadn't been able to do so many different things at Illinois, it would have been harder." After six years at Bell Labs, it was time to move on.

Bell Labs had hired several members of the first computer science class at Caltech, who were "very plugged into the the world of VLSI chip building." "It was a brave new world," recalled Chesson. "Few universities were doing it. Stanford was one." Jim Clark had just started Silicon Graphics, and many of the Caltech people, who knew him as a Stanford professor, joined him. "In the very early days of Silicon Graphics," said Clark, "I hired a couple of Caltech buddies from Bell Labs. One of them said I should meet Greg, because he was a UNIX expert and felt we would need his skills. I flew to Murray Hill to meet him, and the first day we met, we stayed up until four in the morning talking about technology and life. We immediately became friends, and it was only natural that he move out to join us."

C hesson chose to work with SGI "because they were the first company that was going to build their own VLSI chips and incorporate them into their own systems. It was cool to add the dimension of chip building as a tool," he explained. In 1982, Chesson was the twenty-second employee of SGI, which had only about seven or eight design engineers.

After thirteen years, Chesson is one of the oldest people at SGI, and he is still pushing the envelope of computer science and technology. Within SGI he is sometimes called the "Godfather of Networking." When asked why, he responded that he has always "focused on making

our network and interconnect subsystems be the best possible. One of the places where all of the disciplines of systems engineering come together is a network. The principles are the same whether you are connecting two computers, or connecting I/O devices to memories, or connecting subsystems within a VLSI chip or between VLSI chips. We have to look at the micro-, macro- and technology levels at the same time, plus we need some goals: e.g. cheaper, faster, smaller." These are precisely the kinds of problems that Chesson relishes.

"Greg is a tremendous asset to Silicon Graphics for many technical reasons, but like no one else, he adds a spirit to the organization through his intelligent sense of humor. Companies, like people, develop their character and spirit in their youth. They are a composite of the characteristics of the early employees of the organization. Greg's wonderful spirit and humor is directly responsible for much of what is called the 'Spirit of SGI,'" said Clark. "Greg is also a great teacher. He is extremely good at communicating his ideas, and I personally learned about networking from him, as well as UNIX. Silicon Graphics excels at graphics, networking, and computing. Without Greg, we would have been a simple graphics company, because that is all I knew. He and I together were the core technologists that covered all

The first departmental "CRL machine," a PDP-11/45 (actually a /35—an OEM model), along with the two IBM 2314 29MB removable disk drives (the "washing machines").

three during the crucial first years of the company. Greg could have done anything, from teaching to continuing research at Bell Labs, but he came to Silicon Graphics and held on during some pretty disappointing times to find the reward of being one of the fathers of the company. The company is large now, and he is not as universally recognized as I am, but his contribution to the nourishment and growth of the business were just as important."

Amazingly, Chesson finds time for running, serious woodworking, and gardening around his 1904 house in Palo Alto which he shares with his wife and five-year-old daughter. He is also starting to find time to return to performing music; you can catch him playing drums occasionally with the San Francisco Contemporary Jazz Orchestra.

Let us know . . .

what has been happening with you. Not only do the people in the department want to hear about your career and life, but your fellow alumni are also interested in your activities. Send info to address on page 19.

Fontaine Richardson
A Razorback goes from the land of corn to codfish

Fontaine Richardson has the distinction of being the second PhD in computer science that Illinois has produced. (The first, by several months, was Tom Slivinsky.) An early computer entrepreneur, Richardson founded Applicon, a company that pioneered interactive CAD/CAM systems. He is now with Eastek, a venture capital firm. Throughout his career, Richardson has maintained close ties with the Department of Computer Science and the University of Illinois, helping to foster research interaction between the department and the computer industry. He was the first president of the Computer Science Alumni Association and won the College of Engineering's Alumni Honor Award for Distinguished Service in Engineering in 1992.

Born and raised in Fayetteville, Arkansas, Fontaine Richardson earned his BS in Mathematics in 1963 and his MS in 1964 from U. Arkansas. At that time, graduate study in computer science was embedded in electrical engineering and math programs. Richardson entered Illinois's math department. After he arrived, he discovered the Digital Computer Lab and applied for an assitantship. He got one working for Professor Bill Gear on Illiac II. Illiac II had just been fired up in 1963, and there was a great effort to expand its presence on campus. One thing Richardson worked on was a timesharing operating system for Illiac II for four workstations. The resulting combination of software and hardware was not particularly reliable, but it did prove that it could be done and that Illinois could build a timesharing system along with the best of them. Even while working on the Illiac, he did all his coursework in math, passed the qualifying exam, and was ready to start a thesis. At about that time, in mid-1966, the university decided to start a PhD program in CS. He switched and began his thesis with Gear.

Richardson chose a graphics topic for his thesis work. "The idea was that you ought to be able to sit at a computer terminal and draw a flowchart and compose a program in flowchart form and have it run without having to write code line for line," he explained. He wrote it on a PDP-8 which was a front-end workstation for the Illiac II. Conditional and arithmetic statements were in boxes linked with lines. As the program ran, the box that was executing would blink, which was great for debugging. The concept was proven, and he wound up with about 25,000 lines of code on the Illiac II and PDP-8. Someone even made a movie out of it.

"The history of innovation, starting with Illiac I, showed that stuff coming from the University of Illinois could have impact. A lot of what came out of Illinois is used in products day in and day out. For example, cache memory came from the Illiac II (in this machine, it was an instruction cache)."

Richardson's childhood sweetheart from Arkansas, Judy Noyce (MS'65), joined him at Illinois on a fellowship in home economics, and they had a son in 1966. Richardson finished in 1968 and went immediately to Lincoln Labs in Massachussetts. The attraction there was a one-of-a-kind computer called the TX2, which had some very impressive graphics tools on it. (MIT and Lincoln Labs named their computers TX0 and TX1, according to Richardson. Illiac I and TX0 were similar, and Illiac II and TX2 were similar.)

At Lincoln Labs, Richardson worked on using graphics to design integrated circuit photomasks. In 1968–69, people were going from the complexity of a quad latch in a package, which was then state-of-the-art, to a dual inline 14-pin package, taking medium-scale integration to the next state. Richardson

Fontaine Richardson, PhD'68, was one of the department's earliest PhDs and entrepreneurs. He founded Applicon, an early application software company, which led the field in engineering design tools.

set out to answer the question of how to design the photomask and how to get the information onto production tooling. He did a proof-of-concept program on TX1 and showed it to the semiconductor world. "This is great," they said. "Where do we buy it?" The little lightbulb above Richardson's head clicked on.

One guy in Richardson's computer-aided engineering group had written a digital circuit simulator. As circuits got more complicated and faster, there was a need for better and better computer tools. So, in the summer of 1969, Richardson and three of his collegues left Lincoln Labs and founded a company to commercialize electrical engineering design tools. They called it Applicon. "Starting an application software company at the time was kind of crazy, kind of half-cocked," recalled Richardson. Only a handful of companies, including the Norden Divison of United Aircraft, GM, and Lockheed, were doing this sort of work. Applicon built a suite of four products: One was for designing IC photomasks, one was for digital circuit simulation, one was for frequency domain circuit synthesis, and one for microwave circuit analysis. All were to be sold via time- share, except of the IC photomask program, which required a stand-alone workstation or computer. Then, the 1969-70 recession hit and companies were unable to spend money on items with expense characterization. The only thing they could sell was the IC program because it had a computer and workstation, so it didn't hit the expense budget. If this was the only thing selling, concluded Richardson, this was the only thing worth concentrating on. So they did, and the product was called the Design Assistant. Its first customer was Matsushita in Japan. The company grew from there, expanding to include printed circuit boards and hybrid circuits, and another package was added for three-dimensional

designs (mainly for the automotive industry). They produced more and more applications, using the interactive screen design concept, and when Richardson left in 1980, after selling the company to Schlumberger, it was running at revenues of $100 million per year.

After doing consulting for a few years, Richardson joined Eastek, a venture capital firm where he now works. "The thing I enjoy the most," he said, "is working with companies that are trying to get established. With the benefits of all the mistakes that I've made plus a collection of other people's mistakes, I try and help people look at where they want to go." When he's not working, he's playing tennis or golf. He and his wife also enjoy diving throughout the world and observing underwater creatures.

"There's an incredible resource at the University of Illinois that has matured in the computer science department," said Richardson. "There's a heritage and a history that needs to be told." Richardson continues ot be a great ambassador for Illinois.

Faculty notes

Jane Liu was recently elected to the grade of Fellow in the IEEE for contributions to real-time task scheduling methods for computing systems. She has been with the department since 1973, and received her PhD from MIT.

Rajesh Gupta has won the NSF Career Development award for 1995. Gupta, a former Intel microprocessor designer, joined the department in January 1994. He has a PhD degree from Stanford. His research involves CAD for embedded and portable systems, and VLSI design. He also maintains an active interest in computer architecture and broadband communications.

Andrew Chien has won the NSF Young Investigator Award. Chien has been with the department since 1990, after completing his PhD work at MIT. His research focuses on software and hardware issues in high-performance computing, including concurrent object-oriented programming (compilation and runtime support), high-performance workstations clusters (high-speed coordination and communication), and scalable input/output (system software for parallel input/output).

Design Patterns: Elements of Reusable Object-Oriented Design, a book cowritten by **Ralph Johnson**, coordinator of project design activity for DCS, won the 1994 Software Development Productivity Award in the book division. The book, which was published in October, is now in its third printing.

DCS awards: 1995

Congratulations go to the following award winners who were honored at a reception held on April 7, 1995:

Slotnick Scholar
Chad T. Langley

Snyder Award
Daniel P. Maser and Yuxin Zhou

Pasta Award
Arkady Epshteyn

ICCP Snyder Award
Oscar R. Cwajbaum

Gear Undergraduate Award
Jeffrey C. Barcalow and Paul J. Rajlich

CNA Scholarship
So-Mai Leong and Patricia E. Mills

Gear Graduate Award
David A. Koufaty

Outstanding TA Award
Christopher A. Seguin

Gear Junior Faculty Award
Andrew A. Chien

Richard Cheng finds success with ECI

Richard Cheng, left, with his former adviser Professor Bill Kubitz, during a visit to ECI in July 1994.

Richard Cheng is chairman and founder of ECI Systems and Engineering, a company he founded in 1980. Originally called Eastern Computers Inc. and located in Virginia Beach, ECI integrates computer hardware, software, and telecommunication systems, and manufactures, assembles, and tests electronic and telecommunications components. Cheng has been the recipient of numerous awards including Minority Small Business Person of the Year in 1991 by the Small Business Administration. He serves on various boards of directors, including Virginia's Center for Innovative Technology and the National Defense University, and he was recently elected to serve on the Computer Science Alumni Association board.

Growing up in Nanjing, China, Cheng developed his passion for electronics. He was 14 when Mao seized power in 1949, and he and his family fled to Taiwan, where he attended Taiwan National Normal University and received BS degrees in engineering and in industrial education. In 1961, leaving a wife and two children behind, Cheng came to the U.S. on a scholarship to the University of Wisconsin-Stout. His family joined him in 1964. After graduating and then teaching at Wisconsin, he decided to continue graduate studies at Illinois, where he received an MS in electrical engineering in 1969 and a PhD in computer science in 1971.

Cheng recalled living in Orchard Downs with his family. And despite experiencing severe hayfever, he has fond memories of Champaign-Urbana. After graduation, Cheng began a career of developing computer science programs, at University of Wisconsin-Whitewater, Hunter College, Rochester Institute of Technology, and Old Dominion University. He also helped establish a program at King Saud University in Saudi Arabia.

Having believed for a long time that computing in one's native language was a must, Cheng devised a way to use a standard 26-character keyboard to generate Chinese characters. With the help of graduate student Yen De Yen and in collaboration with B. F. Chu of Taiwan, he designed and implemented a computer-mounted circuit board that translated various combinations of keystrokes into about 33,000 Chinese characters. He formed ECI to market the keyboard while he continued teaching at Old Dominion. As ECI prospered, Cheng expanded the company's horizons beyond the Chinese keyboard to 43 other languages. Almost overnight, ECI became a $3 million company when it landed its first government contract with the U.S. Information Agency in 1983 to supply foreign language computers to its posts worldwide. In 1985, Cheng left academia to devote his full attention to ECI.

ECI has continued to receive large government contracts: to design and run a broadband cable network in the Pentagon, establish a computer network for Department of Veterans Affairs' hospitals across the country, provide training for the U.S. Army Corps of Engineers, and, with a six-year, $240 million contract, provide nationwide maintenance on the mainframes that operate the Internal Revenue Service's tax processing systems. ECI now enjoys annual revenues in excess of $50 million.

Cheng feels strongly about establishing and strengthening ties with Asian markets. He also believes that ECI's future lies in high-tech communications and electronics, with a special drive toward building a strong manufacturing base. "Manufacturing was the bread and butter of this country and we sort of pushed it away to overseas," he recently told Transpacific magazine. "I feel that we must pick up this and do it again. Otherwise, we'll become a service nation."

Richard Cheng, PhD'71, left a flourishing career in academia for the high-stakes world of business as he runs his own multifaceted computer company.

Glenn Kowack: On the road again

Glenn Kowack, LAS'78, started his career as a UNIX programmer. Moving from one successful venture to another, he most recently headed EUnet, Europe's largest Internet provider.

Until very recently, Glenn Kowack has been chief executive of EUnet, Europe's largest Internet provider. Though Kowack got two BS degrees from Illinois, one in math and one in psychology, he practically lived at DCL, and we claim him as one of our own. (He was VP of the first Computer Science Alumni Association board.) He has traveled far and wide, during school and afterwards, and posesses a unique global perspective on the world.

While a student at Illinois in the early 1970s, Kowack wrote a book with Heinz von Foerster and about twenty others called The Cybernetics of Cybernetics. Von Foerster ran the biological computer lab on campus and was president of the American Society of Cybernetics. This book was funded by the Point Foundation, who put out the Whole Earth Catalog.

Kowack was influenced by computer science professor Dave Liu, and said that Liu is one of the characters that he carries with him through life. "He was one of the best professors I've ever had. You can get no higher in my estimate," said Kowack. "I met Professor Liu when I took his course in combinatorics where he was always asking for the magic formula." Kowack got his degree in 1978.

Kowack credits Rick Balocca (MS'80) for getting him involved with UNIX. At the time, Rick was a TA in CS and was able to sneak Kowack into the Center for Advanced Computation late at night to play with UNIX. After graduation in 1978, Kowack began his career programming UNIX for Bell Northern Research in Silicon Valley. This put him closer to the Whole Earth people, whose headquarters were in San Francisco, which was a plus. In the meantime, some Center for Advanced Computation people had formed their own company called Digital Technology Inc. (DTI) in Urbana. Its president was Pete Alsberg (PhD'71). DTI did research and development on protocol processing software and security systems. Kowack returned to Illinois to work for DTI where Dave Healey (MS'71) designed the first test suites for TCP/IP. Kowack did programming, quality assurance, became a group leader, and then ran the entire technical staff. The company changed its name to Compion, which was sold to Gould. Kowack ran Gould for four

years and left to work for UNIX International, a trade organization, when Gould was sold to Nippon Mining in 1988. A year later, Motorola bought Gould, and the facility is still in Urbana.

The fall of the Berlin wall in led Kowack to Europe. In 1990, on his way to Poland, where he started a Polish UNIX users group, Kowack stopped at EUnet, "a loose collection of academics running an e-mail system," in Amsterdam. In 1990, Kowack returned to Amsterdam to become CEO of EUnet. EUnet was running UUCP (UNIX UNIX Copy Protocol), a simple, cheap, serial line-oriented protocol for using Usenet across Europe). This proved to be an effective way to transmit e-mail over serial lines. "I held the banner of EUnet high inside and outside, and started the institutionalization of this," said Kowack. "I was giving talks all over the place, selling the Internet idea. EUnet really invented the Internet commercially in Europe." EUnet now operates 28 sites in 40 countries, with 200 employees, making it the largest Internet provider in Europe. In four years, Kowack helped set up a holding company in Ireland and an operating company in the Netherlands.

Kowack resigned from his position in early 1995. "I came for a consulting job, and it became too long," he explained. "I did everything I came here to do, and after four and a half years, I'm going to take a break and look at other options." One of these options is starting another company. With his track record, he is bound for another interesting journey.

Surf's Up: How're the WWW waves?

Professor Dan Reed and two colleagues (Robert McGrath and Thomas Kwan) from the National Center for Supercomputing Applications (NCSA) have recently written a paper addressing the access characteristics of the NCSA's World Wide Web Server, based on NCSA's server logs for a five-month period. In part because it is the distribution point for NCSA Mosaic, a Web browser, it is one of the most heavily accessed Web servers in the world. A study of access characteristics, supported in part the National Science Foundation, was conducted "to increase our understanding of how users access this server and to provide a basis for assessing server and system software optimizations." The researchers analyzed the access patterns in terms of user request patterns and responses of the server. Analysis of the resulting data showed that scalability, protocol efficiency, and effective caching strategies are the major issues for the next generation of Web servers. Because of the tremendous growth in demands on Web servers, more efficient and intelligent server and system file caching and prefetching strategies are needed. "To help understand the dynamics of Web server traffic," said Reed, "we developed a virtual world that allows us to walk about a representation of the traffic."

NCSA's Web server is actually a group of 12 Hewlett-Packard HP 735 workstations. The server architecture consists of three major components: 1) a network of servers that respond to requests from Web clients, 2) a round-robin domain name system (DNS) that makes the collection of servers appear as a single server to the outside world, and 3) a distributed file system that maintains the Web document tree. The server must handle the 30–40 Web requests per second that it now receives, and because the Hypertext Transfer Protocol (HTTP) is connectionless, each request appears to the server as a separate TCP/IP connection. With this architecture, the NCSA Web service is always the same, although the number and identity of the particular servers may change from day to day. The Web document tree is shared among the servers and stored by the Andrew distributed file system (AFS). Importantly, because AFS manages the shared document tree, the individual Web servers are not aware of either the number or identity of the other servers, making it essentially a "plug-and-play" system, where component servers can be easily added or removed without disruption.

Several general trends in request patterns were observed. Not surprisingly, most requests arrive during weekdays. And the growth rate over the five-month study period, weeks between May and September 1994, was roughly 14 percent per month. A surge in requests during September coincided with the start of university classes, confirming the significant impact of the student population. Requests from the major Internet domains edu (education), com (commercial), and gov (government) make up the largest blocks of requests with 26 percent, 18 percent, and 5 percent, respectively. The remaining 51 percent consists of requests from European and other domains. Text and images accounted for the majority of requests, though they are a small fraction of the total data volume. Audio and video account for only one percent of the requests but for 28 percent of the bytes transferred.

The researchers concluded that "as the number of requests to NCSA's and other Web servers continues to grow, the continued scalability of the server architecture, the efficiency of the HTTP protocol, and the effectiveness of caching strategies become increasingly critical research and implementation issues." In particular, they believe that both clients and servers must aggressively exploit caching and prefetching, based on knowledge of request patterns, data types, and hardware capabilities, to improve performance. More information on this study, including still images from a virtual reality display of the Web server traffic, can be found at http://www-pablo.cs.uiuc.edu/Projects/Mosaic/mosaic.html.

What in the world is wOrlds?

The Advanced Collaborative Systems Laboratory of the computer science department presented its wOrlds program to the public during a demo day in January. The project is headed by Professor Simon Kaplan.

wOrlds is a collaborative work environment that provides a metaphor for collaboration based around the notion of shared work spaces (called locales). Its features include integrated audio/video conferencing support; shared artifacts; seamless integration with the Web (using NCSA Mosaic) and e-mail; integration of platform and legacy tools, and a collection of specialized tools and applets such as navigators, postits, mailers, brainstorming support, shared annotators, etc. wOrlds also provides a collection of navigation support facilities for moving among workspaces and calling other users of the system. The demos showed off the use of the system in domains as varied as electronic commerce (selling cars, actually) and sofware development.

For more information, check out http://acsl.cs.uiuc.edu/kaplan/.

Maurice Wilkes: A pioneer returns to Illinois

Maurice Wilkes, a slice of blueberry pie in hand.

Maurice Wilkes, known as one of the founders of computing and the father of microprogramming, spent two very full days at Illinois as a guest of the computer science department. In addition to delivering the 19th Donald B. Gillies Memorial Lecture, he spent time visiting with students and faculty, and touring the campus.

Wilkes recalled the first time he visited the U of I campus, in August 1950. "What I miss now in America," he lamented "is blueberry pie. In those days, there was a drugstore on every corner and they all had soda fountains. And they all had blueberry pie." Wilkes came to Illinois in the course of "going around to places where they were interested in computers. There were only just a few, two or three, computers actually working at the time."

In 1951, as a result of this first Illinois trip, one of Wilkes's students, David J. Wheeler, came to Illinois to be an assistant professor. Wheeler programmed the ORDVAC in Aberdeen by teletype, one of the earliest remote uses of a computer. Wheeler was followed by two other Cambridge men: Stanley J. Gill and A. S. (Sandy) Douglas. Wilkes himself returned a few years later to see the Illiac in action. It was then that he became friends with Don Gillies.

Wilkes expressed his admiration for the late Professor Gillies and found it especially appropriate that he deliver the Gillies lecture. He actually presented two talks. The first was on recent advances in CMOS technology. In the second talk, Wilkes discussed the history of the computing field in a succinct, and often humorous, way. For example, in discussing the transition from vacuum tubes to transistors in the early 1960s, Wilkes described the obliviousness of the computer user to the revolutionary change inside his or her machine: "It was as though the foundations of a cathedral were being removed while services were going on as usual and the organ was playing."

While discussing the rapid pace at which advances in computing technology are taking place, particularly as chipmakers quadruple the number of transistors and double the speed of their chips every two years, Wilkes sees us approaching what he called the "CMOS endpoint," after which we will need to accustom ourselves to a much slower rate of progress. He put it simply: "You can't make things too small. They won't work." He is also interested to see how the two cultures that have evolved, the UNIX X-Windows workstation world and the PC Windows/DOS world, will shake out, saying that this situation cannot go on forever. Wilkes is optimistic, however, that research will continue at the level that it has, probably with software as the open frontier.

Wilkes closed his second talk with an expression of gratitude to computer scientists, past and present, by this quote from H. K. Clifford (1845–79), a popular lecturer on scientific subjects: "The thought which conquers the world is not contemplative but active." And then, he followed up with one of his own: "Computing is a practical art. It owes a debt to mathematicians and theoreticians, by all means. But the major debt is to the practical people, the engineers, the software developers, and users."
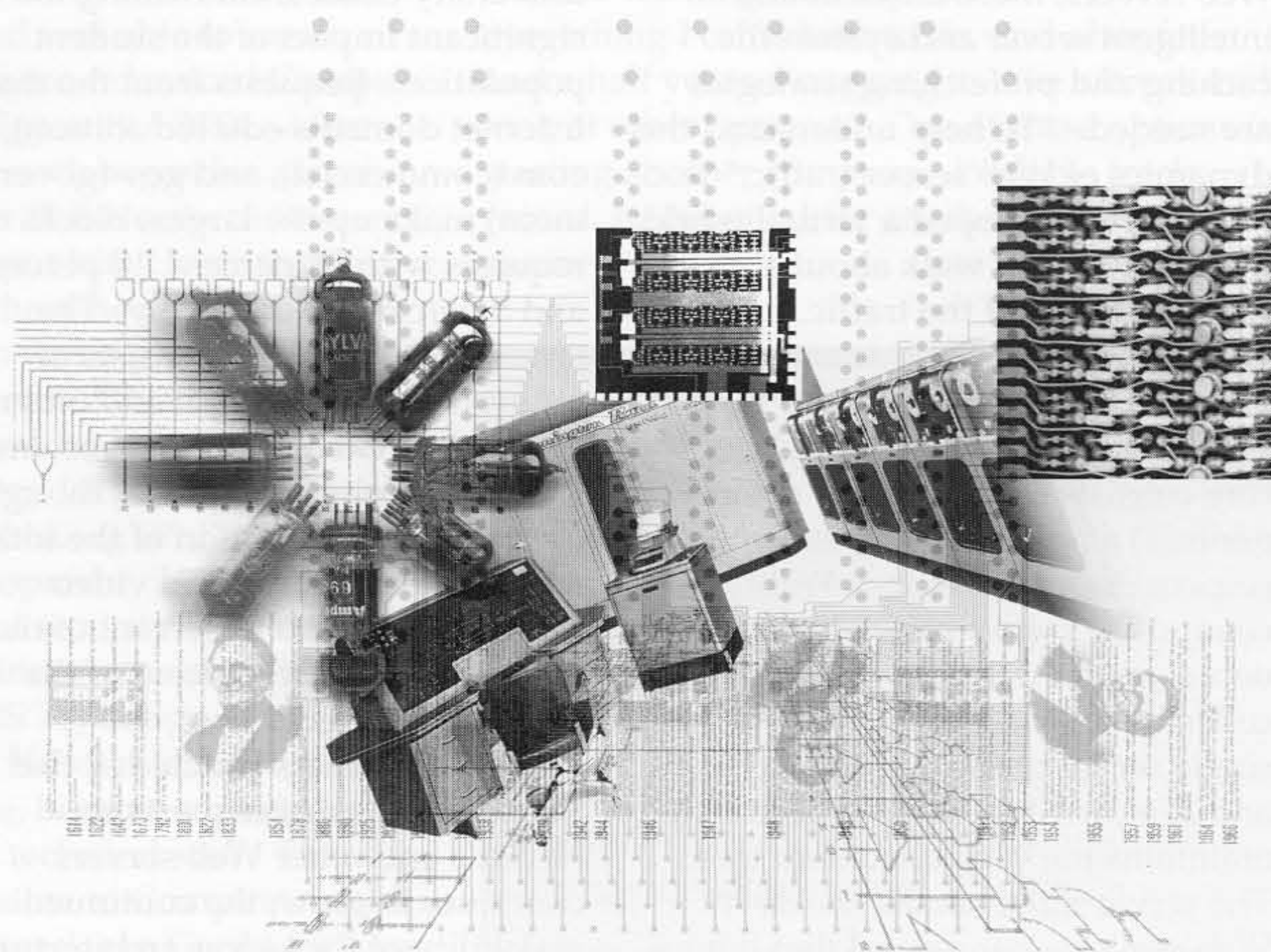
Design from Gillies lecture series poster, by Andre Kuzniarek.

About Wilkes

Maurice Wilkes, born in 1913, was for many years head of the Computer Laboratory of the University of Cambridge where he designed and constructed the EDSAC computer. He was one of the first to develop programming for a stored program computer and the concept of microprogramming. He wrote the first paper to appear on cache memories and was an early worker in wide bandwidth local area networks. Since 1980 he has been in industry, first with DEC and now with Olivetti Research. He is a Distinguished Fellow of the British Computer Scoeity, a Fellow of the Royal Society, and a Fellow of the Royal Academy of Engineering. He is a Foreign Assoicate of both the U.S. National Academy of Science and the U.S. National Academy of Engineering. He was the recipient of the 1980 Eckert-Mauchly Award and the 1992 Kyoto Prize for Advanced Technology. He has written a number of books, including Memoirs of a Computer Pioneer (MIT Press, 1995) and Computer Perspectives (Morgan-Kaufmann, 1994). The book The Preparation of Programs for an Electronic Digital Computer (Addison Wesley 1951), by Wilkes, Wheeler and Gill, is recognized as the first book published on computer programming. Wilkes is currently writing an article on Charles Babbage for the New Dictionary of National Biography.

New Multimedia Instructional Lab: Thanks to Hewlett-Packard

Thanks to a generous grant from Hewlett-Packard Company, CS students will soon have a new multimedia instructional laboratory. The gift, which includes a grant for the Grainger Engineering Library, will enable the acquisition of more than $1.2 million in computers and graphics equipment. The goal of the two-part gift is to help the university build the infrastructure for engineering instruction as it will exist in the next century.

The CS facility will include 15 HP 9000 Series 725 color workstations and a powerful K400 Series 800 server which will ultimately be linked to video equipment and a high-speed network in the CS department. This will enable the piloting of distributed multimedia instructional materials.

"The multimedia telecommunications aspects of this facility will revolutionize our teaching style and audience," said associate head Bill Kubitz. "Long term goals call for extending multimedia networking capabilities to other College of Engineering workstation labs and to a dormitory where many engineering majors reside." The facility's multimedia delivery capability points to "just the tip of the iceberg," he continued. "The future will allow access to multiple 'Learning Channels' where you can choose which courses to take, from a choice of suppliers, from remote locations and have delivered to locations of convenience such as the home or office, with essentially one-on-one interaction with your teacher." Initially, the facility will be used to expose CS students to the combination of audio, video and graphics, and the implications of this combination on computing and networking.

In addition, the facility will provide students with the means for accessing the Digital Library Testbed (DLT), a joint project of the University Library, the Grainger Library, the Graduate School of Library and Information Science, the National Center for Supercomputing Applications, and the CS department. Supported by a four-year, $4 million grant from the National Science Foundation, the DLT will provide the ability to access and use multimedia library materials across networks. Engineering documents and databases will be among the primary materials to be made available electronically through the testbed. HP equipment will be used at the Grainger Library to convert printed materials into electronic form. HP workstations will be used by UIUC software developers to create the information architecture that will underlie the DLT.

Calling all ACM alums

The ACM at UIUC wants to build stronger relations between its current and former members. Both groups have much to offer each other, and alumni hope to encourage and support the ACM activities that many valued so highly Former ACM members Sandra Wilton (BS LAS'94) and Alex Bratton (BS ECE'93) are putting together a database of ACM alumni who are interested in hearing about and participating in alumni events—both social and educational.

If you would like to participate, send your name, address, e-mail address, and telephone number (optional) to s-wilton@uiuc.edu or bratton@mcs.com or to ACM Alumni Relations c/o the computer science department address.

EOH'95: Once again, a grand success

by Eric Adams, 1995 EOH Chair

Engineering Open House '95 was yet again a grand success for ACM@UIUC. This year's theme was "75 Years of Innovation," celebrating the 75th anniversary of EOH. This year probably had the largest number of ACM members participating with somewhere between 70 and 100 people running around helping out at the three locations with exhibits.

Exhibits were shown at DCL, Engineering Hall and in Beckman Institute. In Engineering Hall, SigVR demonstrated its head mounted display (HMD) which had a line of participants eager to try it out all day, both days. The HMD consisted of two Pentium 90s, scan converters, and LCD panels mounted on a welding helmet. The LCDs were then focused on the participants' eyes with some optics handiwork, and the two PCs were networked together so they could stay in sync. As usual DCL was the focal point of

ACM exhibits. Exhibited were such things as SigArch's Cylindrical Display, a spinning array of LEDs which when viewed will render an animated picture. SigNet demonstrated MUMBLE, a program similar to IRC (Internet Relay Chat) but written to run using Multicast technology as well as an exhibit on how the DNS (Domain Name Service) redirector project works. SigGraph won two awards at EOH, one for a "PyroGraphics 101," an explanation and demonstration of computer graphics techniques, and another for "Jug It," a computer animation of a recursive juggler (you just have to see it to understand). The continuing project between the U of I Astronomy Society and SigMicro and their Computer-Aided Telescope System again won an EOH award as well as the Lockmiller Award for Robotics and Artificial Intelligence. SigUnix demonstrated the Illinet Web Interface which eases

access to the library catalogue.

In the Beckman Institute several projects of ACM members were demonstrated in the CAVE (Cave Autonomous Virtual Environment), an immersive virtual reality system for up to eight users at once. Tours were given every half hour during both days of EOH. All of the tickets for the tours were given away by 1 pm on Friday! Think about walking through a Sierpinski Pyramid or taking apart a puzzle floating in front of you. Many thanks go to CCSO, the College of Engineering, Xilinx Corp., everyone who stayed up all night both nights, and all of those who helped make EOH '95 a huge success.

For more information on ACM@UIUC, check out http://www.acm.uiuc.edu/. More EOH pictures at http://www.beckman.uiuc.edu/groups/biss/people/jgross/eoh/beforepix.html.

In memorium: Jerry Keiper, Mathematica developer
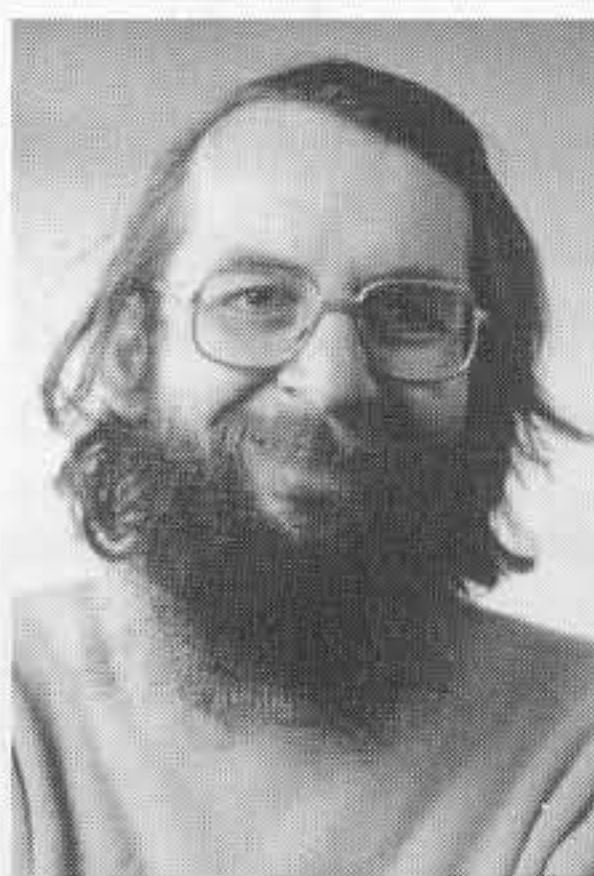
Jerry Keiper (PhD'89), leader of the numerics research and development group at Wolfram Research, was killed in a bicycle accident on January 18, 1995 at the age of 41. He received his BS and MS from Ohio State University in 1974 and 1975. His master's thesis showed that the Riemann zeta function could be expressed as a fractional derivative of the gamma function—the first of many results he was to obtain about special functions. After teaching high school for several

years, he returned to mathematics and earned an MS in applied math at University of Toledo. Then, after working with the Mennonite church and teaching in Nigeria, Keiper began working on his PhD at Illinois in 1984. He specialized in numerical analysis and worked with Professor Bill Gear on the solution of differential algebraic equations.

Stephen Wolfram, original developer of Mathematica, founder of Wolfram Research Inc. and a former CS department faculty member wrote: "In the spring of 1987, Keiper heard about the early development of Mathematica and approached me about working on the project. Knowing his interests in both special functions and numerical analysis, I

suggested that Keiper might work on finding general methods for the numerical evaluation of special functions. Existing academic and other work had been concerned mostly with evaluating specific functions to a specific precision for specific ranges of parameters. But I wanted Keiper to make Mathematica be able to evaluate any of the functions found in standard books of tables, to any precision, anywhere in the complex plane. Many numerical analysts thought this was an absurdly ambitious project, but undaunted, Keiper set about doing it."

After Mathematica was released in 1988, Keiper briefly returned to his PhD thesis project concerning differential algebraic equations, and

he received his PhD in 1989.

Keiper wrote a textbook, in collaboration with Professor Robert Skeel, of numerical analysis based on Mathematica called Elementary Numerical Computing with Mathematica. The book was published by McGraw-Hill in 1993 and is now a standard text in numerical analysis courses.

Illinois and the Pentium bug
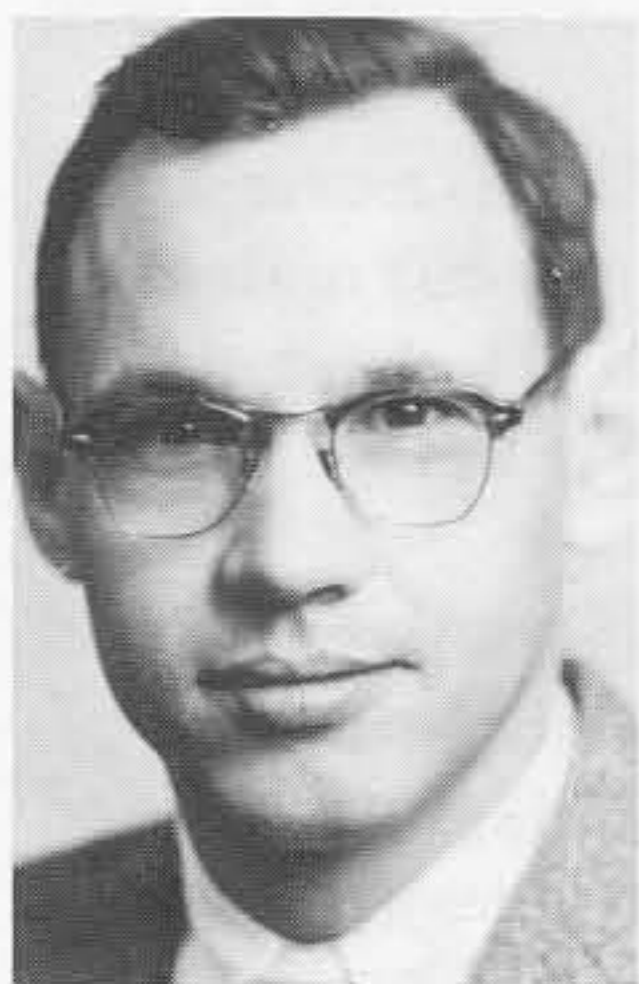
The late Professor James E. Robertson was with the department since 1950 and worked on Illiacs I and II.

"Every new microprocessor chip of higher performance has serious bugs initially," according to Professor Saburo Muroga. "Pentium was not an exception. But this time there was a big difference in media communication. Internet! The discovery of the bug instantly spread throughout the world." The bug was located in a PLA (progammable logic array) inside Pentium. This PLA stores predicted values for the SRT division method for floating point operation. Mistakes in values caused the bugs.

The SRT division method was pioneered by the late Professor James E. Robertson. It is named after D. Sweeney (IBM), Professor Robertson, and T. D. Tocher (Imperial College, London), and it was invented by the three independently at about the same time. It initially formed the basis of the hardware division structure used in the IBM 360 Model 91. It is now found both in hardware and software implementations of the divide instruction and widely used in the most powerful microproces-

sors. An alternative is to use multiplicative division methods (such as Newton-Raphson).

Robertson was a master of these kinds of algorithms, some of which are contained in his classic paper in IRE. Trans. on Electronic Computers, in June 1956. He is also known for the so-called "Robertson-diagram" used to describe divison algorithms. He (and others) later improved the algorithm by modified-SRT. The classic machine to use SRT was the ILLIAC III which used a high-radix (radix-256) arithmetic processor.

CS alums as media darlings

Illinois CS graduates represent major players in some of the most visible computer market battlefields. Perhaps nowhere are our young alumni so prominent right now than in the Internet arena. When we started tracking the original Mosaic developers after they left NCSA, it was possible to keep a file of press clippings on them. In a short time, this task became a full-time job, and eventually we gave up.

Marc Andreessen (BS'93), co-creator of the original Mosaic and now with Netscape Communications, has become quite the media sensation. He made both Newsweek's "50 for the Future" and Time magazine's "roster of America's most promising leaders age 40 and under." He was voted MicroTime's "Man of the Year," and Fortune magazine's roundup of 1994 Products of the Year included Mosaic, right alongside the Wonderbra and Mighty Morphin' Power Rangers.

SPRY, home of the original Mosaic team's Chris Wilson (BS'92), made headlines in March when it was bought by CompuServe for $100 million. "Everyone at SPRY is really excited about the resources that


Jon Mittelhauser (BS'92) stands next to an early rendition of Mozilla at his Netscape office in Mountain View last November. Mittelhauser and Chris Wilson (BS'92) ported Mosaic to Microsoft Windows on the PC while they were students working for NCSA.

Compuserve can offer," Wilson said. "We're now linked to the largest online service in the world." SPRY will maintain its individual identity and continue to offer products aimed to help "regular people" get onto the Internet. To wit: Wilson gave "even" his mother Spry's Internet in a Box last Christmas, which she regularly uses now.

Spyglass, official licensor of NCSA's Mosaic, made a big splash when its version of Mosaic was picked up by Microsoft for shipment with Windows 95. "At some recent technical conferences, Microsoft previewed World Wide Web technology based on Mosaic from Spyglass and NCSA," said Tim Krauskopf (MS'87), Spyglass founder and director of development. "They should ship by the end of the year." Spyglass handles all commerical licenses for NCSA Mosaic.

Former faculty member Stephen Wolfram, creator of Mathematica, and Steve Dorner (BS'83), creator of the e-mail program Eudora, also made the Newsweek top 50 list.
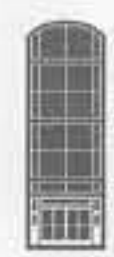
Everyone could use some Charm School

The First Annual Workshop on Charm and Message-Driven Execution took place on campus October 20–21, 1994. The workshop was organized by Professor Laxmikant Kale, director of the Parallel Programming Laboratory. The focus of the workshop was on object-based methods for parallel and distributed programming, with the specific emphasis on message driven objects. Kale and his research group were one of the pioneering groups in development and parallel implementations of message-driven objects, a concept that helps parallel computations adapt to variations in runtime conditions, generates automatic overlap between communication and computations, and promotes modularity. These concepts were embodied in the Charm Kernel system starting in 1987, and evolved into the current Charm and Charm++ systems for parallel programming.

The workshop was held at the Grainger Engineering Library. There were about 25 papers presented at the workshop, on topics ranging from systems issues, compilation, visual GUI-based tools for debugging and performance analysis, and languages, to applications in various areas. Many of Kale's past students, who hold faculty positions elsewhere and continue to work in the broad area of message-driven parallel programming, were present, with their own students. These included B. Ramkumar (PhD '91, now at University of Iowa), Wei Shu (PhD '90, now at SUNY-Buffalo), and Vikram Saletore, (PhD'90, now at Oregon State University). Other participants included a group from Illinois Institute of Technology led by Professor Thomas Christopher and engineers associated with NRAD in San Diego. The last official event was a panel discussion on the future of message-driven techniques. The panel included Professor Gul Agha, who developed the concept of Actors, which capture the semantics of message driven objects. The workshop was a tremendous success.

The Parallel Programming Laboratory explores many aspects of parallel and distributed programming. Specifically, the research involves tools, infrastructure, techniques and applications in parallel computing. The research on tools and infrastructure has centered on Charm/Charm++, a C and C++ based parallel programming language. A more recent focus is on "multi-lingual interoperability." This research aims at leveraging the benefits of many disparate parallel languages by allowing modules written in different languages to be linked in a single application. This is a difficult problem because of mutually inconsistent models used by different paradigms and languages. A framework for this purpose, called Converse, has been designed and implemented.

Reusing parallel software is harder because of additional contexts assumed by different modules. Yet such reuse is essential to amortize the high cost of software development in parallel/distributed programming. Based on the support for reuse provided by Charm++ and converse, the group plans to develop a collection of parallel libraries that can be reused without losing efficiency. Such tools and libraries constitute a key technology that can be transferred to the broader computer software industry. Only with such research will it be possible to jump-start the inevitable transition to broad-based use of parallel software.

The group is also involved with several collaborations in application areas. A significant collaboration involves research on biomolecular modeling, where the group is working with the Theoretical Biophysics group at the Beckman Institute led by Professor Klaus Schulten, other researchers who are supported by NIH, and a "grand-challenge application group" grant from NSF.

For more information, visit the home page of the Parallel Programming Laboratory at http://charm.cs.uiuc.edu.

Donors

Several names should have been included on our last donor list, which included alumni and friends who have directed their gifts specifically to the Department of Computer Science during the period from July 1, 1993 to June 30, 1994. We regret the error and would like to thank those donors here. (* denotes Presidents Council member)

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Classnotes

Teri Sue Gebben (BS'89) and **Alexander Chun Kao** (BS'89) were married in October '94. She is a systems development manager for IVI Business Travel International in Northbrook, Illinois, and he is a network manager for Logic Plus Inc. in Chicago.

Kurt Wagner (BS'88) maried Tanya Chu in June '94. Wagner is a programmer for Wyse Technology and lives in Sunnyvale, California.

Jeff Carson (BS'88) married Kelly Shanahan (BS Accounting'87) in October '94. He is a senior systems analysi for PSI in Lombard, Illinois.

Nayeem Islam (PhD'94) joined IBM's T.J. Watson Research Center in September '94 to work on distributed operating systems. As an IBM Fellow working for Professor Roy Campbell, Islam was one of the principal designers and implementers of the first operating system developed using an object-oriented framework.

Kenneth Rhodes (BS'81) married Nancy Baker (JD'85) in July '94. He is manager of the media architecture lab of Intel Corp. in Hillsboro, Oregon.

Gregg Rabideau (BS'94) married Rachel Ohrazda in July '94. He is currently a grad student in the department.

Wittaya Watcharawittayakul (PhD'88) visited the department in October '94. He is a professor of computer science at the National Institute of Development Administration in Bangkok, Thailand, where his research focuses on algorithms and architecture. He was in the U.S. to examine surveillance systems for tracking stock movement. He invites anyone visiting Thailand to look him up. wittaya@as.nida.ac.th

Joseph B. Sterben (BS'92) passed away in September '94. He was employed by Motorola and developed software for the automtive group in Northbrook, Illinois. He was also a graduate student at Northwestern University.

Sohail Aslam (PhD'90) reports that he has installed Mosaic on the LAN at Lahore University in Pakistan where he is an assistant professor in computer sciences.

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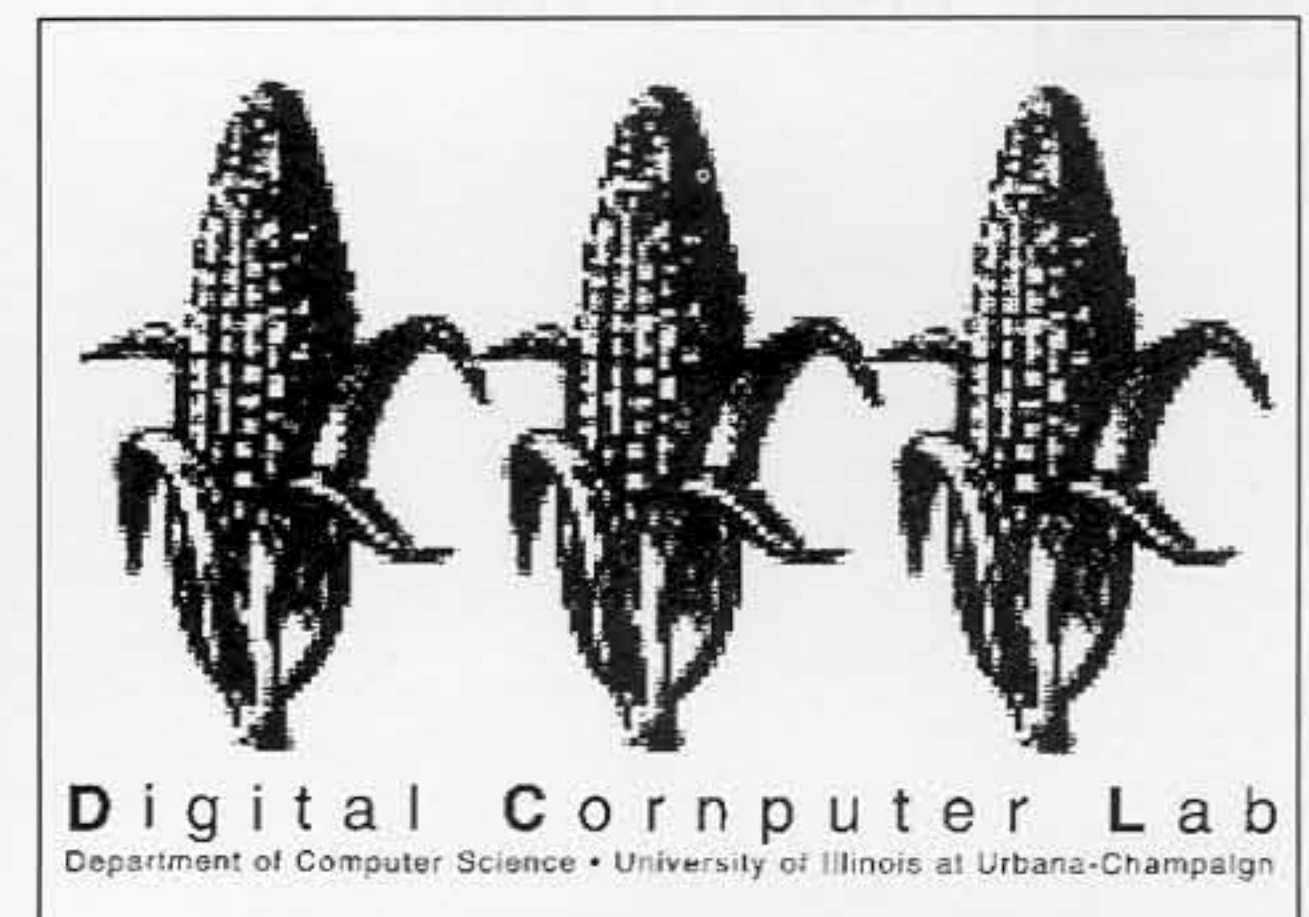
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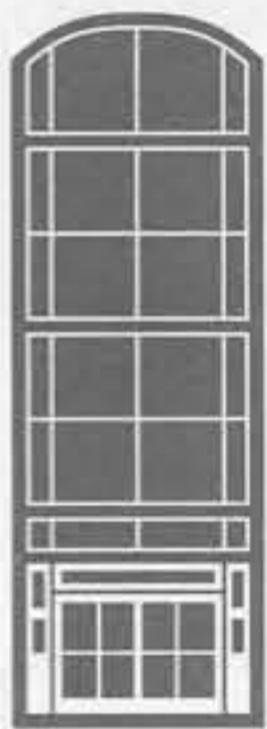Urbana, IL 61801

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You may notice that this issue of the Alumni News does not have a corporate sponsor. Therefore, the sponsor is *you*.

This newsletter is by far the biggest drain on CS Alumni Association money, most of which comes from our share of your dues to the University of Illinois Alumni Association. We hope to keep this going to our 4500 alumni and friends and 1000 current CS students.

How can you help? Join the University of Illinois Alumni Association. Sponsor an issue of the newsletter and receive a full-page placement ad. Contribute directly to CSAA or the department. Buy lots of mousepads and t-shirts. Contact me for details on how to do these things, 217–333–1621 or tolliver@cs.uiuc.edu. Thanks!

—*Judy Tolliver, editor*