NeXT on Campus
Summer 1990

Text Version. No Images.

NeXT ON CAMPUS.
RESEARCH. LEARNING.
EXPLORATION. STUDY.
ACADEMIC PROJECTS.
HUMANITIES. PHYSICS.
SPEECH RECOGNITION.
PERSONAL REFERENCE
STATIONS. GODZILLA.
USER GROUPS. MUSIC.
DSP. PRODUCTS. NeXT.

Welcome to *NeXT on Campus*.

This is the first issue of *NeXT on Campus*, a quarterly publication provided by NeXT to the higher education community.

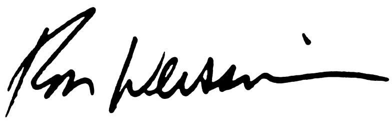
The 1990s are already witnessing significant improvements in the ways educators compute. At NeXT, computing environments are being designed to advance scholarship by providing sophisticated tools and a data-rich environment for learning and research. Powerful analysis, visualization, and presentation tools, and rich intellectual content are allowing the development of customized “scholar’s information stations” of man y kinds. Tomorrow, we will see such integrated environments as the foreign language workstation, the geographer’s workstation, the historian’s workstation, the physicist’s workstation, and the musician’s workstation. Welcome to the NeXT generation of academic computing.

On the following pages, we will share with you the most important NeXT-related news affecting college and university faculty and students: partnerships between NeXT and the college community, unusual academic projects and applications, exciting new products, and resources available to the NeXT community—a glimpse of the many ways in which NeXT technology is advancing scholarship.

I look forward to hearing from you, and receiving your ideas and news about projects on your campus. Please send your comments, suggestions, and contributions to:

next_on_campus@next.com

Yours,



Dr. Ronald F. E. Weissman
Director, Higher Education
NeXT, Inc.

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COLOPHON
NeXT on Campus was produced using a NeXT Computer and FrameMaker software. The trees in the illustration on page 7 were created by Jay Capela using a fractal generating program he developed on the NeXT Computer. Proofs were printed using a NeXT 400 dpi Laser Printer. Final, camera-ready artwork was created on a Linotronic 300 imagesetter.

CREDITS
This issue was written and created by Patty Kammerer, Keith Yamashita, Jean Craig-Teerlink, Eddie Lee, Joan Howard, Karen Steele, Susan Mandell, and Anne Kaplan-Neher. The illustrations on pages 3, 4, 5, and 15 were created by Jeff Yaksick. The illustration on page 7 was created by Jay Capela. Thanks to Sarah Cooper, Conrad Geiger, David Grady, Doug Keislar, Barry Silverman, and Jeff Wishnie for their contributions. Special thanks to the faculty, researchers, and students whose work appears in this issue.

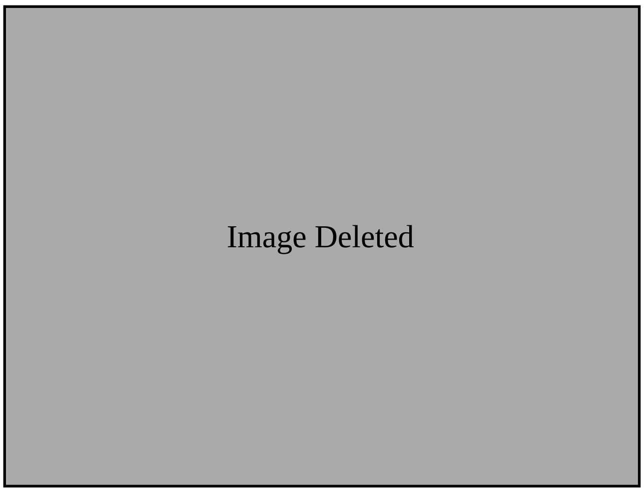
Campus Profile

Stanford University
Fostering discovery and learning

To the students and faculty at Stanford University, computing is an integral part of everyday life. In talking with Stanford faculty members and students who are using the NeXT™ Computer, a common theme arose: Computing is not only about getting day-to-day tasks done more efficiently, but, more important, it is about accelerating the process of learning and discovery. These faculty members and students are using the NeXT Computer to simulate, analyze, and visualize data, information, and events. In the process, they are testing old theories, formulating new ones, and uncovering the unexpected.

Developing a powerful searching tool for the humanities

"I'm now pushing workstations in the humanities," says George Drapeau, a workstation environment specialist at Academic Information Resources (AIR)—a group of technology advocates in charge of academic computing at Stanford. "At Stanford, it's no problem to give workstations to a computer scientist or engineer,"Drapeau comments. "We already know how to d o that. What we know less about is building tools for professors and students in the humanities."



A year ago, a colleague offered a challenge to Drapeau: Build a powerful text-searching tool for the humanities—a tool that would help professors and students analyze text in ways never before possible. Drapeau accepted the challenge. He started by looking for a search engine (a program that handles complex, multiple-criteria queries). After extensive research, he recommended that Stanford purchase PAT, which was developed at the University of Waterloo, and integrate it with the NeXT system.

Using Interface Builder™ on the NeXT Computer, Drapeau and his coworker Jayson Adams designed an easy-to-use interface for the search engine that enables even computer novices to perform complex searches across hundreds and thousands of pages of material—for instance, on-line books, articles, and research papers. Drapeau wanted users to be able not only to perform word or phrase searches quickly, but also to perform much more complex searches.

"Say, for example, you wanted to find all the occurrences of the theme of love in *The Adventures of Sherlock Holmes*,"says Drapeau. "You should be able to search for 'love' as well as for its synonyms. You should also be able to do Boolean searches — for example, be able to search for 'love' and 'death' but not 'hate' within a story. And you should be able to do proximity searches—for instance, searching for all occurrences of 'murder' and 'dagger' that appear within 50 characters of each other.

"The idea here is that you couldn't do this kind of analysis just by opening a book, even if you were to read it 10 times. With a computer, you can," says Drapeau. By being able to analyze the way text is organized, the types of words an author chose to use, and where certain words and phrases appear in a text, scholars can formulate and test their theories about the work.

The following are some of the ways Drapeau's program is being used:

- A graduate student in sociology has used the program to analyze the political changes happening in China. The searching program helped him analyze the content of reporting over time, seeing how the topics of conversation changed based on the events that week.
- A pathology professor is in the process of converting all past pathology records into digital form, and creating case studies for his students from these past records. Using Drapeau's

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program, students studying a particular case could then easily find related cases by searching by a particular symptom, or by doing a Boolean search for a group of symptoms.

- The secretary of the academic senate has 22 years' worth of senate minutes on-line, and would like to be able to analyze them—say, for instance, to search for similar discussions, issues, and decisions. He intends to use Drapeau's application.

Drapeau also plans to put a NeXT Computer in the undergraduate library to give all students access to the searching tool. He is also pushing Stanford to buy more on-line text. Stanford has already put the Bible, the entire collection of works featuring Sherlock Holmes, and numerous news files on-line.

Overall, Drapeau thinks the project is a great success. "When I first came on board here, my boss asked me to figure out the future of workstations at Stanford. Then the NeXT Computer came along, and I told them they should fire me — because the problem was pretty much solved. Hands down, it's the best for developing applications."

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Researchers at the Stanford Linear Accelerator Center develop a visual statistical analysis tool

In physics, as in many academic disciplines, researchers need to analyze vast amounts of data. Formulating new theories and testing established ones requires being able to look at the data in a variety of ways. Often, the greatest challenge lies in finding a tool that doesn't get in the way of the analysis.

At the Stanford Linear Accelerator Center (SLAC), data about particle collisions is collected from detectors at the end of the accelerator and then processed on an IBM® mainframe computer. A small group of researchers led by Paul Kunz has developed an application on the NeXT Computer to analyze these complex data sets and to test theories.

The goal was to create an application that gives physics students, professors, and researchers the ability to analyze data visually—in an intuitive manner.

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The application lets users set up analysis chains by using the mouse rather than having to write computer code. Users select an input (for example, a file that contains data about physics events), determine the analysis that should be performed, and choose the type of output to be displayed (specifically, the type of histogram, graph, or chart). Users can quickly execute a variety of cuts on the data. Because graphs and charts are produced almost instantly, users can immediately see the results of their work.

Kunz and his colleagues have already used their application on many different data sets containing thousands of physics events. "It used to be the case that working with a computer involved a tradeoff," Kunz says. "You'd have an idea of what you wanted to do, but completing the programming for it would often take hours. With our application, there's no programming involved, so analysis takes very little time and more tests get tried."

In designing the application, Kunz and his colleagues were careful to separate general data analysis functions from functions that are particular to physics. The application provides a palette of objects that perform operations such as input, output, looping, and the plotting of histograms. Physics-specific objects are organized on a user palette. Users can also write their own objects to perform any number of functions and include these on the user palette. As a result, the application can be customized to perform tasks applicable not just to physics but to any field requiring statistical analysis.

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“If you remove the barriers and difficulty associated with analyzing the data—if you make it easier to manipulate the data, to cut and browse through it—I believe you’ll do better work. You’ll discover things that might otherwise have been overlooked,” says Kunz. “You’ll actually understand things better.”

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Synthesizing the human singing voice

At the Center for Computer Research in Music and Acoustics (CCRMA), tucked in the hills behind campus, Stanford professors and students are pushing the boundaries of computer music research. Ph.D. candidate Perry Cook’s project—to use the NeXT Computer to synthesize the human singing voice —is a prime example of the innovative work they’re doing.

Since the early 1950s, when Bell Labs began researching how to replicate the human voice, spectral analysis models have been the primary method researchers have used for reproducing the human voice. Commonly, researchers have taken actual voice samples, analyzed them, and then tried to synthesize the sounds with a computer—essentially using a computer to mimic what the human ear hears.

Cook’s model takes a completely different approach. His project, called SPASM, is based on physical modeling synthesis and wave guide theory. In essence, he is trying to build a computer model that represents the physics of the vocal tract. Cook explains his approach: “Using a spectral model, the hardest thing is making the voice sound pleasant. But if you use a physical model, or start with a model that approximates an actual vocal tract, you’ll find that you can reproduce the voice much more accurately—and if your model is off, you can make adjustments more easily.”

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To duplicate the human vocal tract, Cook began by dividing it into a series of sections and defining the physics of each section. Using Interface Builder, Cook then built a graphical model of a human head. The radius of each segment of the vocal tract and the size of the opening into the nasal tract can be controlled using the mouse. A filtered noise source can be placed at any point within the tract to simulate consonants. Transitions between sounds—for instance, between two vowels—can be constructed by specifying initial and final sets of parameters, speed, and an interpolation curve for the transition.

“It used to be that researchers would come in at midnight to get run-time on the mainframe, because it would take nine hours just to get four seconds of sound,” says Cook. His mode l improves the situation dramatically: A user can generate a voice, and then can manipulate the vocal tract and hear changes in the voice—all in real time. The result is an application that Cook hopes will change the way musicians and composers work, giving them greater flexibility for studying the voice.

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Creating a new computer language for AI

From his office in Margaret Jacks Hall—the heart of the computer science department at Stanford—Chairman Nils Nilsson advises students on their artificial intelligence and robotics projects. One of these students, undergraduate Jonas Karlsson, sits at a NeXT Computer demonstrating his on-screen simulation of a robot navigating through a dynamic, changing environment. Karlsson types in a "goal" for the robot: "Go to the corner." Then he places obstacles in the robot's way. The robot moves across the screen, stopping briefly when it encounters an object. Responding to that object, the robot moves around it and continues on its way. The simulation is highly interactive: Karlsson uses the mouse to reposition the robot, forcing it to readjust and plot a new course to achieve its goal.

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The NeXT Computer enabled Karlsson to test the theories underlying his robotics simulation quickly. Building this simulation on any other computer would have been a daunting task. But by using Interface Builder, Karlsson was able to develop the user interface for his simulation in only a few months. Along the way, he was able to try different ideas about how the simulation should work and make changes to the interface as the project progressed.

One of the most difficult aspects of programming a robot to perform a useful task is that the information you can feed the robot about its environment is often incomplete and is constantly changing. To tell his robot what to do, Karlsson took advantage of ActNet—a programming language developed by Stanford Ph.D. candidate Rebecca Moore and undergraduate Mark Torrance, also under Nilsson's guidance.

ActNet bridges the fields of artificial intelligence and control theory by providing an easy way for programmers to program a robot in environments that are characterized by incomplete or changing information. It is based on the concept of action networks—trees of logic gates that select actions in response to sensory and stored data. Each gate has binary inputs and thus implements a Boolean function. Essentially, by using ActNet, a programmer is able to define a series of desired actions for a robot—"go forward," "go backward," and so forth. The robot will draw upon these actions to achieve its assigned goal, choosing the appropriate action based on feedback it gets from its environment—and then modifying its action based on the progress it makes.

So far, ActNet has worked exceptionally well in simulated settings. The next challenge is to use it to control multiple robots, each depending on other robots to do a portion of work. This, of course, would be directly applicable to real-world applications—for instance— controlling robots to build a space station. And, in fact, experiments are under way at Stanford's robotics lab to do just that.

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Campus Profile

Allegheny College
Creating a new learning environment

Over the next few years, large numbers of NeXT Computers will be employed in classes spanning the entire undergraduate curriculum, from English, philosophy, and music to mathematics, chemistry, computer science, geology, and physics.

The NeXT Computer is helping to provide the technological foundation for revolutionary changes in the undergraduate curriculum at Allegheny College, a small private liberal arts college in northwestern Pennsylvania.

"We believe that innovative approaches to the traditional liberal arts curriculum offer the best hope of educating young people for life in an increasingly competitive, technology-driven world economy," says Allegheny College President Daniel Sullivan. "Our youth must learn to think critically, solve ever-changing problems, and provide leadership. These are exactly the areas in which liberal arts colleges excel, and our new curriculum gets to the heart of this."

"The subject matter in the new curriculum hasn't changed—the college's revolution is in the approach to learning,"adds Allegheny College Provost Andrew Ford. "Professors here are focusing on creating new learning environments in which students are encouraged to experiment, explore, and make mistakes and learn from them." And the NeXT Computer is proving to be an ideal tool to foster this exploration.

Using NeXT across the curriculum

The goal is to support virtually the entire curriculum with a powerful, yet flexible, computing environment. "The NeXT Computer is not just an expensive typewriter or a replacement for a calculator. It's a very powerful thinking medium," says Ed Barboni, vice president for planning and information at Allegheny College. "It offers a forgiving environment in which students can test new ideas, see connections, and develop skills at their own pace."

And because they will use the same tools in all their classes, students are encouraged to apply the various problem-solving strategies that they have learned across disciplines. Barboni believes this will lead to a qualitative improvement in how students learn subjects as diverse as calculus, English, philosophy, and music.

NextStep offers ideal development environment

A major reason that Allegheny chose the NeXT Computer to support the curriculum is its very powerful and accessible academic software development environment, NextStep®.

"Without NextStep, I would be right where I was two years ago," says Barboni. "Back then, I was not encouraging our faculty to think about developing their own applications, because it was so difficult and time-consuming in relation to its impact on learning. Now it's just the opposite."

NextStep solved the problem of developing user interfaces, which is usually the most difficult and time-consuming programming task. As philosophy professor Joel Smith explains, "You can easily tailor the software to the class. A lot of things I am doing now in six hours would have taken me three months before. The exciting thing is that I can decide a few days before a class that we need to have a certain kind of application, and turn it around very quickly."

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Learning mathematics by focusing on concepts

Calculus is being taught in a lab of 13 networked NeXT Computers using *Mathematica*, an application that comes with every NeXT Computer. The faculty have developed several calculus notebooks and are collaborating and sharing notebooks with colleagues at other institutions. They are also using the NeXT Computer's word processing and graphics capabilities, which are designed to integrate with *Mathematica*.

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“The NeXT Computer and *Mathematica* allow the student to focus on the concepts rather than simply solving equations, because the machine handles the computations,” Barboni says. “Once students understand the concepts, they are motivated to learn how to do what the machine is doing.”

The physics, chemistry, biology, economics, and psychology departments are also interested in *Mathematica* for teaching mathematics and for use in conjunction with scientific instruments, data collection, and analysis.

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Enhancing communication in English classes

In the freshman English composition class, Professor Susan Smith discovered that the NeXT Computer provided a less intimidating learning environment that allowed her to communicate with her students in a new way. Taking advantage of the NeXT Computer’s standard voice-messaging capabilities, Smith asked students to send her rough drafts of their papers using electronic mail. Rather than taking the usual approach of writing comments in the margins, she reviews the papers and uses a microphone to add verbal comments directly into the text of the paper. To hear her comments, the students then click on the icons embedded in their papers.

Smith says that students who received the vocal commentaries showed demonstrable improvements in the quality of their writing. Ginger Willis, acting director of academic computing, says there were also some surprises: “The students feel the oral comments are much more helpful and very personal. They feel they have gotten to know Professor Smith in a way that they probably never would have if the comments were in writing.”

Smith has also created applications to help students develop critical reading and writing skills. To help students focus on the craft of writing, she encourages them to use on-line outlining tools, spelling checkers, and Webster’s dictionary and thesaurus.

“Nothing that I have done in 15 years of teaching writing courses at the university level has been as exciting,” say s Professor Smith. “When I asked my class how many of them wanted to continue to use the NeXT Computer for their written work, virtually every hand in the room went up.”

Exploring new possibilities in the humanities and music

The multimedia capabilities of the NeXT Computer can be used to create interactive learning environments. Several humanities professors are interested in using NeXT Computers with an application such as MediaStation™ to create a multimedia archive of class materials containing art slides, music, literary criticism, and other documents that will be shared among classes.

The music department is exploring the use of NeXT Computers to replace the traditional listening room in music appreciation classes. “The storage capacity of the machine, combined with its ability to link text, scores, and graphic images to sound, has great potential in this environment,” Barboni says.

One music faculty member plans to use the NeXT Computer as a tool for voice training. The machine has the ability to display graphic representations of the human voice, which can be used to help students train their voices more effectively. Using the MonsterScope spectrum analyzer, the student will see two windows on the screen, one with the “ideal”sound and another that the student uses to visually match his or her voice to the model.

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Making complex ideas in philosophy easier to comprehend

Professor Joel Smith plans to use the NeXT Computer to aid in teaching an introductory philosophy class called Models of Human Reasoning.Using exercises that Smith has de veloped for the computer, students will be able to explore and become comfortable with complex philosophical ideas at their own pace.

"Some students come in here unprepared to do abstract reasoning," he explains. "The idea is to get them to think about abstract reasoning before they have to use it widely, and to see how it applies in all their other classes, especially science."

Often, the best way to understand an abstract concept is by exposure to many concrete examples of the idea. Using Interface Builder and Objective-C, Smith has designed homework exercises that combine text, images, notebooks, and writing to give students the opportunity to study abstract ideas in a dynamic environment. Students can be exposed to multiple ideas simultaneously and see the connections between them. Smith says this better prepares the students for class, so lectures can become more of a discussion.

"If you could get young people to sit at their desks with five books open and a piece of paper, conceptually, it's the same thing," says Smith. "But a very major practical difference is that they will be more intrigued by this way of getting the information."

Providing the best technology to achieve educational goals

Over the next few years, Allegheny plans to spread NeXT technology to other departments throughout the curriculum, with the goal of using this tool to facilitate collaborative learning and connections between disciplines.

"This institution cares about one thing: providing the best educational experience we can for our students," Barboni says. "If we see a technology out there that can make a dramatic difference in support of teaching and learning, and we choose not to use it, then we're stopping short of achieving our goal. So really, I don't think the choice was very difficult."

Campus Profile

Rose-Hulman Institute of Technology **Building the foundation for an innovative curriculum**

The Rose-Hulman Institute of Technology, a four-year engineering college located in Terre Haute, Indiana, recently purchased 70 NeXT Computers to design and teach a new integrated, first-year curriculum in science, engineering, and mathematics.

At many colleges, the engineering curriculum is compartmentalized: There are physics tools for solving physics problems, chemistry tools for chemistry problems, and mathematics tools for mathematics problems. Educators at Rose-Hulman believe that this compartmentalization cripples learning, because ideas, concepts, and problem solving techniques in one discipline do not support learning in other subjects. The goal of the new curriculum is to give students broader problem-solving skills—the kinds of skills that can be used in all their classes.

For example, students will be taught fundamental mathematical concepts—such as differentiation—by focusing not on manipulating equations, but instead on understanding how concepts apply to actual problems in physics, chemistry, and engineering.

Jim Eifert, vice president for academic affairs, believes that workstation technology will have a profound effect on the profession of engineering. "Because the computer can do the mathematical calculations, it will make the field of engineering more accessible to those who may not be naturals at grinding out mathematical equations," he says. "This will open up the profession to more creative minds with new perspectives on solving problems."

By standardizing its curriculum on one computer, Rose-Hulman will help students make connections between disciplines. Jeffrey Froyd, associate professor of electrical engineering, believes that the NeXT Computer offers exactly what students need. Because all NeXT applications— word processing, graphics, electronic mail, and *Mathematica*—work together, students are able to move data between programs easily, which encourages them to explore different problem solving techniques. And the NextStep development environment will enable professors to create customized courseware that fosters a creative learning process.

"As an educator, I need to look down the road 20 years to when these students will be at the peak of their careers," Eifert says. "Engineers in the future will do a lot less manipulation of equations and a lot more creative thinking. So we need to prepare these students now to be able to excel in that environment and teach them with the tools they will be using in that future world."

Academic Project

Pennsylvania State University

The personal reference station: Meeting the information explosion head-on

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Society is experiencing an information explosion, yet our ability to comprehend and use this information is limited. The challenge lies in finding a way to easily access, organize, and navigate through this data. Higher education is one of the places where this challenge is felt most keenly.

John S. Mayer, M.D., assistant professor in the Department of Radiology at Pennsylvania State University's Milton S. Hershey Medical Center, believes that the NeXT Computer can help people meet the challenge.

"I think the NeXT Computer is the first personal workstation that will realistically allow nonprogrammers to better assimilate and manage large volumes of reference literature," says Mayer.

The concept of a digital reference library is especially intriguing to Mayer. Dr. Mayer and his project team are currently working on their first contribution to the Digital Library: an on-line version of *Gray's Anatomy*, the classic human anatomy book with more than 1,600 pages and 1,000 illustrations. The program will have a variety of options and features, such as fast searches, book markers, and "notebooks" for collecting excerpts and taking notes. It will also be able to interact with other NeXT applications such as Digital Webster™—an on-line dictionary and thesaurus that comes with the NeXT Computer. With the on-line version of *Gray's Anatomy*, physicians, medical students, and anyone else interested in human anatomy will find it more convenient and efficient to look up anatomical facts.

"We're anxious to set a standard for how digital reference books and periodicals should look, feel, and, of course, perform," says Mayer. "Our digital on-line references won't replace the bound volumes, but they *will* offer advantages. For instance, they'll give you the ability to conduct powerful searches, to manipulate data to meet specialized needs, and to compare text and illustrations side-by-side. They could also interact with other applications that would supplement *Gray's Anatomy*."

Another major advantage of digital references is that they support interactive images. As Mayer explains, "Interactive images are particularly useful for studying anatomy in the broad sense: aside from human and animal anatomy, let's say, the anatomy of machinery. Suppose you needed to know where a particular component would fit into a complex machine. You could double-click on its name, which would bring up a diagram showing that part highlighted and labeled in the machine. That kind of reference is pretty powerful.

"I think the NeXT Computer has the potential to function as a personal reference station—a great personal reference library. Until now, affordable, easy-to-use personal workstations have not had enough memory, speed, or storage capacity to enable nontechnical people to manage large volumes of digital literature. The NeXT Computer has changed that. In the overall picture, what NeXT offers is a harmonious orchestration of hardware and software features that is more advanced than that offered by other computers with graphical interfaces."

In explaining why he chose the NeXT Computer for his project, Mayer cites the easy-to-use development environment featuring Interface Builder and NextStep, the UNIX® operating system, the high-resolution display; and the computer's large memory and storage capacity. "The NeXT system is a clean new start, very well thought out," he says.

"I see the Digital Library as one of the greatest advantages of this machine, and maybe its most significant contribution to society. Once we get a critical mass of reference literature on-line, the NeXT Computer should be theworkstation of choice for many professionals. It would be useful for the study of any topic imaginable—from economics to art history to astronomy," Mayer concludes.

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Academic Project

Princeton University

Composing music — and comparing notes

Computers have been used in the field of music for some years now—but the relationship has not always been a harmonious one. According to Paul Lansky, professor of music at Princeton University's Computer Music Lab, the NeXT Computer has changed that.

"I think that the NeXT Computer is the most important musical development to come along in years," Lansky says. "It's the first computer that combines a lot of things that we've been forced to piece together in the past. We really like the total package—the environment, the Digital Signal Processor, the Music Kit™, the Sound Kit™, the converters, the Objective-C programming environment, the MIDI driver, and Interface Builder. It's a package that we think is really coherently and brilliantly thought out.

"Given the software that's there, and the hardware, and the development that companies such as Ariel are doing, the NeXT Computer really looks to us like the music machine of the future—so we're intent on supporting it in every way we can."

The NeXT Computer is being used by the Computer Music Lab at several levels. Lansky and his graduate students are using it for music production.

Lansky has had his NeXT Computer since last summer, and has already used it to produce three computer music pieces. "That's very rapid for me," he says. "Usually, I produce one or two pieces a year."The three pieces—two of which will be released commercially next fall on compact disc—are a varied lot. "They're musical images of aspects of the real world," Lansky explains. "One is about somebody playing rock-and-roll guitar, another is the processing of a conversation in Chinese, and another is about the sounds of a shopping mall."Lansky uses these sound inputs as musical sources with which to make musical patterns and shapes. "The piece about the guitar, for example, is sort of a musical portrait of a player. I took large stretches of improvisation that he did, manipulated them, and added computer instruments to go along with it. Then I did a lot of editing, reverberation, and room simulation, and put it all together."

At the undergraduate level, Lansky is using NeXT Computers for several courses he's teaching. Students have access to a lab with four NeXT machines, which they use for a variety of purposes. The computers—along with a number of synthesis languages, such as CSound from MIT, and NeXT's Music Kit—enable them to experiment with sound in ways they couldn't otherwise.

Princeton students are using NeXT Computers to make music even after they leave school. Two of Lansky's former graduate students are now using NeXT Computers to produce music for commercials and MTV.

According to Lansky, NeXT is a great machine for computer musicians. "It's an extremely useful package for us,"he says. "And for the first time, we're able to share a lot of software with people all over the country who are using it. Being able to share establishes a sense of community that is really lively and interesting and makes the whole development process much faster."

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Academic Project

University of North Carolina at Chapel Hill

Solving equations and predicting earthquake behavior

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Being a geophysicist can require spending a lot of time with computers. There are immense amounts of data to handle. Complex equations to solve. And sophisticated graphics to produce, both for analyzing the data and for communicating findings.

Dr. José A. Rial, associate professor of geophysics in the geology department of the University of North Carolina at Chapel Hill, is using the NeXT Computer for all of these tasks. He is especially enthusiastic about the computer's data-storage capacity, graphics capabilities, and *Mathematica* interface.

"The NeXT Computer gives me the ability to have hundreds of megabytes of data on a single optical disk—for instance, all of the California and Japan seismicity information (data on earthquake location and time of occurrence) from this century," says Rial. "With respect to graphics, the grayscale that I can obtain makes color superfluous. Since I don't need to use color, I can publish my results much more cheaply. And I like the front ends that the NeXT object codes allow me to construct to deal with *Mathematica*. Using *Mathematica* with the NeXT Computer is a dream, because of all the graphic software you can access, and because of the very high quality printout."

Rial is a seismologist and theoretician who specializes in wave propagation, chaos, and nonlinear dynamic systems in geophysics. One of his primary areas of research is called "earthquake hazard estimation." Using data such as seismograms, he performs mathematical analyses to predict not *when* earthquakes will occur in a given area, but *how* that area will behave during a quake.

"We know that the strength of the shaking depends a lot on what types of soils you have underneath," he explains. "Many cities— like Los Angeles and San Francisco—are built on flat land surrounded by mountains. The land is flat because it started out as a trough and has been filled in with all kinds of soft sediments. As the bowl-shaped basin vibrates during an earthquake, the sediments in it oscillate at resonant frequencies. I'm trying to figure out the resonant frequencies of oscillation of sedimentary basins."

The work has very serious real-world implications: "Once we know what the resonant frequencies of a particular basin are," says Rial, "we'll have to design buildings that do not oscillate at those frequencies to avoid the destructive effect known as 'double resonance.' This happens if buildings oscillate in unison—at the same frequency—with the ground, absorbing all of the shaking force until their oscillations grow so large that the whole structure shatters and collapses."

Rial has found the NeXT Computer of great help in his research work, which depends heavily on graphical representations of mathematical functions. "I've been doing some beautiful graphics with *Mathematica*, evaluating functions," he says. "One thing I do is model solutions to partial differential equations. I know more or less what the solution is, and I can use *Mathematica* to evaluate it within a certain domain. It's wonderful, because I can see what the solution is going to look like. This gives me lots of clues as to how to proceed theoretically to guess the right solution.

"It's very exciting. Two days after I got my NeXT, I was doing simulations of solutions to partial differential equations just by typing a couple of lines in *Mathematica*. Getting the same kind of results, and at a much lower resolution, with my other computers would have taken me about two months of programming. On the other computers, it's hard work just to do the graphics well—things like putting in the scales, and grading the grays. Using *Mathematica*, all that is given. You can worry about what really matters in your work."

Along with using the NeXT Computer in his research work, Rial hopes to use it in a graduate/undergraduate class he'll be teaching. In this course, called Geomathematics, students will use *Mathematica* to become familiar with solutions to standard differential equations in physics: wave equations, diffusion equations, nonlinear systems, and so forth.

One of Rial's goals is to convince geology students that mathematics is useful, and that they can let computers do a lot of the work. "The computers can help the students visualize things in three dimensions, in nice projections from different viewpoints, and for all the domains of parameters they want. And geologists appreciate that, because they work with pictures, not equations. They have pictures in their minds when they think. By helping researchers and students picture things more clearly, the NeXT Computer can help them think, solve problems, and communicate more effectively."

José A. Rial
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Academic Project

Los Alamos National Lab

Managing multimedia as a learning tool: From computer graphics to *Alice in Wonderland*

Image Deleted

The printed page has traditionally been one of the most widely used ways to record and communicate information. But reading a document isn't always the most effective way to *learn* new material. Many topics are better communicated by means of sound or video. Or by a combination of these and printed text.

Richard Phillips, staff member in Los Alamos National Laboratory's Computer Graphics Group, has developed an application on the NeXT Computer that combines digitized text with a variety of media to provide a powerful learning tool.

In developing the application—called MediaView—Phillips' first project was to make it possible to interactively browse through the proceedings of a SIGGRAPH conference (an annual meeting that brings together top computer graphics professionals from around the world). This involved converting all of the papers from the proceedings into digital form, and then adding multimedia components. These components included:

- High-quality digital images that could be manipulated interactively
- Videotapes—clips from videos shown during the original presentations
- Sound—such as the question-and-answer sessions that followed the presentations
- A link to the program *Mathematica*—to allow the user to manipulate mathematical expressions included in the papers
- Digital "paste-on" notes—to make it easy for the user to add notes anywhere in the material
- "Draw-it" notes—to let the user add notes in graphical form.

In the future, Phillips hopes to include the actual computer graphics programs that were demonstrated at SIGGRAPH.

According to Phillips, the NeXT Computer was the only computer available that could handle the project. The system's sound capabilities, and the fact that they are integrated into the entire development environment, were especially important. And the development environment itself, with the Application Kit™ and Interface Builder, proved invaluable. Phillips began work in February 1989 on the proceedings from the previous summer, and had demonstrable results in time for the next SIGGRAPH conference, in July 1989. "I can't imagine any other environment that would have let me get as much done in such a short time," he said.

Phillips chose to use the SIGGRAPH proceedings as the basis for his first MediaView project because, as he said, "as a body of literature it's very demanding. It probably has as many multimedia components as you would ever run into. But the intent was never to limit it to those kinds of things. Rather, MediaView is intended to be a general 'corpus manager,' for which the corpus could be any body of literature. In fact, what I'm working on right now is *Alice in Wonderland*.

"In general, the best application of MediaView would be in situations where multimedia components would help to amplify the literature or make it more interesting. It could be used for training or teaching in almost any field. It would also be useful for fostering collaborative research —in medicine, physics, mathematics, engineering, or whatever—because documents in digital form are so easy to annotate and exchange with other people. As a tool for learning and communicating information, its possibilities appear to be endless."

Richard Phillips
Staff Member

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The DSP: Making computers listen, speak, and sing

by Julius O. Smith
Signal Processing Engineer
NeXT, Inc.

In brief: Digital signal processing
For analog signals, such as sound, to be stored in a computer, they must be "digitized,"or converted into a set of numerical values. Processing signals in digital form is called "digital signal processing."

Imagine being able to talk to your computer—and to have it talk back. You could say commands, rather than typing them or selecting them from menus. Verbally dictate correspondence, database entries, and other information for the computer to type and file. Ask the computer to look up information and read it to you. And do any of these things remotely, via the telephone.

This kind of "natural interaction"between humans and computers isn't just the stuff of science fiction. The technologies that will make it a reality are being developed today. Exciting work is already being done in areas such as speech recognition and music synthesis—the beginnings of natural interactions with computers.

Much of this work is being done with NeXT Computers, thanks to the Motorola DSP56001 Digital Signal Processor (DSP) that is included in every computer. The DSP chip, which is installed alongside the central processing unit and floating-point processor, offers extremely fast processing of digital signals—including sensory data such as sound, music, speech, and images. The DSP also handles data compression and expansion, a valuable feature when dealing with the very large amounts of data typical of sound files.

Because the DSP is included in every NeXT Computer, developers and researchers have a standard platform for exchanging music applications, sound files, and other software—and the opportunity to routinely include advanced "sensory interactions," such as speech and music, in their applications. To meet the requirements of speech and music, the DSP is supplemented by hardware and software that enables it to generate sound of the same quality offered by compact disc players.

The DSP56001 is designed specifically for digital signal processing. It is a fixed-point chip, so it is not primarily for floating-point number-crunching. (A floating-point coprocessor, the Motorola 68882, is also built into every NeXT Computer.) What it excels at is processing music, speech, and other real-world signals.

Some of the most promising work with DSP technology and the NeXT Computer is being done at universities. The following is a sampling of these academic projects.

The Sphinx Speech Recognition system developed at Carnegie Mellon University is widely regarded as one of the best of its kind. Using the DSP chip, Sphinx runs in real time for 40- to 50-word vocabularies. It currently has a recognition rate of better than 96 percent for a 1,000-word task with moderately difficult grammar. The Sphinx team includes Raj Reddy, Eric Thayer, and Fil Alleva. The Sphinx system is based on recent thesis research by Kai-Fu Lee at Carnegie Mellon. For more information, contact Alex Rudnicky at air+@cs. cmu.edu.

At the University of Michigan, Gregory Wakefield and John Feng are developing NeXT courseware for a class in signal processing. The class will cover spectrum analysis and digital filter design. Wakefield will be offering a two-day workshop in late July on the package in Ann Arbor, Michigan. For more information, contact Wakefield at ghw@caen.engin.umich.edu.

The Computer Audio Research Laboratory (CARL) at the University of California, San Diego's Center for Music Experiment has ported its *cmusic* program to the NeXT Computer. *cmusic* is a general-purpose computer music program, that has been modified to produce and process NeXT-style soundfiles. In addition, a new phase vocoder program (a tracking spectrum analysis system) has been implemented on the NeXT Computer. To obtain the CARL software package, consisting of about 115 programs for computer music, including complete sources and documentation, contact F. Richard Moore at frm%plexus@ucsd.edu or write to him at CARL, Center for Music Experiment, Q-037, UCSD, La Jolla, CA 92093.

At Stanford University's Center for Computer Research in Music and Acoustics (CCRMA), NeXT is the development environment for a variety of research projects:

Perry Cook's SPASM project. (See Stanford article.)

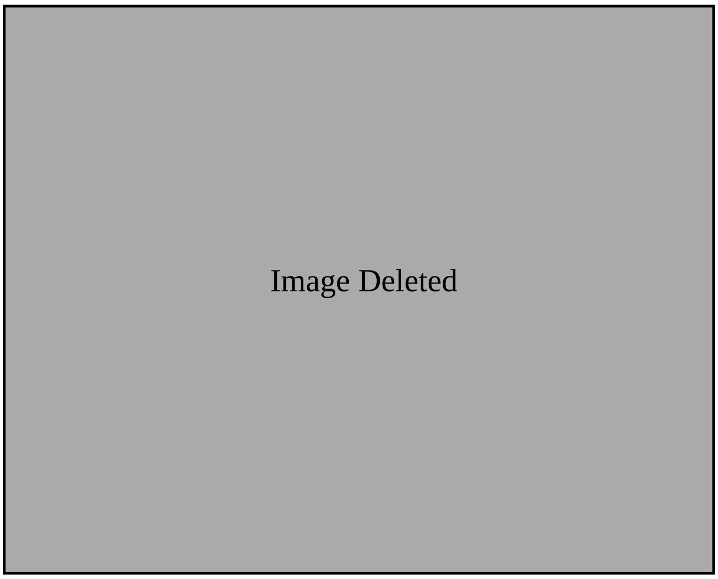
Glen Diener has developed a powerful music notation environment for the NeXT, which also makes use of the DSP sound synthesis in the Music Kit.

Mike Malcom helped develop an application for measuring perception of group-delay distortion in digital filters. Bill Schottstaedt is developing, in LISP, a high-level music compiler that drives the DSP directly in array-processing mode.

As these examples show, the DSP and the NeXT Computer are already changing the way we interact with computers. Before long, the work being done with these technologies will lead to a world in which talking with and listening to computers is as routine as talking on the telephone is today.

Tales of godzilla: Adventures in distributed computation

by Richard E. Crandall
Director, Scientific Computation Group
NeXT, Inc.



I have in the last year gained a powerful new colleague: an intelligent beast equipped with a supercomputer brain, but also possessed of a certain flair for etiquette. This creature I named “godzilla,” an appellation not entirely specious. I understand that according to conventional monster folklore, Godzilla was not fundamentally aggressive, but only attacked when the situation called for intervention. The new creature is not of flesh and blood. It is a collection of NeXT Computers participating in distributed computation.

The first implementation of godzilla made use of most of the office computers in NeXT’s Software Division.The initial research success of godzilla was to resolve special cases of Format’s “Last Theorem,” one of the very oldest, but still unsolved, conjectures about numbers. I shall describe this experiment below, but first let me turn to a description of the beast.

The godzilla network is computationally powerful. We denote by one “godzilla unit,” or g.u., the equivalent of 50 NeXT Computers. One g.u. has 250 MIPS capability, which puts it roughly in the supercomputer range (for problems not requiring Cray-type high-speed throughput.) There is a total of 400 megabytes of physical memory, and more than 1 gigabyte of virtual memory, the latter depending on how the distributed programs allocate memory.

The idea is to have one master server machine with a running slave thread that scans through a list of “permitted machines.” The slave thread uses the UNIX rcmd(3) library to remotely execute processes on slave machines. In the initial experiments, each machine dealt with a separate case of Fermat’s “Last Theorem,” feeding the results to destination files of choice. Usually these results would accumulate in a specific NFS (network file system) directory, but distributed storage is also possible.

Now we come to the friendly character of godzilla. Every NeXT Computer screen dims automatically if the machine has been left dormant for a period set by the user, which typically is 10 minutes. The etiquette strategy is devilishly simple—when a screen dims, for example at the end of a working day, godzilla intervenes and performs calculations; if the screen is brightened by touching the keyboard or mouse, godzilla backs off. In this way, calculations were carried out during our initial experiments of 1989, with office personnel noticing very little, if any, godzilla intervention. The initial calculations, which I shall describe next, would require about 500 CPU hours on a Cray-YMP. Depending on industrial rates for such time, the conventional cost of such a calculation would be on the order of 10^5 dollars. Given that godzilla caused no untoward interference with office workers during the project, our cost was virtually zero.

Now to the numerical research. Pierre Fermat conjectured in 1637 that for $n>2$ the equation

$$x^n + y^n = z^n$$

has no solutions in positive integers x, y, z. One learns in elementary geometry simple identities such as the Pythagorean relation $3^2 + 4^2 = 5^2$, but Fermat’s “Last Theorem” refers to exponents greater than 2.

There is romance connected with this problem for two reasons. The first is that Fermat wrote a marginal scrawl, in his Bachet edition of the works of Diophantus, that he had a proof which the margin was too small to contain. We shall probably never know whether he actually had such a proof. The second reason is simple: to this day, nobody has a proof, and there is no known counter- example. The “Last Theorem” persists as sublimely difficult. I am sometimes asked what the use is for such a theorem. For one thing, attempts to conquer it have opened whole new fields of inquiry. For another, there is no telling where any intellectual idea may lead.

We investigated various Fermat exponents n on godzilla. Each machine was given an n and had to compute the reciprocal of a polynomial of degree $(n—1)/2$. So each machine had to compute an expression

$$1/(a_0 + a_1 x + a_2 x^2 + ...)$$

where the denominator could have up to half a million terms.

The allocation of a polynomial (the denominator in the previous polynomial fraction) invokes about 4 megabytes of virtual memory. All of this for one polynomial, but each case of exponent n involved the allocation of a handful of such polynomials. Each machine would set up the polynomials, use Newton’s iteration and Fast Fourier Transform (FFT) multiplication to find the polynomial reciprocal, and report either “exponent n is conquered” or “a little more proving must be done.” After all primes n between 3 and 1,000,000 were checked, we had established that many n were resolved (i.e., $x^n + y^n = z^n$ is impossible), with some fraction of the n values awaiting one final check by godzilla. The resulting data,

(continued on page 21)

Resources

Latest Third-Party Products

This section includes some of the exciting software and hardware products that are available for the NeXT education community. We also focus on FrameMaker, a superb program for scholarly publishing.

Abaton™ Scan 300/GS™—A 300 dpi, 8-bit scanner, that offers 256 levels of grayscale scanning. Abaton. 1-800-444-5321

Adobe® Plus Pack—A collection of 26 popular typefaces from the Adobe Type Library. Adobe Systems, Inc. 1-800-344-8335

BioTRACE 8™ Biomedical Research System—An eight-channel data acquisition, monitoring, and measurement system for biomedical research. Includes features for digitizing, recording, real-time monitoring, data manipulation, and hard copy output.
Bio-Medical Design Group, Inc. (612)645-9062

ClickArt® for NeXT—A collection of nearly 400 illustrations in Encapsulated PostScript (EPS) format.
T/Maker Company (415)962-0195

Communicae™—A communications package that includes both DEC VT220™ and Tektronix 4010/4014™ terminal emulation, as well as standard file transfer protocols.
Active Ingredients, Inc. (617)576-2000

DaynaFile™—External disk drive that lets NeXT Computers read and write to MS-DOS and NeXT-formatted floppy disks.
Dayna Communications, Inc. (801)531-0600

Digital Ears™—Audio input device and control software for entering and recording CD-quality sounds.
Meta-research, Inc. (503)238-5728

Digital Eye™—A hardware/software package that allows you to enter and record still and moving NTSC video images from laserdisc players, video and still-video cameras, and VCRs.
Metaresearch, Inc. (503)238-5728

DM-N™ Digital Microphone—High-fidelity stereo microphone with lab-quality data acquisition capabilities. Ariel Corporation. (201)249-2900

Extron Board—A board that allows the NeXT Computer to display video on a large screen projector or monitor.
Extron Electronics 1-800-633-9876

FORTRAN 77—Object-oriented FORTRAN™ compiler; fully compatible with NeXT's Interface Builder. Allows programmers to add a graphical interface to any FORTRAN program. Absoft Corp. (313)853-0050

FrameMaker 2.0—Technical publishing software package; includes word processing, graphics, page-layout, equation-editing, and book-building tools. Frame Technology Corporation. (408)433-3311

GatorBox®—Intelligent Ether-net-to-LocalTalk® gateway; connects NeXT and Macintosh® networks.

GatorShare™—Software for file sharing between Macintosh and NeXT Computers.

GatorMail-Q—Allows you to link Macintosh QuickMail users with the NeXT e-mail system.
Cayman Systems, Inc. (617)494-1999

INGRES™ Relational Database Management System—An integrated application development environment providing 4GL, SQL, and visual programming methods for relational database management. Ingres Corp. (415)769-1400

JETSTREAM® Tape Backup—A tape backup system capable of archiving up to 2.3 gigabytes of data per tape at speeds of up to 14.4 megabytes/minute.
Personal Computer Peripherals Corp. (813)884-3092

LaSTLock—A heavy-duty cable-and-plate locking security system to prevent theft of cube. Prevail. (408)296-6550

MacLink®Plus/PC—Complete kit for file transfer and translation between the NeXT and Macintosh environments. DataViz Inc. (203)268-0030

MediaStation—A tool for multimedia archiving, computer-based training, interactive documentation, and desktop presentations; stores, retrieves, organizes, and presents multimedia information. Imagine, Inc. (313)487-7117

Oasys FORTRAN, C, and Pascal cross-compilers—Oasys. (617)890-7889

PM 1.44—A SCSI floppy disk drive; also reads Macintosh and MS-DOS disks.
Pacific Microelectronics. 1-800-628-DISK

Scan-X 600™ and 1600™—High-resolution scanners, at up to 1600 dpi for line art and 400 dpi for grayscale. Scan-X software which comes with scanners supports TIFF and EPS file formats. HSD Microcomputer U.S., Inc. (415)964-1400

SCSI 488/N™—An IEEE 488 interface and software driver that enables a NeXT system to control up to 14 IEEE instruments. IOtech, Inc. (216)439-4091

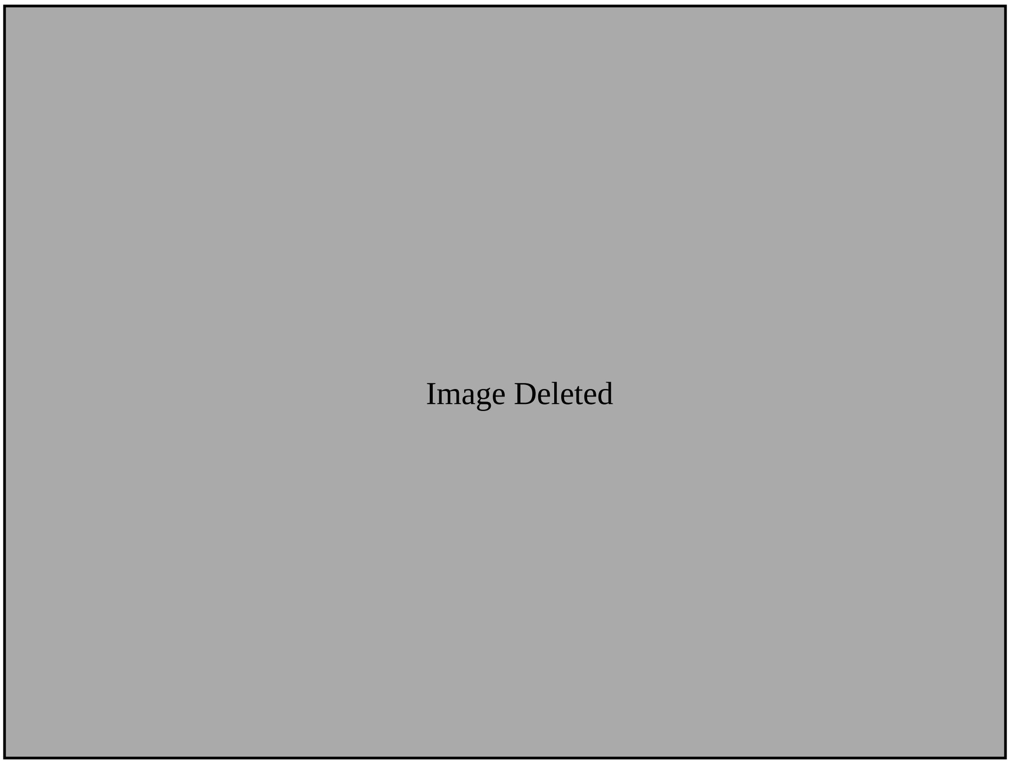
TextArt™—Drawing package and PostScript generation tool that produces a wide range of special text effects. Stone Design Corp. (505)345-4800

TopDraw®—Object-oriented drawing package with sophisticated illustration and layout capabilities. Media Logic, Inc. (213)453-7744

(More products on page 21)

Uni-Kit for NeXT, Virginia Tech InfoStation™, Who's Calling?™, and Wingz™

In focus: FrameMaker for scholarly publishing



FrameMaker software on the NeXT Computer offers an ideal system for scholarly publishing. FrameMaker's integrated word processing, graphics, page-layout, equation-editing, and book-building tools allow you to create everything from one-page letters to dissertations to thousand-page books. The program excels at producing long, complex documents.

The following are a few of the features that FrameMaker offers to the scholarly publisher:

Powerful word processing

- Search-and-replace capabilities, automatic hyphenation, and a sophisticated spelling checker.

Drawing tools

- A full set of advanced drawing tools to create graphs, charts, and diagrams directly in your document.

Layout and design features

- Multiple-width text columns, master pages, and options for using various page sizes and orientations.
- Easy creation and integration of mathematical equations and expressions into documents.

Integration with other applications

- The ability to import files created with other applications into FrameMaker documents. For example, graphics produced with TopDraw can be linked to your document so that changes in the graphics file will be reflected automatically in the FrameMaker document.

For lengthy documents

- Automatic pagination; generation of tables of contents, indexes, and bibliographies; cross-referencing; automatic numbering of charts and figures; running headers and footers; and footnotes.

Sound annotation

- Voice-annotation capabilities, which could be used to facilitate communication in the writing and editing process.

Hypertext

- The ability to create dynamic links between related sections of your document. This could be used to create interactive courseware.

Access to on-line reference materials and indexing tools

- Integration with the built-in searching and indexing capabilities of the Digital Librarian™.
- Digital access to *Webster's Ninth New Collegiate Dictionary®* and *Collegiate® Thesaurus*.

Resources

The NeXT Archives

by Gerrit Huizenga
Purdue University

The NeXT Archives are centralized resources for sharing public-domain software, bug fixes, and other general information for NeXT users. There are currently two major archive sites: Purdue University and Oregon State University. Other sites that provide NeXT specific programs are listed below.

Items currently available in the Purdue Archives include: *NeXT on Campus* (which you are reading); newsletters from Georgia Tech's User Group; the complete collection of Usenet news discussing the NeXT machine (from comp.sys.next); the X Server for the NeXT Computer; source code for the NeXT Developer's Camp Labs; programs developed by NeXT users such as: Cassandra, an appointment scheduler (see below); communications programs such as Hitchhiker, kermit, and XModem/ZModem; and a sophisticated digital picture composer/editor called popi, the Digital Darkroom.

There are two ways to access the archives. The first is via file transfer protocol (ftp). If you are directly connected to the Internet, you can browse through the archives interactively by connecting to the servers, as described in "Using ftp" in the NextAnswers article.

If you don't have access to Internet but are able to send e-mail through UUCP or one of the other gateways to the Internet, such as CompuServe♦, you can access the Purdue archives by sending an e-mail message to archive-server@cc.purdue.edu with the subject "help." A program will read the mail and send you information on how to use the server to request programs from the archives. The server takes commands of the form "index directory"and "send directory program."

Questions should be sent to: next-ftp@cs.orst.edu for Oregon State, or archive-management@cc.purdue.edu for Purdue. Send submissions for Purdue to: next-archive@cc.purdue.edu.

Archive Sites

Location	hostname	IP address	Directories
Purdue University	cc.purdue.edu	128.210.9.2	pub/next/docs/NextAnswers
Oregon State University	cs.orst.edu	128.193.32.1	pub/next/documents/NextAnswers

Other ftp sites with NeXT-specific programs

Indiana University	cica.cica.indiana.edu	129.79.20.22	
MIT	aeneas.mit.edu	18.71.0.38	pub
Princeton University	princeton.edu	128.112.128.1	pub/music
San Francisco State University	sutro.sfsu.edu	130.212.15.230	
Stanford University	sumex.stanford.edu	36.44.0.6	pub
University of Maryland	umd5.umd.edu	128.8.10.5	NeXT/NextAnswers
University of Texas at Arlington	eesun1.arl.utexas.edu	129.107.2.51	
University of Virginia	uvaarpa.virginia.edu	128.143.2.7	

Cassandra: Alarm Scheduler

by Jiro Nakamura,
Cornell University

Cassandra was written to fix an important problem in my life: I can't remember to do things. Mundane things—such as friends' birthdays, project deadlines, and waking up in the morning—have a nasty habit of slipping my mind. Cassandra can act as a simple alarm clock, but it is also a powerful way to handle appointments, anniversaries and birthdays. It uses the NeXT Computer's special sound capabilities to allow you to easily attribute different sounds to various types of alarms and events. Although I've tried to avoid the "kitchen sink syndrome," I hope to see Cassandra continue to develop as a complete "office in an icon" environment.

I've been continually striving to improve both the program's power and flexibility since the day the first beta tester looked at the first implementation, smiled, and handed me a checklist of about 50 things to fix in the interface.

Last, kudos to the NeXT development environment. It is the best one I've ever seen or used. NextStep easily outpaces all other user-interface and development environments in both its power and flexibility. It is definitely the wave of the future.

NextAnswers: How to get answers to your technical questions

"What's the best way to make routine backups on optical disks?"

"I've installed an external disk, and the system won't boot now. What's wrong?"

"How can I programmatically add text to the end of a Text object?"

If you have technical questions like these and can't find the answers in the NeXT manuals, help is right on your desktop—only a click or two away.

NextAnswers is a directory, available on the Internet, that contains answers to well over a hundred commonly asked technical questions about the NeXT Computer.

The topics covered include system administration, programming, hardware, and NeXT applications. Updates will be distributed monthly.

When incorporated into theDigital Librarian, NextAnswers will supplement the existing on-line and printed documentation, further helping you to understand and apply the power of the NeXT Computer. You can obtain NextAnswers via anonymous ftp from an archive server, as described in the example below.

The steps below should create a directory called May_90. The next step is to carefully read the files INSTALL and README in this directory for further instructions on installation and usage.

Using ftp (file transfer protocol)

Here's a sample ftp session, in which you obtain NextAnswers from an archive server. You can also follow these steps to obtain other files. See the comments in parenthesess. For more information, read the UNIX manual page for ftp. Replace words in italics with correct addresses from the Archive Sites table on the previous page.

`Local Host> ftp` *hostname-or-IP-address* (See Archive Sites table.)

Login> anonymous

`Password>` (Enter your login name as the password.)

`ftp> cd` *Next_directory*
(This switches to the NeXT directory on the archive server. Type appropriate directory name from table).

`ftp> cd` *NextAnswers_subdirectory*
(This switches to the NextAnswers directory. See table for name. To find other NeXT files, use ls (list) and cd (change directory) to traverse the file system.)

`ftp> binary`
(Sets the mode to transmit binary files. Skip this if you're retrieving text files.)

`ftp> get NextAnswers_May_90.tar.Z`
(Or replace with the file name you want.)

`ftp> quit`

After you have obtained NextAnswers from the archive server, uncompress and untar the file by typing:

```
zcat NextAnswers_May_90.tar.Z  | tar -xvf  -
```

NeXT User Groups

If your user group is not on this list, or if you have questions about starting your own group, or just want to share what your group is doing with us, please contact: conrad_geiger@next.com

California

Riverside
UC Riverside NeXT User Group

Contact: Paul Lowe
(714)787-3883 or
plowe@ucrac1.ucr.edu

San Diego
SNUG
San Diego NeXT User Group

Contact: Nicholas MacConnell
(619)481-7535 or
(619)565-9738

San Jose
BaNG
Bay Area NeXT User Group

Contact: Robert D. Nielsen
(408)995-5775 or (415)780-2884
or nielsen@everest.sjsu.edu

Canada

Vancouver
Vancouver NeXT User Group

Contacts: Lionel Tolan
(604)291-4702 or
tom_poiker@cc.sfu.ca

Colorado

Boulder/Denver
Contacts: Brad K. Green
green_bk@cubldr.colorado.edu

David R. Hieb
davehieb@boulder.colorado.edu

District of Columbia

Washington
Washington Apple Pi
NeXT SIG

Contact: Hugh O'Neill
P.O. Box 39036
Washington, DC 20016 or
NeXT office: (703)938-NeXT

Georgia

Atlanta
Georgia Tech—BuzzNUG

Contact: Erica Liebman
erica@kong.gatech.edu

Massachusetts

Boston
Boston Computer Society
NeXT User Group

Contact: Dan Lavin
(617)969-6555

Minnesota

Minneapolis Area
Minnesota NeXT User Group

Contact: Mike Tie
(507)663-4067 or
mtie@carleton.edu

Ohio

Columbus
Ohio State NeXT User Group

Contacts: Chuck Dyer
(614)292-4843 or
dyer-c@osu-20.ircc.ohio-state.edu

Holly Hirst
(614)292-1302 or
hirst@osc.edu

Oregon

Corvallis
Oregon NeXT User Group

Contact: Bryce Jasmer
(503)758-5743 or
jasmerb@cs.orst.edu

Texas

Dallas
Dallas Area NeXT User Group

Contact: Dirk Hardy
(214)385-2991

Houston
Houston NeXT User Group

Contact: Dr. John Glover
(713)749-1820 or
glover@tree.egr.uh.edu

Washington

Seattle
University of Washington
NeXT User Group

Contact: Corey Satten
(206)543-5611 or
corey@cac.washington.edu

News

NeXT wins major software award for NextStep

NeXT was recently named the winner of the prestigious Andrew Fluegelman Award for its NextStep development environment. The award, sponsored by *PC World*, *Macworld*, and the Software Publishers Association (SPA), honors software programmers for their innovative contributions to the personal computer community. Past winners of the Fluegelman Award include the developers of Adobe PostScript, Apple's HyperCard®, and Aldus PageMaker®.

NeXT extends warranty to one year

NeXT announced in March that it has extended the warranty on its new hardware products from 90 days to one year. The new warranty, which covers parts and service charges on all components of the NeXT Computer System, applies retroactively to customers who have purchased NeXT products within the last year. All other terms of the existing warranty remain in effect.

Customers who purchased extended warranty contracts will be contacted, and a newly structured extended warranty program will be announced soon.

If you have questions, call your Authorized Service Center, or 1-800-848-NeXT.

Tales of godzilla

(continued from page 15)

which is being prepared for publication, so far supports the "Last Theorem."

According to godzilla, Fermat's "Last Theorem" is true for all exponents less than one million. Previously published results have only reached 150,000. As an exercise of virtual memory capability, some random, very high exponents were analyzed also. For example, godzilla claims that

$$x^{2000291} + y^{2000291} = z^{2000291}$$

has no positive x, y, z solutions. The 1 g.u. godzilla network can provide about 50 such results per hour.

To my mind, the superb virtual memory performance of godzilla is the most important aspect for research. It is not difficult to simply append via TCP/IP protocol a machine such as a Cray (provided one has an account, time, and so on) to godzilla's permission list. It is a tribute to the beast that a single such appendage typically increases the computational power only by a small factor.

What's more, the godzilla concept is suitable for other distributed processing, such as audio paging systems and parallel ray-tracing. I am working on turnkey godzilla applications so that this wonderful adventure may continue in a most practical vein.

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(continued from page 16)

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