

# NEXTWORLD

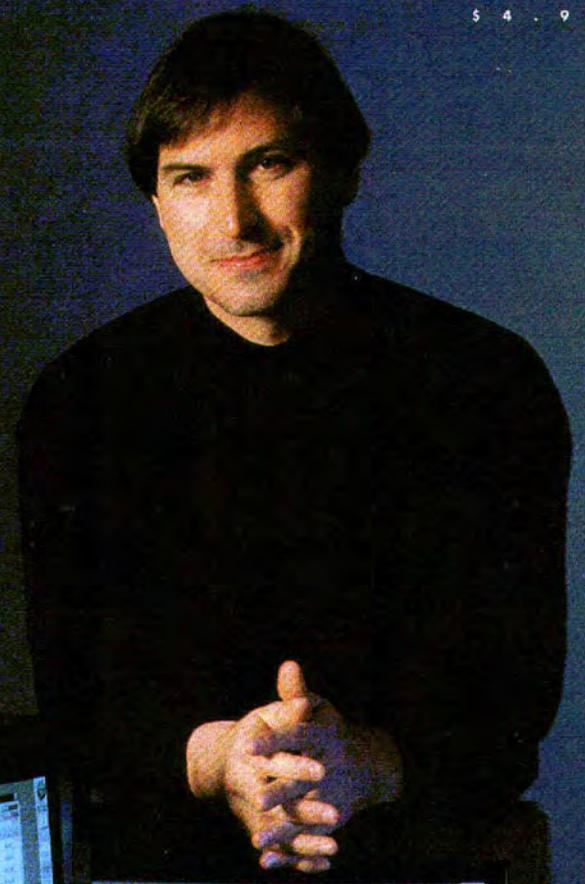
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**The New NeXT  
Steve Jobs's  
Boldest Machines**

**Nicholas Negroponte  
Multimedia Computers:  
Your Future TV**

**First-Time NeXTworking**

**Product Reviews**  
Comparing Improv,  
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# NEXTWORLD™

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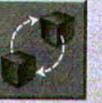
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# NeXTWORLD™

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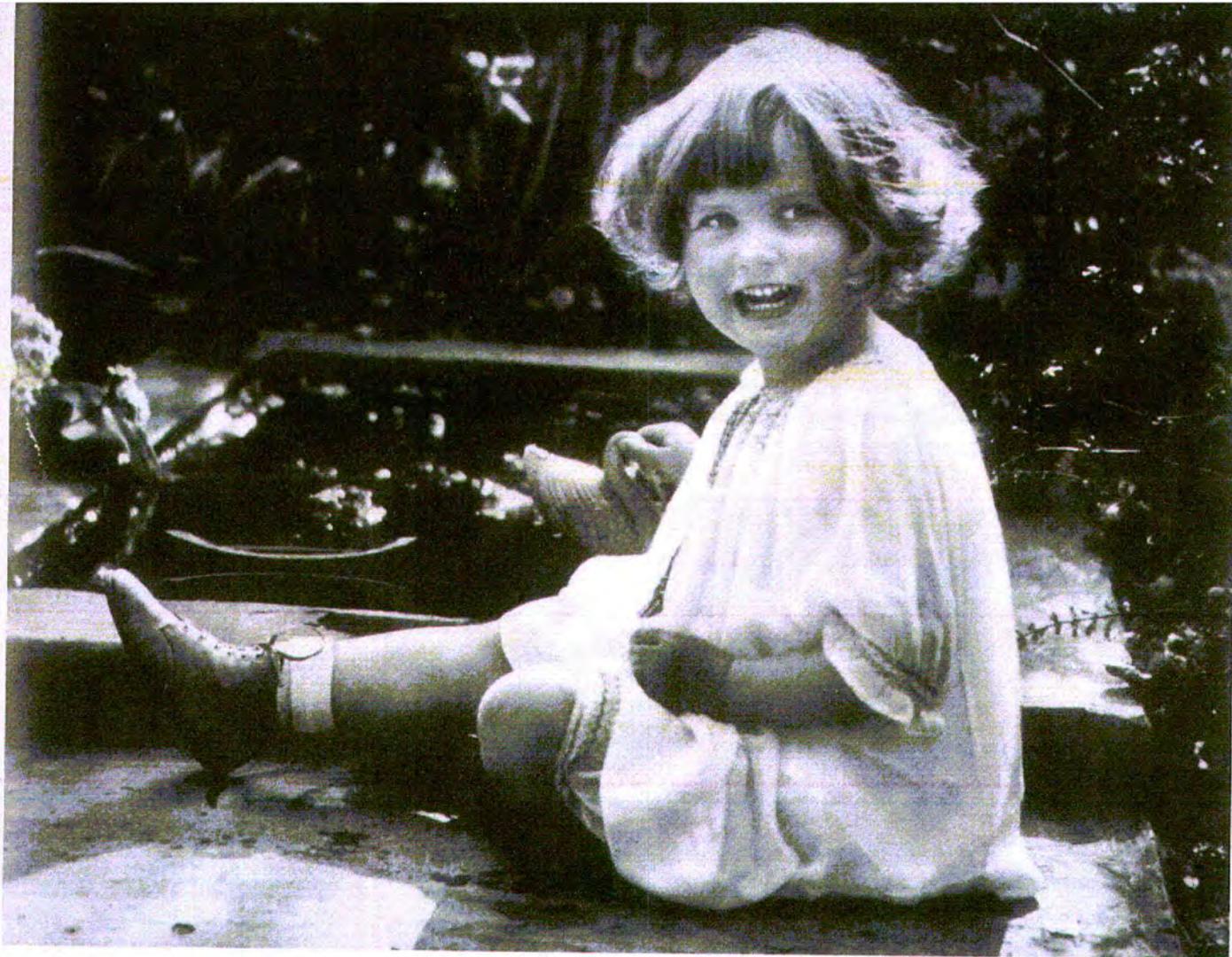
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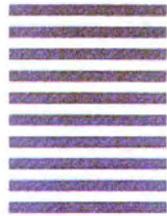
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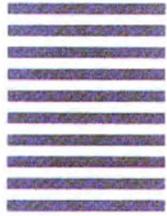
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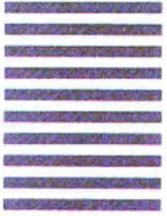
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**GET INTO  
NEXTWORLD!**

**GET OUT OF  
THIS WORLD  
SAVINGS**

**BI**



## Black Box/Michael Miley

Welcome to the NeXT world. So glad you could come. Take a look around, then pull up a chair and make yourself at home. You may need a small orientation.

For starters, you may not have a map of the road that got you here, and you're just a bit bewildered by the unfamiliar terrain. What is this magazine? Is *NeXTWORLD*, as its name might imply, some new age rag invoking the afterlife, masquerading in computer dress? It certainly looks a bit otherworldly. The black machines photographed inside bear no resemblance to any you've set your hands on, and the pages aren't littered like the usual product dumpsite once known as a user magazine.

What you have in your hands is a magazine that spans two worlds, worlds that are already making an impact on *your* world. The first is the world of NeXT, a computer family that operates at the forefront of the world of microcomputer technology. The second is the wider world of Information Technology *IT*self, both the "news" variety—print and its digital equivalents, the worldwide information networks—and the "entertainment" variety—television, film, music, and video. The NeXT intersects with this wider world and, in the future, will act as a control center for it. *NeXTWORLD* is both a NeXT user magazine and one that takes the deeper view of IT,

showing the ways that IT has entered into your homes, gotten under your skin, and begun to change your future.

Both a new computer *and* a new computer magazine? Why in either world does the world need either? Let's spin both globes and see where we wind up.

**Why does the world need another computer?** I myself asked this question of Steve Jobs, president of NeXT Computer, in a recent conversation we had in his sleek boardroom at NeXT in Redwood City. As he sat down, I thought he looked a bit professorial, with the beard and Lennon glasses he wore at the time, as if he'd prepared for a lecture. Fact is, Jobs is relentless, like a train traveling down a mountain: always on track, always looking ahead, but always moving at a terrific velocity. You don't talk to Jobs, you listen. I listened. Here, with some dressing up, is the gist of what he said.

The world has lots of computers, but not many *kinds* of computers. Think of it as a technological playground where the many kids on the swings come in only a few shapes. Setting aside mainframes and supercomputers for the moment, Jobs identified four types, each representing one wave of the microcomputer revolution: the IBM PC and its clones, the Apple Macintosh, the Sun workstation, and the NeXT.

The IBM PC and its clones represent the first type: character-based personal computers running the single-tasking DOS operating system. Call it: the Character. Historically identified with basic business applications such as spreadsheets (Lotus 1-2-3), databases (dBase), and word processors (WordPerfect), the Character is tough to get to know, given the fact that you have to remember commands to run its programs, and no program resembles another. Since it's a single-tasking machine, moreover, you have to quit one of its programs to start up another, and the new graphical mask put on its face, called Windows, doesn't really cut it. Imagine it: the Character, doing Windows. Funny Character. Can't get 'em clean.

The Apple Macintosh is the second type. Call it: Pretty Face. Pretty Face revolutionized the personal computer interface with its graphical approach: pull-down menus and icons representing files, folders, and applications on a desktop. What's more, Pretty Face set guidelines across the board, so that what you learned in one program could be applied to another. With Pretty Face's approach came graphics programs (MacDraw,



Illustrator) and the notion of WYSIWYG applications: What you see on your screen is what you get in your printout. And with its page layout programs (like PageMaker), Pretty Face launched the desktop publishing revolution—but fell down when it tried to play round robin with other Pretty Faces. The networking software, AppleTalk, built into every Pretty Face, bogs down under intensive use, even in the DTP arena where it's famous. Pretty Face then shows a sad face—not a pretty sight.

The third type is the workstation, exemplified by Suns. Call it: the Alien. The Alien operates basically as a highly intelligent multitasking terminal on a network set up for workgroups. Up until now, the Alien has been used primarily by people such as engineers, designers, architects, and scientists, running custom-made applications. More powerful and expensive than a personal computer, the Alien is a bit difficult to use. For one thing, its language is hard to decipher. Using a network operating system like UNIX, the Alien is tough enough to handle many tasks in a multitasking environment, but it requires people who know how to speak its language for setup and maintenance. Mere mortals get strange when they hang around the Alien for too long. Bug-eyed.

The fourth type is the NeXT. Call it: the Mind Reader. Its goal is to be as accommodating as Pretty Face, with all its pretty off-the-shelf applications, while at the same time giving you all the power of an Alien with none of the pain. Mind Readers run on UNIX (which makes them multitasking) and have Ethernet built in (see our Special Report in this issue, "The New NeXT," for an explanation of these capabilities), but Mind Readers hide the network's complexity from you. A Mind Reader knows what you need. Everything's up its sleeve, where you don't have to see it. Just pull what you want out of its hat. And its system software is designed from the start to facilitate doing groupwork on a network. Deep in its brain is a multimedia e-mail program that lets you message many people at once, and include in your message files from word processors, graphics programs, fax transmissions, and voiceprints. You get pretty clairvoyant when you use the Mind Reader for any length of time.

In short, unlike a personal computer, the NeXT is made from the ground up for *collaborative computing*, and unlike a workstation, it's easy to use. It's an *interpersonal computer*, the first of its kind.

This (minus my naming conventions) was Steve Jobs's message that day. It was a message meant to remind me of my microcomputer roots, a kind of lesson in evolution. From Jobs's standpoint, it all points to the NeXT—as inheritor of all the gains of the microcomputer revolution and the progenitor of their future.

But our second riddle remains to be solved. Question is, can such an act of memory both remind us of our future and act as a charter for a new computer magazine?

**Why does the world need another computer magazine?** In an apocalyptic parable of mine I've been musing over, memory is an archive in a near-perfect computer. The archive stores the original purposes for which that computer was made—only no one cares to retrieve them, since the impulse to do so has long since atrophied in the collective mind. As an ironic device, the plot is too simple for more than a passing mention, and it's also simplistic for another reason. This magazine, the one you're holding, is a more elaborate testament to the recovery of lost meanings.

Let's conduct a simulation. Imagine in place of my bleak, ironic tale, a magazine on IT that continually reminds you of the reasons for which IT's made. Its purpose is not simply to provide an outlet for NeXT user stories (though we like users and we will be profiling them), nor is it just a catalog of techniques and technologies (though it's not without both), nor is it simply a rodeo of product shoot-outs where the defeated dead return each month to be shot down again (we like product comparisons, but we'll think of less murderous metaphors). The key to this magazine is that it should explore the nature of the symbiotic relationship of people to IT, that "intimate living together of two dissimilar organisms in a mutually beneficial relationship" (Webster, not Bruce, but Digital) that constitutes life with IT, and that has been going on for quite some time, right under our noses. Imagine, then, conducting that exploration from the vantage point of a computer that will act like an engine for the mind in the future world of IT.

So far, so good. Since the magazine deals with the next generation of IT, call it *NeXTWORLD*, with the implication that NeXT computers share a future with us. Now do something radical. Whenever you discuss a specific technology, keep it in the context of human tasks. Take a hard look, then, at the present to see if the brave new world

of IT that's being shaped before your eyes is the one "dreamt of in your philosophy." If it isn't, say so, and say why. Give a cogent analysis of the monster, if IT's a monster. If IT's a Frankenstein, don't be afraid to pull the plugs out of IT's neck.

How's our simulation doing? Are all the chips in place? Not quite. Presume, then, that this magazine does all that a magazine needs to do for its first cybernetic tribe, its NeXT users, but that it also puts the original creative thinking back into the discussion of techniques and technologies. Think of it: a recovery of *reflection* in a magazine about computers. Think of this, too: a recovery of *discernment* in a magazine about IT, so it's not just an intellectual smorgasbord. Since computers have gotten into our minds like no other electronic device since the television, one project for this magazine is to look into the mind and explore the model of ourselves that we've embodied in these machines. As computers become more human, is the human psyche becoming more computerized?

So aside from a core of NeXT-based features, user and corporate profiles, and product reviews, look for articles that discuss the nature of the self and of work in a computerized society. Imagine also columns discussing the computer as TV, the TV as computer (see Nicholas Negroponte in "Vanishing Point" in this issue). And look for articles on computers and the Internet, on hackers fighting agents of the FBI, on mass media and the vanishing notion of *evidence*, as well as articles about William Gibson and cyberspace, computer visualization, and virtual reality.

End of simulation. That's it. That's your magazine. Let's print it out and look it over. Looks like only one thing remains: to devote one issue, our premiere, to a more complete answer to our key first question, Why does the world need a NeXT computer? We'll reserve future issues for an answer to the second, Why *NeXTWORLD*? If simulation means anything, IT'll grow clearer and more real. ☐

Michael Miley is editor-in-chief of *NeXTWORLD*.



## Living Technology/Hazel Kahan

It's been ten years since the personal computer burst onto the market, ten years since the computer became a self-sufficient, liberated machine, rather than one umbilically connected to a mother mainframe. In those ten years, millions of eyes around the world have stared at innumerable screens, while fingers, pecking dutifully on keyboards, have filled these screens with words, numbers, and pictures.

You would think by now we'd all be used to computers.

But the fact is, they still inspire admiration or revulsion, and rarely do you find a person who, after having had anything to do with them, is indifferent to them. Familiarity has not bred contempt. Just try separating people from their PCs, even the ones who've had an uneasy marriage to them. You may find toothmarks on your hand. Lovers should be this faithful.

For those of us who see the computer as more than a mere instrument, the affair deepens with familiarity, warms as our expertise evolves, and blossoms as we grab new applications the moment they come to our attention. The heady addiction that began during our earliest encounters was not produced by fad or gimmick. We did not grow out of it. We grew into it. We grew because of it. And, as grown-ups, we still find ourselves in heated discus-

sions, defending our use of it, even when the uninitiated complain that, well, things were more personal back when the personal computer was a mere twinkle in Apple's eye.

How can we account for such passion?

**Computers have brought philosophy back into daily life.** Thinking about what computers do raises questions both ancient and new. What is the mind? What is life? What is artificial? What is reality? The debates are not made less interesting by the indignation some feel for the computer as a model of human intelligence and for the gross injustice that model does to that which is essentially human in us: our sense of morality, justice, and humor; our feelings and insights. The idea that a human mind could be reduced to a set of procedures and rules seems preposterous to common sense—yet there are those whose brilliant reasoning would take it that far. That's the point. Computers seduce us into such hyperbole and fling us into such debates.

**Computers demand that we compose a new language.** When people push the limits of their understanding, they're likely to create new words to describe their experiences. Hence, in twentieth-century philosophy we have the neologisms of Wittgenstein, Heidegger, and Sartre. In computer circles, you hear words like *artificial intelligence* (or *artificial intelligencia*, if you're an AI cynic), *virtual reality*, *hyperspace*, *time-shifting*—sources of both wonder and revenue to media analysts, and of consternation to purists of the Queen's English. But a language that changes, even in ungainly ways, is a language that lives. Under the press of discussing computers, creative things happen to language.

**Computers allow us to both simulate and transcend reality.** The concepts here are artificial intelligence. Artificial life. Networks that imitate the neural exchange of the central nervous system. Alternative universes made up of mathematically perfect creatures and environments that we ourselves create. These are not the fantasies just of hackers who've been cooped up too long in front of a glowing screen, but of computer scientists and philosophers preoccupied with notions of creation and re-creation—re-creation of the world they can see and creation of worlds they can't.

Indeed, computers allow us to transcend common notions of time and space. We're not talking here about the impulses of a few science fiction writers. We're talking about the basic desires of your everyday citizen. Americans, by way of an old

example, have been in love with cars ever since the Model T was mass-produced. This love is based on the extension of physical performance the car permits; it is the Earth-bound answer to the dream of flying. The car allows people to ignore the limitations of their own physical abilities and to become something bigger, faster, more powerful.

Computers are doing the same thing for our minds. It sounds grandiose until you've done it. When we connect with other people and remote databases, anytime, anywhere, the size of the globe does not intimidate us, and we grow wings to fly wherever we wish. We enter worlds of color and dimensions and speeds and scenarios that would never be available to us otherwise. And when we come back from those worlds, we come back nourished, invigorated, and a bit dizzy. Simulations are good for the soul. Transcending time and space is not too bad for it either.

**Using computers changes who we are.** We haven't begun to fathom the long-term effects that computers can have on the way a person perceives and leads his or her life. The intense, everyday interaction has created a new entity, a symbiotic I-and-thou computer that was never there before. When a person sits down in front of a computer, a ritual centering occurs, which has replaced what was once felt as a kind of disorientation, a loss of contact with one's work. Now, sitting down to the computer means getting into one's work, being entranced with it, entering a special world for the mind.

And each time we enter that world, we are changed. We grow more courageous because we expand our sense of what is possible. We experience what it is like to change our minds without fear of undue penalty. We discover we can write, paint, calculate, draw, and see in ways we never knew we could, an expansion that spills over into activities that have nothing to do with computers. We grow not only in what we think we can do, but in what we can imagine.

It all sounds a bit weird, and outsiders smile with indulgence when we talk this way. But they've never experienced the power, pleasure, and self-knowledge the computer affords. It's an intriguing thought that computers help us acquire self-knowledge, but the fact is, computers help us measure our own mastery of tasks more easily. The computer, through its personalized interface, can record our own learning curves in mastering a piece of software. (Future software will learn along with us.) In fact there are no limits; we can

go as far as our imaginations take us. And because there is more than enough for all, we're exempt from competition. One person's gain is never at another person's expense, and we can share our mastery without blunting our own advantage.

**We're citizens of a newly created, interconnected world.** We can create our own personal world, but then we necessarily find ourselves sharing it with others. After the decade of the personal computer, this is the emerging meaning of interpersonal computing: individuals fulfilling themselves in the group. On a local area network, one invariably finds that he or she is part of a team working for common goals, and with the networked computer, work can easily be shared with others. We can trade information back and forth in a way that wasn't possible when everyone was confined to paper.

What's more, connection to the wider world is just a modem away. On-line services let us send messages or conference with a whole group of people we've never seen. It's no accident that on-line addicts who spend all their time in electronic conferences experience a feeling of connectedness that is independent of the body. On line, mind

speaks to mind without sound, interacting in a meta-realm where different rules apply, where language has a different syntax, and where physical and social distinctions are wiped out. In this dimension, there is true interoperability; that is, we are all operating on the same platform, under the same architecture, in a true community of shared interests.

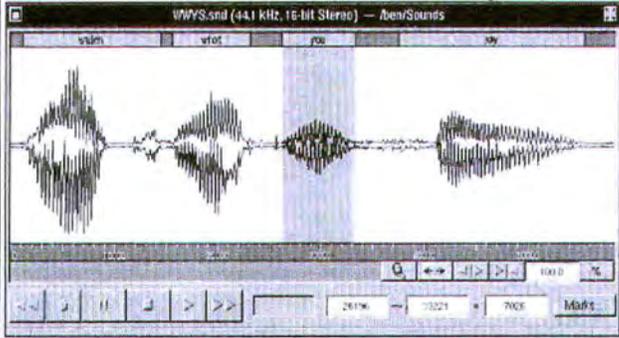
This on-line world is available to more and more of us each day. The expanding interconnection is breaking down boundaries of both geography and culture. The promise is that with access for all, this interconnectedness will attain the critical mass it needs to make all the difference in the way we live in the world. This linking of minds even has a name. It's called the "global brain."

Think of it: a complex, intelligent being, the size of the globe.

There's something undeniably captivating about that image. 

*Living Technology will explore how information technology changes the way people work and live. Hazel Kahan is a psychologist living in New York City, where she runs her own market research firm.*

## Watch What You Say!



and then change it around, if you like. In fact, the SoundWorks™ software package from Metaresearch, Inc. gives you complete control over any sounds you use on your NeXT™ computer.

SoundWorks is just the most recent product from Metaresearch. We specialize in hardware and software tools for multimedia on the NeXT platform.

There's Digital Ears™, our precision audio digitizer that's powerful enough to be used for laboratory data acquisition, as well. And Digital Eye™, our video digitizer that comes bundled with the software applications Snapshot™ and MovieWorks™. Plus future products that will help you further enhance and expand your NeXT computers.

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Photography/Mary Merrick

## NeXT Ink/Dan Lavin

The people at NeXT have one clear goal: They want to change the world. The lever they plan to use is computing. They view computers as tools that, if engineered correctly, can liberate human beings to think and create more freely.

Reaching beyond the idea of personal computers, which are built for individuals, they extend this vision to the group. Over the past five years, the NeXT team has come up with an idea based on their own experience working together so tightly—that people working together can do so far more effectively with the aid of computers. Computers can encourage groups of people to think, create, and exchange their thoughts with a flexibility impossible with other modes of working.

NeXT as an organization has been fundamentally changed by this vision, which they call interpersonal computing. The vision is still being formulated, but the promise is clear: By providing a complete set of technologies that work together, the NeXT family of computers will fundamentally change the way a group works. These technologies currently include such things as e-mail, fax, and a shared calendar; they promise to evolve into an even richer set of tools over time.

The problem NeXT faces is that in order to change the world, a lot of people have to buy into the vision, which means—from the standpoint of

NeXT—buying a NeXT computer. Moreover, this vision needs to be refined and put into practice by many workgroups. Therefore, lots of people need to buy lots of NeXT computers.

This is the area, then, where NeXT needs to do some leg work. They must find ways to sell their computers.

For a long time the stumbling block was obvious: It was the machine itself. In the process of pushing the parameters of technology, NeXT ended up with a product that, ironically enough, had performance problems and was priced out of the reach of most people. The '030 cube was sufficient to test the workgroup concept but not to implement it. This time around NeXT has solved the problem in spades. The new machines are a *tour de force* addressing the former problems in both performance and price. If sold by the millions, the NeXT could be a machine for the mainstream.

The big dilemmas now hinge on UNIX and distribution.

UNIX is the right operating system for NeXT. It is unsurpassed in flexibility and power. Interpersonal computing requires support for many things going on at once, and UNIX is the only real choice for true multitasking. But UNIX is complex. NeXTstep, NeXT's graphical interface layer on top of UNIX, is a stupendous achievement (see "NeXTstep 2.0" in this issue), but there are holes in this layer that make it less than plug-and-play. Currently the system software is like a car with its hood up. NeXT has left some wires exposed while they work out the kinks. Now it's time to close the hood, make the interface seamless, and move onto the mainstream highway.

As it stands now, too many tasks require technical expertise. One important example is setting up a network, a key to interpersonal computing. NetInfo is the proprietary administration tool provided by NeXT to do this. It's powerful, but it has a complex user interface that may intimidate the average user. Ideally, a department should be able to order five machines by mail order, set them up, and run a standard network with minimal help. That would bring the promise of interpersonal computing to the average person. Then the first gear would be in place to start changing the world.

Another important goal of this vision is to make communications with the outside world seamless and built-in. You would be able to plug in your NeXT machine, plug your phone directly into the back of it, run a simple piece of software, and have the world as your oyster. There should also be



an easy connection between telecom and e-mail because, after all, you have to be hooked up to the world before you can start changing it.

But even a perfect machine needs to be in people's hands before it can make a difference. You can't change the world a few engineers and mathematicians at a time. Distribution is currently in a total shambles, and Steve Jobs is not revealing what he's going to do next. Even interested potential buyers may not be able to become NeXT owners simply because they can't get the machine.

NeXT must now make some serious choices. As a small band of about 500 people they have the power to transform the face of technology but not create new retail channels or modes of consumer marketing. In order to sell to the broad market, a company must succeed at retail like Apple. In the traditional workstation market, it must sell direct, like Sun. NeXT must choose one road or the other because the pricing strategies, if nothing else, underlying the two methods are completely different.

Though the NeXT is a great workstation for a fantastically low price, it would be a mistake to focus sales efforts on the traditional workstation

market. At its heart this machine is a logical extension of the personal computer—an interpersonal computer. Though NeXT has developed the best sales and sales support team in the world, they are not equipped to swell to the thousands of salespeople needed to sell directly to large customers, as Sun and IBM do (and that kind of effort would miss the small customer and dilute the vision). Right now, the sales force is spending all its energies selling directly to the Fortune 500. It would also be more productive if the sales force could be used to help leverage more traditional channels of distribution.

NeXT has got to go retail, and go retail with a vengeance. They need to make the machine available through a wide range of outlets. They need to sell through most computer chains. I also envision a powerful network of independent retailers specializing in these machines. Brand-new entrepreneurs, working hard, could really spread the idea of an interpersonal computer. Look at what independents have done for cellular phones, another relatively complex technology. NeXT would need to help the dealers get going both financially and

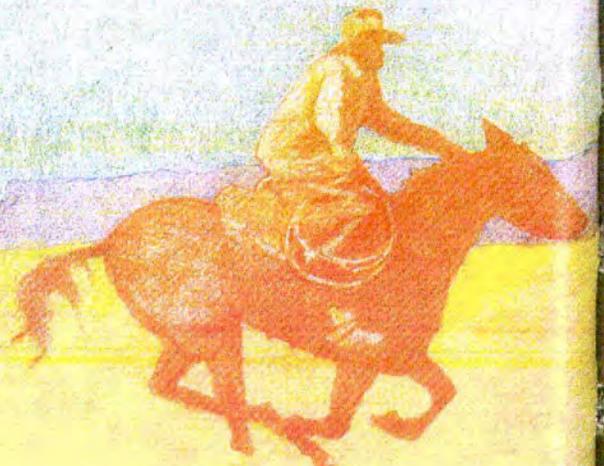
technically, but that would cost only a fraction of the price of a direct sales force.

For wider distribution, I strongly advocate mail order sales. If NeXT would solve some of its interface problems, especially in networking, you wouldn't need all the hand-holding now going on nationwide. People like to buy through mail order. Let them. Mail order would legitimize NeXT as a mainstream player and provide low-cost access for isolated pockets of users not in the Fortune 500 or near a major computer retailer.

At the same time, the NeXT family needs to be rounded out. NeXTstation screams for a laptop. I hope that NeXT is hard at work on this. Pop the hood on a NeXTstation and you'll see a single board, light power supply, and small drives. Let's put together an eight-pound NeXT with a flat screen, just as sharp as the current one—and include cellular communications, of course.

The software goals I've mentioned have never been met by anyone, including Apple, and certainly by no one in the UNIX environment. Generic distribution of powerful computers would also be a new trick. But you have to pull some aces if you are

Adamation.....the stor



going to change the world. . . . Can NeXT possibly do it? Well, their way of approaching the future is interesting. Rather than pre-ordaining a path, they gather up the best and the brightest, fuse together the best of their ideas, sprinkle in state-of-the-art technology, and watch what comes out. After a few stumbles, this freewheeling method seems to have paid off—they've given us 90 percent of their interpersonal computer. After NeXTstep, NeXTstation, and NeXTdimension, I think the company that is changing the world is up to those challenges.

*Note: I'd like to credit Stewart Alsop for the insights into NeXT's place in the computer market, which he contributed during a conversation with me last summer.*

### Shorts

NeXT Connection (NC) has entered the marketplace. This is an arm of the large, well-established, well-regarded company in Peterborough, New Hampshire, that also owns Mac Connection and PC Connection. They are an important part of the community because they provide small software developers with a sales outlet, and the NeXT allows small, focused applications to be created by people in their spare time—folks who have no time for sales or marketing.

The combination of NC and 2.88MB floppies helps to solve these problems. I had a chance to speak with the folks at NC. They have innovative ideas, a reputation for service, and an unbelievable middle-of-the-night deadline for next-day delivery.

Both Apple and Sun have released new machines. The offerings look impressive on paper, but I've had little hands-on experience with either. The low-cost Macintoshes sport an optional microphone (shades of IPC). These features were sorely needed, but they don't really advance the cause of computing, especially if Apple can't ship them.

Sun's machines, on the other hand, run 20+ MIPS. Though much more expensive than the new NeXTs, anyone willing to pay NeXT's old prices for the most powerful machine might be tempted by these Suns. A Sun is still inappropriate in the general business community, but the company bears monitoring in the traditional workstation market.

Total sales of NeXT machines announced are 25,000 units, including 10,000 for higher education. This is an important number, demonstrating the success of the new platforms.

Finally, NeXTstep 2.0 and NeXTstation shipped on time on November 26. Congratulations to Dave Besemer, Curtis Sasaki, and the rest of the team. ☺

**NeXT Ink** will focus a sharp eye on NeXT and its impact on the microcomputer market. **Dan Lavin** is technology editor of NeXTWORLD. He is always interested in talking about these and other NeXT issues. He can be reached at 415/978-3186, or e-mail [nextwrl@davin@uunet.uu.net](mailto:nextwrl@davin@uunet.uu.net).

## ...the strong leader on the NeXT frontier

Taming a new frontier takes courage, skill, hard work, determination and vision. NeXT has presented the world with a new technological frontier, and Adamation is blazing a trail across it.

While holding a tight reign on office automation, Adamation is steering the complex world of interpersonal computing with intelligent, productive software. It's total solution approach begins with 'Who's Calling?', the most advanced client database management system available today. And it's available exclusively on NeXT. Adamation also offers Live Wire, a true interpersonal computing product for sharing information and collaborating effectively over a network.

Beyond these shrink-wrapped solutions, you can put the Adamation posse to work to solve your unique information management needs. They can build on existing products or create new ones from scratch, whichever works best for you.

One thing is for sure. Adamation is the one to lead you into the NeXT frontier.

Adamation 1435 Center Oakland, California 94607 415-452-5252

Circle 8 on reader service card

You're witnessing quite an important moment in the history of the Motorola 68040 microprocessor.

It's actually shipping. In volume.

And while advances in chip technology have become an almost annual event in the industry, you may rest assured that

## MOTOROLA DELIVERS THE REVOLUTIONARY 68040.

there's never been anything like the 040 in a desktop computer before.

With its "single chip implementation," the 040 is as much an economic breakthrough as it is a technological one. Because many of the sophisticated functions that used to require expensive additional equipment are now built in.

For example, the 040 chip incorporates the capabilities of a "floating-point" co-processor. So it can not only handle high-level mathematical routines, but do so up to ten times faster than its powerful predecessor, the 030—the processor at the heart of many of today's fastest machines.

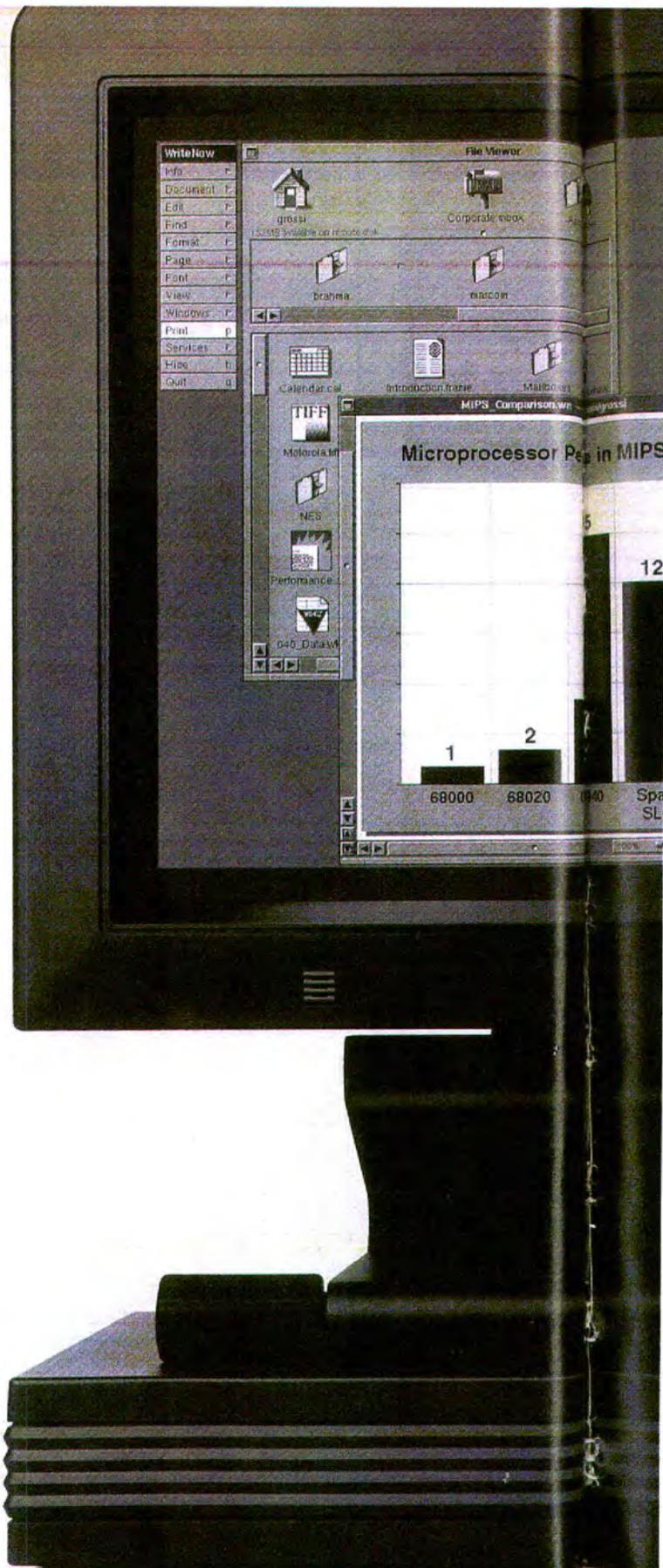
Cache memory has also been built in, to further speed the chip's operations.

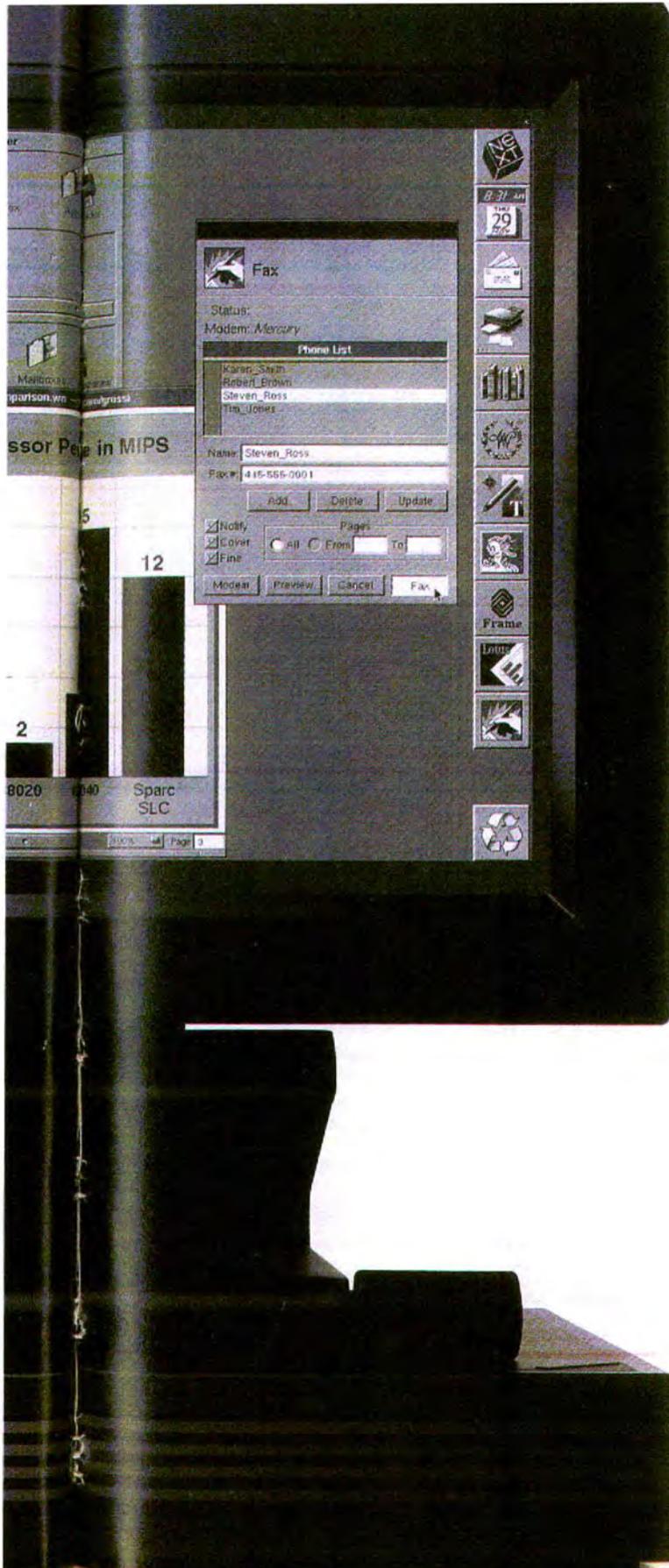
While we're on the subject of speed, we're pleased to report that the 040 chip delivers a full 15 MIPS. In overall performance, that's 300% better than the 030. (And, for comparison, literally twice the performance of a Compaq Deskpro 486.®)

Of course, the 040 chip was designed to be perfectly compatible with all those computers that have been built around other chips in the 68000 family. So it will support the enormous base of 68000 software that currently runs on Macintosh® and UNIX® platforms.

The 040 is the result of an extraordinary effort by Motorola engineers. But if you think the chip is something, wait till you see what happens when you build a computer around it.

 **MOTOROLA INC.**





By no coincidence, this is also a milestone in the history of NeXT™ computers. As promised, the NeXTstation™ computer is now officially shipping. In volume.

It's the first computer designed to take advantage of Motorola's most recent feat of engineering: the 68040 processor.

## NeXT DELIVERS THE FIRST COMPUTER THAT HAS IT.

The NeXTstation offers the networking and multitasking power of UNIX, but without the complexity most workstations are known for. The graphical NeXTstep® environment makes it as easy to use as any desktop PC. Even Macintosh.

But the applications you can run on the NeXTstation are beyond anything you've seen on a desktop computer before.

Lotus® has recently unveiled Improv™, a revolutionary spreadsheet that lets you view your data in infinitely different ways. WordPerfect® is offering the first "What-You-See-Is-What-You-Get" version of its best-selling word processing software. And Adobe® will soon be releasing the NeXT version of Illustrator™, which fully exploits NeXT's pure PostScript® environment.

And with true multitasking, all of your applications can run at once. Including NeXTmail™—provided with every NeXT machine—which helps keep you in contact with everyone in your working world, using text, graphics and voice.

The NeXTstation computer comes complete with the 17" MegaPixel Display, 8 megabytes of memory, a 2.88MB floppy drive, a 105MB hard disk and both thin- and twisted-pair Ethernet. All for \$4,995. Reason enough for *Byte Magazine* to say the NeXTstation "may now be the workstation price/performance leader."

If you'd like a brochure describing the NeXTstation computer in detail, just call 1-800-848-NeXT. We deliver.



Circle 12 on reader service card

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# Business Calls **TI**

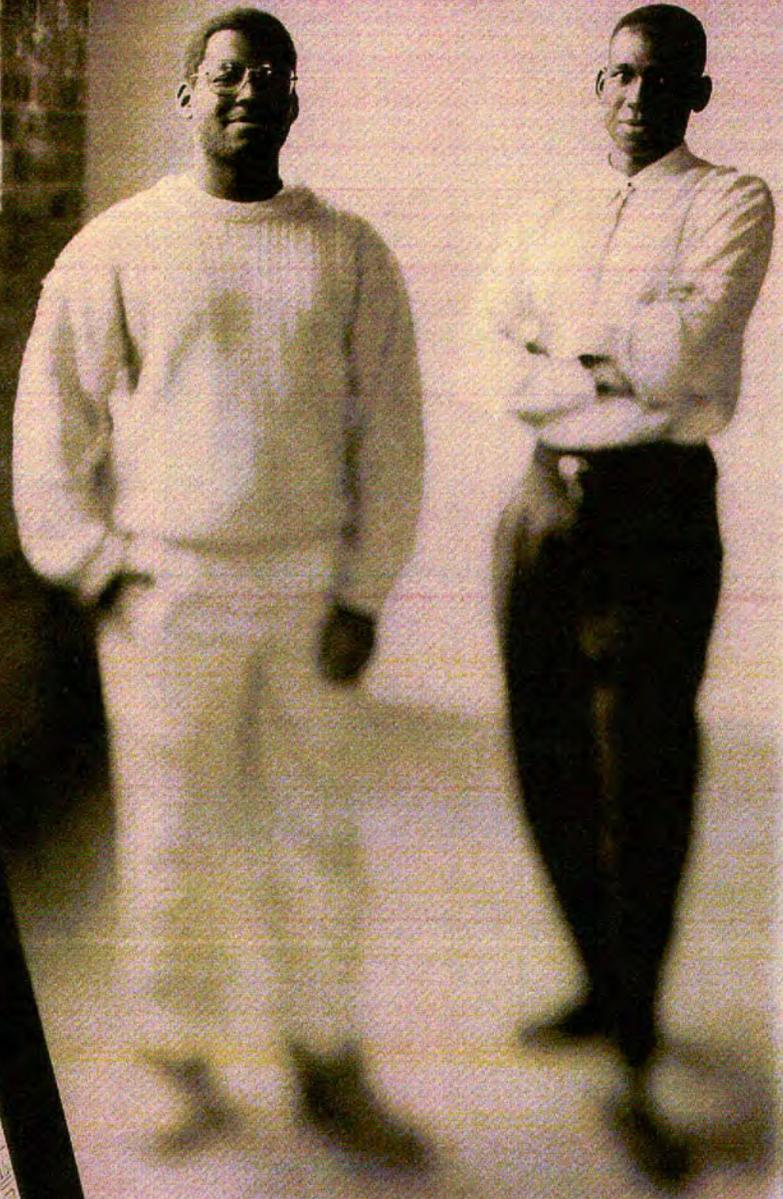
**Who they are** Stephan and William Adams

**Company** Adamation, Oakland, California

**Product** Who's Calling?, an interactive client data management system that combines a mailing program with multiple utilities such as client databases, calendars, and telephone management features

**Time in development** Four to five months

**Current or upcoming projects** Live Wire, a package that lets users share internetwork information via live conferencing with multimedia support



# The Story of Adamation

The complementary talents of two brothers, a strong focus, and the right platform combine to make Adamation a success.

by Roger Dubin

Center Street in Oakland, California, is a world far removed from the geometric gleam of Silicon Valley. The people who live here are working class, mostly black, and mostly struggling. Yet, in a loft above a loading dock and a video services firm, a software company for the NeXT computer is thriving on Center Street. Adamation's two young founders, brothers Stephan and William Adams, grew up in neighborhoods like this one. Theirs could be a Horatio Alger story, and the nature and future of their company seem intrinsically linked with the character and success of the brothers themselves.

**"We think it's right that corporations support minority businesses with affirmative action programs, but anytime anyone buys a product or service from Adamation, it's going to be because we competed head-to-head with industry leaders and won."** —Stephan Adams

William and Stephan, now 26 and 28, learned the value of a competitive spirit from their parents. The Adams brothers were born and raised in Southern California, but forget visions of swaying palms, golden beaches, and easy living. Home was the barrio. Joseph Adams, a tough Navy veteran of World War II, and his wife, Julia, a social worker, encouraged their children to compete in sports to keep them straight. Joe died suddenly when William was almost eight and Stephan ten, but Julia remained determined in her involvement—going to every game, supporting every effort.

By the time he entered high school, William proved to be a mechanical whiz with gadgets, erector sets, electronic kits—"taking apart the stereo and not quite getting it back together," as he puts it. Meanwhile, Stephan realized an innate entrepreneurial flair. Teamed up, these characteristics proved to be a strong foundation for business ventures.

By this time the family had moved to the suburbs. When a neighbor installed a complex sprinkler system, Stephan watched to learn how it was done. Then he put in a clone system in his own yard. When he realized that the local landscapers were making a killing off of the systems, he decided to go into business for himself. Armed with photos of his system, lugging around sprinkler heads and manifolds for visual aids, he went door to door, underbidding contractors by 75 percent. He installed 16 sets. "The key was cheap labor," he jokes. "I got William to help with the mechanical side and recruited my friends to dig the ditches, and I paid them, well, not peanuts exactly, but pizza."

**"You've heard 'What you see is what you get'? Our philosophy at Adamation is 'What you want is what you get.' What many companies don't understand is that when they make an investment in technology, what they are really doing is gambling on the development time for their custom appli-**

**cations, because so often by the time the applications are ready the technology is obsolete. That's the beauty of NeXT and, frankly, the beauty of the way Adamation develops applications with NeXTstep. A company might pay a little more for NeXT hardware, but development time is light years faster than it would be on any other platform, which more than offsets the hardware costs. And the results are going to be exactly what they want, for less money than they expect."** —Stephan Adams

Taking pictures of the sprinkler system sparked Stephan's interest in photography. Coupled with a passion for track and field, this interest led him, with his brother's help with the wires, to produce multimedia slide shows of their team to present at awards banquets. At the same time, William was just discovering computers.

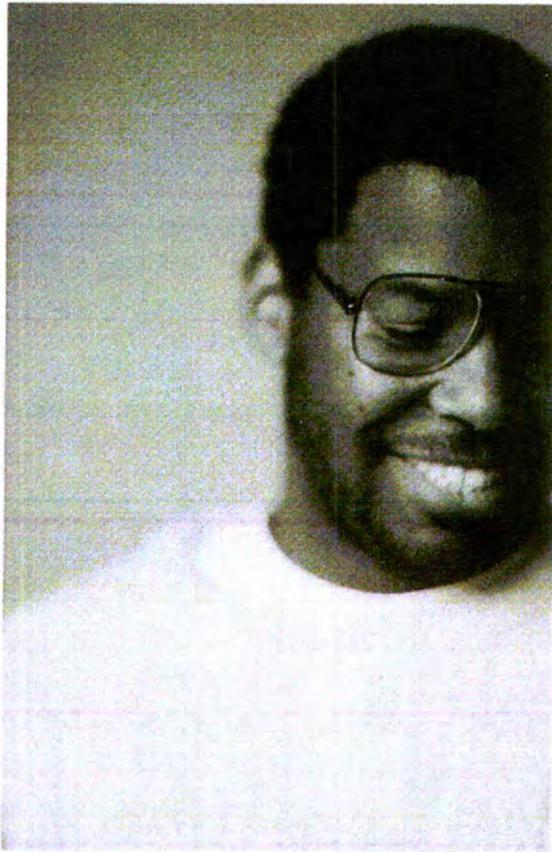
"I entered the computer world feet first," William says. To occupy him during recovery from a foot operation, William's podiatrist gave him a book on programming. Soon afterward, an uncle gave him a Commodore Pet, and William began programming in BASIC and machine code. When he was 15, William and a friend founded their high school's computer club, becoming the primary users and programmers of the school district's DEC PDP-11/10.

William was also discovering heroes: Nikola Tesla, Thomas Edison, Guglielmo Marconi. "Those guys were really on to something, you know?" he says. "Still, I looked at Tesla, who invented thousands of things, including AC electricity, and I wondered: Why is he so unknown; why did he die so poor? And the answer is that he was always at the mercy of money, having to sell his patents to Westinghouse and J. P. Morgan and others just so he could continue with his work. My thought was that ultimately I wanted to do those sorts of things too, and run my own little research facility, except to have it be self-funded. That's when I decided I needed to go into business."

**"There are a lot of community programs that teach black kids about computers, except it's usually just word processing and spreadsheets. All that makes them into is some cog in the corporate wheel. One of the things we eventually want to do is teach black children how to program computers, so that they can learn to manipulate the computer's potential for good and be part of directing the future. We really want to leverage our business to help the community."** —William Adams

After junior college, Stephan transferred to UC Berkeley, the same campus where William was enjoying being away from his elder brother. "It was role reversal time for me," Stephan recalls. "At home, I was usually the leader, but now I was entering William's world, and he took the lead." But as usual, the brothers





**William Adams**

pooled their resources. Stephan earned money as a waiter in upscale restaurants; William became the assistant manager of the campus computer store. The following year, William quit school to become manager of the store.

That year, 1984, was exciting for the Adamsons. The store was doing about \$4 million a year, the Macintosh had just been introduced, and Berkeley was chosen as a prime test site for the Mac educational program. In April, the brothers decided to form Adamation. They also began publishing a magazine called *Computer Dialogue*, to which William contributed some free-ranging articles featuring ideas, such as voice annotation and network-distributed databases, that later found a home in Adamation's products for NeXT.

On the computer side of the business, William and a friend (who now works at Sun Microsystems) developed a word processor for a blind student and a joystick for the Mac before one was available to the public. Meanwhile, Stephan landed their first big contract in 1986 from an Oakland company named Catalyst Productions, which needed a custom mailing program. Out of that project, William developed PC windowing tools long before they were available from Microsoft. They never marketed any of these products, however. "I mean, who would want a joystick for a Mac or windows for a PC?" William quips.

Not until the 512KB Fat Mac came out did Adamation offer its first real product: memory upgrades for the 128KB machine. That's when William took the plunge and began to devote all of his time to Adamation. Stephan supported himself, William, and their fledgling company while simultaneously beginning a Ph.D. program in clinical psychology at the Wright Institute, which he will complete in June.

Despite some lean years that followed (they dubbed 1986 the Year of Peanut Butter and 1987 the Year of Popcorn), the brothers' attitude toward money has remained the same: "Whatever we have belongs to both of us and to our business." But peanut butter and popcorn get pretty old pretty quick. William knew he had to earn some money.

***"When we heard that Steve Jobs had left Apple, we wrote him a letter. We said: 'Whatever you do next, we want to be part of it.' We knew that even if it involved processing horse manure, if Steve Jobs was doing it, it would be new and visionary and important to the world, and we didn't want to miss out."***—William Adams

Responding to an ad posted on the Berkeley campus from a company called Ingres, William got a contract to test its UNIX database. The project lasted two years, but more important than the financial relief was the birth of a professional association that would prove crucial to Adamation's future. The relationship with Catalyst Productions also produced key results. Impressed with the custom programming Adamation had created, Catalyst offered the brothers some unused space in their new offices on Center Street free of charge until they could afford to pay rent. Catalyst's patronage took Adamation out of William's apartment and put it on the map. Now the brothers were ready for NeXT. And NeXT was just about ready for them.

Before they even entered the ground floor of development with NeXT,

William and Stephan realized that all the major packages, like spreadsheets and word processors, would be produced by major vendors adapting programs from other platforms. They also figured, judging from their past interests, that the type of product they would want to create for Adamation would require a database. Sybase was slated to be bundled with NeXT machines, but Sybase wasn't available yet. Instead, they saw an opportunity with Ingres and sweet-talked their way into the NeXT development community.

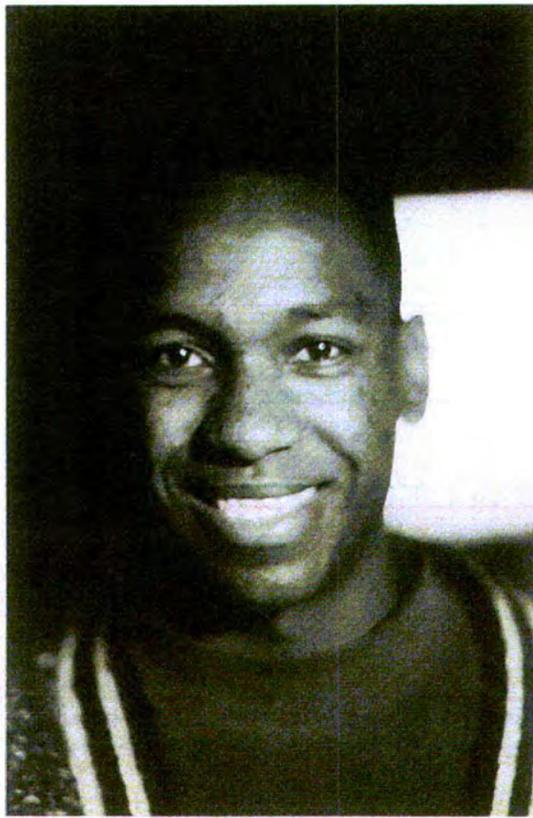
***"We had Ingres saying they'd contract us to port their database to NeXT if NeXT would give us a development machine, and NeXT was saying they would give us a development machine if Ingres would contract us to port their database. We convinced each one that we had the other, and before anyone could think about it too long, we wrote a check to NeXT for \$14,000. The only problem was that we only had \$6000 to our names. So while William went off to developer's camp, I flew to New Mexico and got a company who knew our work and had expressed an interest in using our services to front us \$8000 against a future contract. Then I rushed the funds into the bank just before the check bounced. Aside from that, every dime in Adamation is our own."***—Stephan Adams

"The important thing is that we ported Ingres to NeXT, normally a very expensive process, for no fee to Ingres," Stephan explains. "Instead, we negotiated a very favorable licensing agreement for ourselves. Because of that, we were able to build our own product inexpensively on what we feel is a superior foundation. Plus, we had a substantial lead over anyone else who wanted to do a database product, because Sybase still wasn't ready."

All they needed now was a great idea, something nobody else would think of for the NeXT platform—a horizontal product that would cut across a multitude of industries and all the departments within those industries. So they surveyed Macintosh and PC magazines. What they got were a lot of little ideas that added up to a big one.

"We started noticing all the little utility programs that were available—calendars and telephone management, client databases, and the like," Stephan explains. "Then we thought about the mailing programs we had created and realized that with that sort of program at the center and the best of these other utilities linked to it, we could create a product that would utilize the unique features of the NeXT machine yet be aimed right at the real beauty of NeXT, which is networking. That's how *Who's Calling?* came to be."

*Who's Calling?*, Adamation's flagship product, is an interactive client-data management system. The evolution of the package brought together everything the brothers had learned from their diverse experiences—the hard knocks they'd earned from their own business endeavors, the insight they'd gained from Catalyst Productions into how corporations live or die on client data, and their natural savvy about finding the right market niche. This company's philosophy of development—using the knowledge gained from doing custom applications to develop shrink-wrapped products that have already undergone real-world testing—has paid off in a unique profile with which Adamation can approach the corporate community. *Who's Calling?*, now in release 2.0, has been the



Stephan Adams

deciding factor in selling NeXT hardware to some big clients, such as the William Morris Agency, the oldest and most prestigious talent agency in the world. Adamation's latest product, Live Wire, an interpersonal computing program for sharing internetwork information via live conferencing with multimedia support, seeks to follow the same philosophy.

People at NeXT also recognize the success of Adamation's tack and the developers' commitment to the NeXT environment and philosophy. "Here are a couple of guys who were there at the beginning, who bet their futures, their business, everything they had on this machine and this philosophy, and won," says Max Henry, executive director of the developer partnerships program at NeXT. "I think they are a very important part of our future, because they are on the leading edge of this thing we call interpersonal computing."

Henry points to an instance when Steve Jobs visited the William Morris Agency early on in the Adamation project. "People were coming up to him and saying, 'I have never used a computer before a month ago, and now I don't know how I could survive without one. It's changed my life.' They were speaking about Adamation software running on NeXT hardware," Henry explains. "I think that speaks for itself."

*"In the future I know I'm going to be involved with Mindlink, the direct hookup between the human mind and computers. What I'm doing now is a lot of thinking about the practical social implications—how this can affect mankind, how it can be used to help young people better organize their thought forms, how to prepare and change society so as to avoid culture shock when it becomes reality. Look at the beginning of the PC revolution. The advertising tried to scare people into using computers: 'If you don't learn this, in five years you'll be obsolete.' A lot of the educational software was written by programmers who didn't know how to teach, or teachers who didn't know how to program. Sometimes I think it's still that way. With Mindlink, we can't afford to be unprepared because the implications are just too overwhelming. I hope when the time comes, I can help lead it down the right road."*

—William Adams

Regardless of what lies ahead, the Adams brothers plan to maintain the spirit of competitiveness they learned from their parents. Although he recognizes that at some point Adamation may have to consider some form of capitalization to continue growing, Stephan regards that decision as a test of their character. "We look at it this way: If we have to compromise our ideals and the opportunities we've worked so hard for just to raise money, then we don't deserve to keep this company," he explains. "What's the worst thing that could happen? That we'd have to go out again and get jobs to support it? That's not so bad. We've done that. Sure beats selling out." 

*Roger Dubin is a free-lance writer, advertising and marketing consultant, and NeXT user living on the island of Maui, Hawaii.*

"My brother is a mastermind," Stephan Adams says reverently. But talking to William Adams makes you believe that almost anyone can program in NeXTstep.

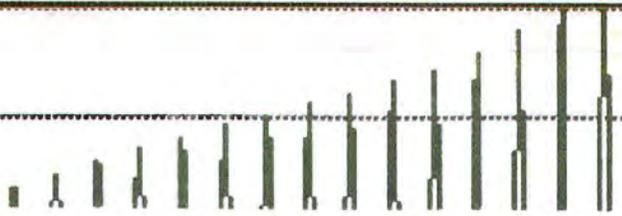
While completing the part of the Ingres database to the NeXT, William was also getting to know the NeXT way of programming. The front end of an application is set up completely through the Interface Builder. "You just lay out your screens, drag windows off the palette, position them where you want, and then drag your buttons and sliders into place; when it looks right, well, that's it as far as your interface."

That's a total departure from the norm, he says, because there are no tedious codes to write that specify exactly where to place windows or buttons. With a Mac or any other platform, you must write those codes, "which consumes 80 percent of development time and represents about 80 percent of the code as well," he gauges. "With NeXT's Interface Builder, that's reduced to maybe 10 percent."

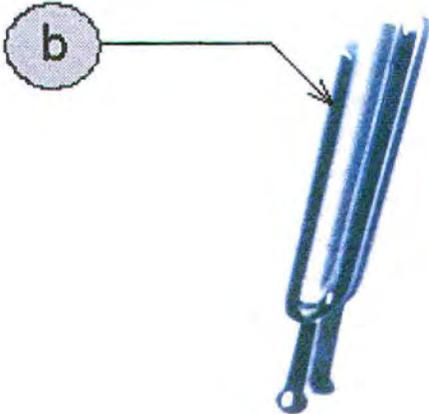
Once he had built the front end, he still needed to write the part that manipulates the database to make it talk. "That's the essence of the code you are writing, of course, and even NeXT hasn't gotten around that part of the process yet," he says. The problem for Adamation was that Ingres wasn't designed to be used with an object-oriented environment. William had to create his own object-oriented interface between Ingres and Who's Calling? This represented about 500 lines of code that were going to have to be repeated over and over.

"What NeXT has done is make it possible for us to eliminate that 500 lines of code by writing a general interface object, which we call Data Manager, between Ingres and our application. Now, when I need to send a command to Ingres, I just send it to Data Manager and let it worry about how Ingres wants to deal with it, how the results come back, and how those results get transferred to the program."

By working in the NeXT environment, William has been able to develop a set of these special tools and objects that combine common sets of codes so that each time a function is desired, the code doesn't have to be rewritten. Programming time, mistakes, and bugs are cut to a fraction, he adds. Who's Calling? took about four to five months to develop in the first place. "That's only half the time it would take on any other platform, even if you could find another platform with all the NeXT features, which you can't," he says. "If I started right now, with all the tools and objects we've created, it would take maybe two months. Our development time keeps getting shorter and shorter as we go along because we keep building off these objects."



# A Sound Thesis



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## Researchers at Stanford study synthetic sounds to create the NeXT generation of computer music.

by Laura Fredrickson and Thierry Castro

Stanford University's Center for Computer Research in Music and Acoustics (CCRMA) resides in a Spanish Renaissance-style mansion atop "the Knoll" on campus. Students and faculty come to CCRMA (pronounced "karma") from the fields of music, electrical engineering, computer science, and psychology. Their projects span the far reaches of the arts and sciences.

"We can extend our fantasies," says John Chowning, professor of music and director of the center. "It starts with passion for music and composition and a curiosity about the medium in which we work. Computers let us break the boundaries of the physical world to create sounds that don't naturally exist."

Studies at CCRMA range from composition and performance to digital synthesis and psychoacoustics (the study of how the auditory system perceives sound) and reflect the center's interdisciplinary nature. The physical atmosphere, too, is a mixture. State-of-the-art sound equipment stands in sharp juxtaposition to the old-world surroundings. Modern studios packed with synthesizers, mixing boards, and NeXT computers are just steps down the hall from a grand ballroom where classes convene beneath sky-high ceilings edged with baroque fixtures.

**Behind the scenes.** At the heart of CCRMA's work is the Common Music software, a vast set of programs and system tools for editing, viewing, and synthesizing sound. Common Music is a collection of CCRMA's nearly two decades of research. Working without it, Chowning says, "would be like putting a violin in a student's hands and telling him to learn to play, without giving him any idea about how to hold the bow or how to pull it across the strings—without any knowledge of previously discovered techniques."

Until recently, Common Music resided on a Foonly F4 mainframe, a DEC

PDP-11/10 emulator. Implementing the software required the Samson Box, a one-of-a-kind synthesizer that looks like a giant green refrigerator. It was commissioned with grants from the National Science Foundation and the National Endowment for the Arts when CCRMA began. According to Chowning, the Samson Box with the Foonly "probably produced more music than any specialized synthesizer that has ever been built . . . and has been the center of all of our instruction and research over the years."

Just about a year after moving to its current site, the CCRMA staff decided to retire this behemoth setup. The Foonly was a time-shared system, but the music playback from the Samson Box was a central service that had to be scheduled. Instead, what CCRMA needed was an integrated multiuser system that would support both functions simultaneously. So in 1989, they began moving operations onto NeXT computers.

Two major factors convinced the CCRMA staff to choose the NeXT platform, according to Chowning. Most important was NeXT's commitment to music and sound. "NeXT was providing not only an integrated system with sound capability—which you can have now with other systems, but not from a manufacturer—but also the supporting software. That was a commitment that no other computer vendor has ever made," he explains.

Second, NeXT had recruited Julius Smith, an associate professor at CCRMA and an expert in digital signal processing (DSP), to design the computer's DSP software for music. This move showed the people at CCRMA that NeXT was hiring top talent. It further convinced them that NeXT was seriously committed to music and, in Chowning's words, "wouldn't make any dumb mistakes."

Chowning also cites a key advantage for university settings. "If you have a system that costs about as much as a piano," as the NeXT does, he says, "there's a hope that you can go to your department chair and say, 'Look, this is what we need, and this is what it costs.' It's within imaginable budgets. But what one gets is enormous. That's one of the reasons we adopted NeXT."

**Off and running.** Although CCRMA has had the NeXT machines for only a short time, several projects on the computer are already underway. One graduate student is creating a real-time MIDI performance system; another is studying how a machine perceives music so he can develop a cognitive model of listening. Others are physically modeling instruments; that is, they are constructing computer models of instruments so they can manipulate the instruments' shapes on screen and study the effect that these changes have on the sounds produced.

On the faculty side, visiting professor emeritus John Pierce is conducting experiments with tone pitch perception to better understand how the auditory system works. And in addition to conducting classes on the NeXT, Chris Chafe, CCRMA's technical director and an associate professor of music, is modeling stringed instruments to determine the effects of friction on the strings.

**A new voice.** When CCRMA's first NeXT machines rolled onto the Stanford campus in January 1989, Perry Cook was able to grab a Cube for his project, one of the most notable pieces of research underway at CCRMA. Cook, a doctoral candidate who holds degrees in both voice and engi-



neering, is developing a computer simulation of a human singing voice.

Cook's program, called Singing Physical Articulatory Synthesis Model (SPASM), is an interactive program that models the physics of the human vocal tract. Cook regards the voice as an instrument and, as such, a natural progression in the work that CCRMA has been doing for the past decade in computer modeling. "Voice extends the family of models," he says.

A synthesis model that is based on the physics of an instrument, Cook explains, lets a musician or researcher physically describe what something sounds like. This, in turn, can help him or her understand what may need to be done to fix a problem in the simulation. By looking at how the inside of a singer's head works, he says, you can intuit how things should sound. "You get a lot of natural behavior. It behaves as a physical simulation would," he explains. "You know how to play it, in a way.

"On top of this natural behavior is the flexibility to do really weird things, too," Cook notes. "Like build a singer with three mouths. We can do that with a computer. It's still a very natural sound, because it's based on something physical, but it's now entered the realm of the non-human."

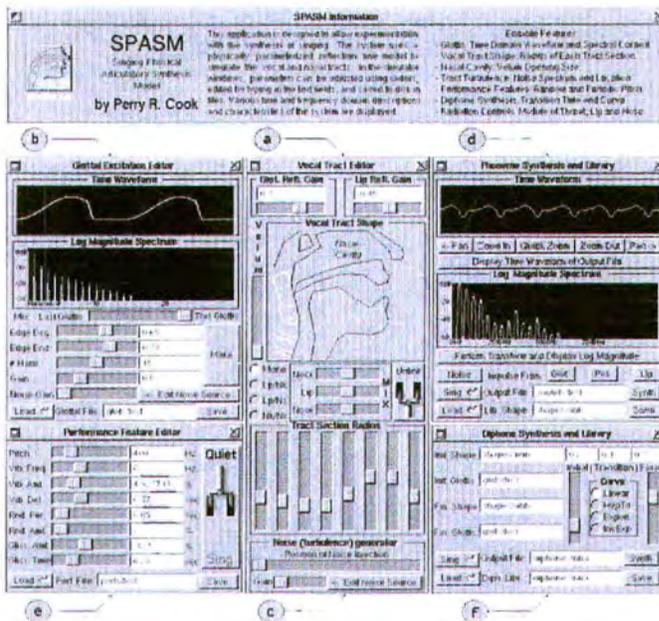
So what's the point of enabling a computer to sound like Ella Fitzgerald? A computer simulation of a singing voice, just as a simulation of an instrument, could be added to synthesizers, giving composers another component for their computer music. Further research should yield voice tracking and recognition, or being able to imitate—"mina bird fashion," Cooks says—the way a speaker sings or talks. A capability like this could be an interactive model for language instruction, both for students learning foreign tongues and for the deaf learning to speak. The machine would give feedback on the speaker's performance. An interactive system would also be a boon for linguistics or speech therapy students. Or it could be used to generate controlled stimuli for testing in psychoacoustic research.

On screen, SPASM displays the cross-section of a human head, showing the mouth, throat, and nasal cavity. Cook can manipulate the parameters—change the shape of the mouth, alter the position of the membrane separating the nasal cavity, or imitate other physical changes—by using sliders and switches in various editor windows. By clicking on the appropriate switches, he can choose to hear the resulting vocal changes either in real time or on request.

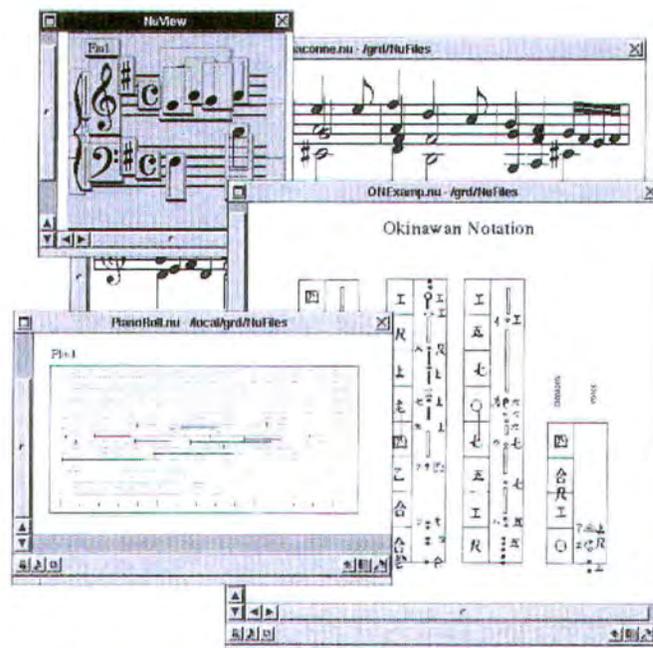
But creating a singing voice is much more complex than synthesizing the sound of a musical instrument or a speaking voice. Voice is a unique instrument. It varies from person to person and is full of random fluctuations. SPASM can map a specific singer's voice, but, Cook cautions, a person's voice cannot be exactly duplicated because of its many individual traits. "Perlman's violin in my hands sounds pretty awful," he quips.

One of these personal characteristics is an individual noise component present in a voice. Cook says SPASM will help him to study sound frequency and control in order to understand more about this individual noise. He hopes to eventually model the noise as well.

Further complicating the task of synthesizing a singing voice is the need to



Myriad controls and switches operate the diagram of a human vocal tract in SPASM, a computer simulation of a singing voice. When the lips are repositioned or the nasal cavity closed, this "singer" produces sounds based on how a real singer would perform with the same physical changes.



Nutation, a music notation program, allows composers to write in a layered fashion, placing staves on pages, then notes on top of staves, and so on. Because Nutation is a visual programming language, composers can use non-Western notation or even create their own notation within the program.

incorporate pitch and vibrato. In speech synthesis, Cook notes, these factors are usually ignored. In SPASM, pitch and vibrato can be added using the controls. Cook hopes to add the option of setting the program to make pitch and vibrato automatic.

Cook began his work on a Mac II but moved to the NeXT to take advantage of the Sound Kit, DSP tools, and the Interface Builder development environment. "Probably the most important thing," Cook says, "was having the built-in CD-quality sound in the DSP chip. When I first started out on this project on a Mac II, I had to walk to another building to hear my sound files." They had to be produced by other equipment in another location.

Having built-in sound has helped throughout the project, he adds, "because when I go somewhere to give a talk, if they have a NeXT machine, I can count on their NeXT machine having sound. That is not true for Macs or anything else. There are plenty of sound options for those machines, but you have to figure out which one they have, if any. All I have to do is make sure they have a NeXT, and that guarantees I can show what I'm doing."

**3D music.** Glendon Diener, a CCRMA grad student in the last throes of his dissertation, has also been busy on the NeXT. Diener has created a music notation program that he calls Nutation. The name is a pun of sorts, incorporating the ideas of notation, mutation, and newness. Basically, Nutation is an object-oriented visual programming language with which composers can write musical scores in a hierarchical, or layered, fashion.

By developing Nutation, Diener hopes to support his thesis that hierarchical data structures are superior to the linear, or flat, representations used in most computerized notation programs. With Nutation, the composer can layer the elements, or objects, of a score (the staff, clef, notes, and so on) on top of one another. "That is how most musicians are accustomed to thinking about notation," explains Diener, whose background is in music composition. "They are taught, for example, to draw staves on pages, to draw notes and clefs on staves, to draw dots on notes, and so on."

The flexibility of a hierarchical structure allows a composer to more easily shift or duplicate individual objects or groups of objects in a musical score. At the same time, it allows the NeXT computer to immediately play any part of the emerging composition.

Nutation is not limited to the display of conventional music notation. Because the system is a visual programming language, it gives musicians free reign to use other forms of notation (such as eighteenth-century Okinawan, a vertically oriented Japanese form) or to create their own.

Diener completed his project in about 15 months. The NeXT's simple user interface and Display PostScript were the key advantages for his research. "PostScript is available on many computers," he explains, "but on most computers it's available only for printing. The NeXT has Display PostScript. I don't really care about the printing. My program does print, but that's not what it's there for. On the NeXT, I can use PostScript directly on screen. And that's where I need it."

Diener will be keeping busy on the NeXT in the future, too. He recently took on the roles of NeXT system administrator and research associate at CCRMA.

**The NeXT move.** One of CCRMA's most formidable and important projects has been writing a compiler to get the Common Music from the Foonly/Samson Box configuration onto the new NeXTs. The task of rewriting all the old Algol-type code into Lisp fell to Bill Schottstaedt, another research associate at CCRMA with a background in composition theory. He began the project a year ago and has completed the port from the Samson Box. Schottstaedt estimates he should be finished by spring, but the material he has ported so far is being used for teaching students on NeXTs during the current winter quarter.

The NeXT provides several advantages over the older technology, according to Schottstaedt. For one thing, the interactive Lisp language makes manipulating the code easy. "It lets you try things out and change them," he says. Previously, even simple changes required rewriting a lot of code. "Now, for instance, to change the instrument on the synthesizer for one toot takes only about a minute."

This resulting increase in speed is another advantage he cites. On the Samson Box, composing a six-minute piece "would have taken four and a half weeks," Schottstaedt gauges. "On the NeXT . . . it would take an hour and a half." The DSP in the NeXT acts as an accelerator. Schottstaedt says the power of the DSP chips is essential to execute complex or demanding music techniques.

In order to match the computing and synthesizing capability of the Samson Box, CCRMA added a board developed by Ariel Corporation, with the collaboration of Julius Smith, that provides five more 56001 chips. "This brings us right up to the power of the Samson Box and more," Chowning says. "Now this is a system that excites composers."

Schottstaedt has grander visions for increasing the number of 56000s. "Once there are 50 or 100 chips on a board," he says, "composers will approach having an orchestra in real time. I don't see any technological barrier. Somebody just has to do it."

**Instrument for the future.** One idea that Chowning has clearly formed in his mind, if not in the studio yet, is something of a paperless concert hall. The NeXT project he envisions is an instrument and conductor all in one. Not only would the computer produce the sound for a performance, but it would also display musical scores on screen—complete with automatic page turning—for accompanying players. The NeXT's graphics, he says, could dispense with conventional paper sheets.

In addition to scrapping paper, the NeXT could also give a high-tech angle to music lessons. An interactive program, Chowning says, could give feedback from performances and help develop a trained musical ear.

Apparently no ideas are too fantastical. The NeXT has been a very welcome newcomer to CCRMA, and it's not about to be left to rest on its laurels. Whatever future roles the NeXT finds at CCRMA will surely be as inventive, creative, and diverse as the center itself. 

Laura Fredrickson is lectures editor at NeXTWORLD.

Thierry Castro is creative director of CX5, a design and production group in San Francisco.



# The New NeXT

**San Francisco, September 18, 1990.** It's a packed house at Davies Symphony Hall. An expectant crowd, filled with journalists, with the microcomputer industry's best and brightest, impatiently await the appearance of Steve Jobs. They've come to see what bold, new engines of the mind NeXT's been engineering at the cutting edge of computer technology. When Jobs walks quietly on stage, a round of applause relieves the tension. He wastes no time. He's here to dazzle.

Point by point, he addresses his critics. The Cube, he says, was an expression of potential, still unrealized. We've been in a long beta phase. You complained about expense, performance, the lack of color, the paucity of applications. In each case, we've got a few things here to show you. On top of that, our vision for the NeXT platform has grown more explicit. We're here to show you an interpersonal computer. We think you'll like it.

As the industry learned that day, it's pretty clear that NeXT has done its homework.

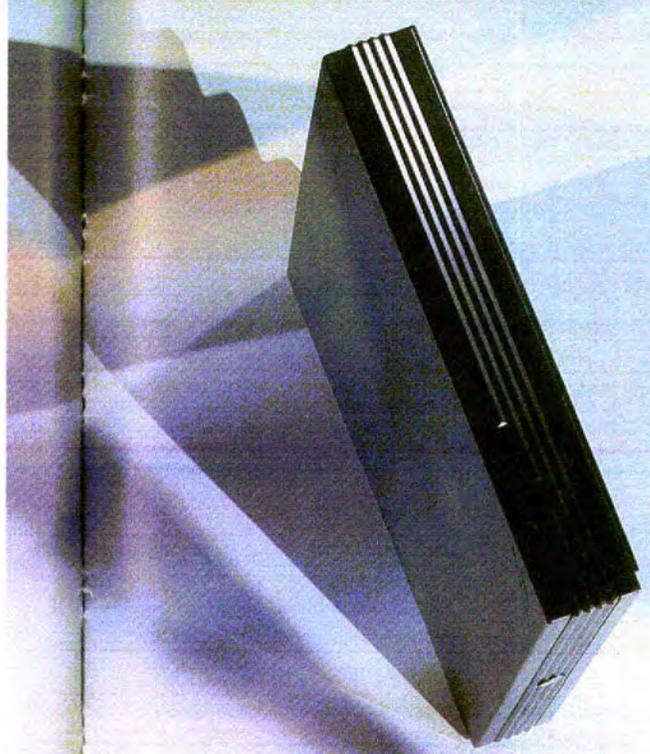
**NeXTstation and NeXTstation Color.** Here are two low-cost, high-performance engines poised to blow away the Mac IIx and the Sun SPARCstation. The two "slabs," the black-and-white NeXTstation and the 16-bit NeXTstation Color, are sleek desktop workstations that promise to open a world of markets to NeXT in the realms of business, desktop publishing, engineering, and education. And like all new NeXT machines, they're built on the 68040 chip set, and run at three times the speed of the former '030. And—also like all new NeXTs—they've got a floppy drive.

**NeXTdimension.** Here's the high end for a NeXTcube system: a full 32-bit color board and monitor, targeted for those who want the best color system for desktop publishing. But that's not all. With onboard real-time video compression and 30-frame-per-second video processing, it's fast enough for film and video. Here at last is a multimedia platform that works, and you don't have to go to six vendors to get it. Move over Apple and IBM.

**NeXTstep 2.0.** Picture a graphical interface to UNIX that gives you clear transport through both individual and group filing systems across a network. Picture also an integrated suite of tools that includes e-mail, fax, interapplication communication, sound compression, and support for color across all applications.

**Key software solutions.** Finally, picture "best of breed" applications now running on the NeXT. Lots of them. Revolutionary spreadsheets, like Improv from Lotus. Electronic document management systems from companies like Boss Logic. Standards in the industry like WordPerfect for word processing.

With a performance is like this, we're a captive audience. We invite you now to sit back and judge for yourself. —**Michael Miley**



# The Slab

The NeXTstation and NeXTstation Color provide NeXT power in a sleek and affordable new package.

by Nicholas Boran

Following the tradition, begun with the Cube, of naming NeXT computers after their distinctive shapes, insiders have dubbed NeXT's new NeXTstation computers the Slabs. A more apt nickname might be the Wedge, however, because these cut-rate, cutting-edge machines are designed to penetrate deep into the competitive personal workstation marketplace. The \$4995 black-and-white NeXTstation and the \$7995 NeXTstation Color are tough competitors of similar offerings from Apple and Sun. A black-and-white Sun SPARCstation SLC with a 100MB external drive costs about \$11,000. A Macintosh IIfx with graphics and storage capabilities similar to the NeXTstation Color costs well over \$10,000. NeXT's new prices pull their computers down into the high-end PC market, and out of the rarified atmosphere of \$10,000-and-up workstations. And now that NeXT computers will be discounted at retail like the other vendors', these prices are fair comparisons.

At the September 18 introduction of the new computers, NeXT founder and president Steven Jobs acknowledged many of the problems that had barred the first NeXT computer from wide acceptance. Jobs admitted that the original Cube was too expensive, too slow, and lacked applications and color. The NeXT offerings Jobs then announced answered all those criticisms and more—including the strong criticism leveled at the original NeXT for its omission of a floppy disk drive. The question remains, however, whether the new machines' features will finally give NeXT a market share in computing's lucrative middle ground.

**First impressions.** The NeXTstations' sleek shape is the most obvious departure from the previous design: The NeXTstation and NeXTstation Color measure approximately 15 inches on each side and only 2½ inches tall. The magnesium case, with its scratch-resistant plastic cover, is strong enough to support the black-and-white MegaPixel Display, which weighs



in at 33 pounds (10 pounds lighter than the original version), or the new MegaPixel Color Display, a hefty 70 pounds.

Though visually identical to the NeXTstation, the NeXTstation Color's system board uses a different memory configuration, which supports 16-bit color (4 bits each for red, green, and blue, and a 4-bit alpha channel for specifying transparency). You'll have to consider very carefully which computer to buy, because a monochrome NeXTstation can't be upgraded to a NeXTstation Color. This fact may give more than one buyer pause.

The new MegaPixel Display offers two improvements over the original version: an internal microphone, which replaces the microphone jack on the old model, and a much-needed anti-glare screen. The keyboard and mouse interfaces, microphone, and speaker are internalized in the MegaPixel Display, but are supplied through a separate device, called the Sound Box, for the MegaPixel Color Display. This allows for the connection of third-party color monitors, though NeXT's monitor is currently the best value on the market. Unlike the black-and-white MegaPixel Display, the color monitor requires a separate power cord.

**A closer look.** The real news, however, is inside the box. All of NeXT's latest machines (including an updated version of the Cube—see the sidebar "The NeXTcube" in "True Color" for details) feature Motorola's new 25MHz 68040 microprocessor, which is three times faster than the 68030 processor used in the original NeXT. According to NeXT, the 68040 processor offers a performance of roughly 1.5 million instructions per second and 2.8 million floating-point operations per second. In terms of raw power, that puts the NeXTstation in the same league as the more costly SPARCstation, and makes it faster than Intel 80486-based workstations running at the same clock speed.

In practice, the NeXTstation's performance far outshines the original NeXT computer, thanks to the 68040 processor, the fast hard disk, and the improved system software (for more on the new software, see "NeXTstep 2.0" in this special report). Operations that took several seconds on the old Cube are processed virtually instantaneously on the NeXTstation. Applications load immediately, and disk access is hardly noticeable. This performance boost was particularly apparent when I indexed a large text file using Digital Librarian, an application that uses keywords to search large text files. Indexing all the Supreme Court rulings from 1980 to 1989—an operation that would have taken minutes on the Cube—took only seconds on the NeXTstation. That's fast.

The streamlined NeXTstation owes its compactness to a few well-calculated design choices. NeXTstations lack the Cube's expansion slots and accept only half-height disk drives (the original Cube's full-height optical drive is available as an optional external SCSI device). Eliminating full-height devices decreases the demand on the power supply and cooling systems, which consequently have been made smaller. The NeXTstation power supply, in contrast to the Cube's 300-watt unit, draws only 120 watts and is based on a space-saving technology called parallel resonance switching. A set of fins underneath the power supply dissipates heat, and a small, virtually silent "whisper fan" sucks air across the system board from vents at the back of the case. Compared to the noisy whirring

fan and hard disk of the Cube, the relative silence of the new NeXTstation is a welcome change.

**Optical delusions.** The lack of a floppy disk drive, and thus compatibility with the rest of the computer world, was one of the original NeXT computer's biggest limitations. Although optical disks are a great backup medium, they aren't very practical for exchanging data. Who wants to send a 2KB text file on a 256MB cartridge that costs over \$50? In addition, the time it takes to access data on the optical drive makes it too slow to be used as a main storage device. The old NeXT machines needed a hard disk.

So NeXT saw the light. The new 2.88MB floppy drive is standard in the NeXTstations and in the NeXTcube. Files on the floppy disk are treated like any other file on the UNIX file system. The drive also reads 720KB and 1.44MB MS-DOS disks. Although the drive can't read Macintosh disks directly, file exchange is possible with Apple's new SuperDrive floppy, which reads and writes DOS disks. According to sources at NeXT, the company will support direct exchange with Macintosh disks in a future software release. Software currently available from DIT (Digital Instrument Technologies) can support direct Mac transfer.

The NeXTstations' standard 105MB hard disk demands a trimmed-down version of system software. But even in its reduced form, the system takes up 70MB, leaving little disk space for applications and data. The small disk won't trouble network users, who benefit from a central file server. Stand-alone users, however, will probably need either NeXT's optional 340MB hard drive (add about \$2000 to the cost of the system) or an external SCSI hard disk. The new system software makes using third-party drives easier than in the past.

**NeXT betters its board.** An even closer look at the NeXTstation system board reveals space-saving omissions and performance-enhancing breakthroughs. Because there are no expansion slots on the NeXTstation (the NeXTcube includes three expansion slots), the NeXTstation board lacks a NuBus backplane connector for the NeXTbus. The NeXTstation accepts a maximum of 32MB of RAM using 4MB surface in-line memory modules (SIMMs)—half the Cube's maximum capacity—but more than enough for a single user's needs for the foreseeable future.

All new NeXT system boards employ the same custom chips that the original Cube used for managing direct memory access (DMA) and controlling peripherals (called the Integrated Channel Processor and the Peripheral Controller Chip, respectively). The Integrated Channel Processor is one of NeXT's major technical achievements. It provides DMA channels for SCSI and floppy devices, serial devices, Ethernet, the digital signal processor (DSP), the printer, sound, video, and virtual memory.

There are now more options for networking your NeXT: The new system board provides both thin Ethernet and twisted-pair Ethernet connectors. Twisted-pair Ethernet cuts network wiring costs by allowing the use of pre-installed, easy-to-troubleshoot telephone wire. In addition, there are two serial ports, a display port for the monitor, a DSP port for connecting digital or analog devices to NeXT's built-in DSP chip, a printer port, and a SCSI connector for attaching external hard disks, scanners, and CD-ROM drives.

## The NeXTstation and NeXTstation Color

The most important features NeXT's newest systems boast are their low prices. Standard versions of the NeXTstation and NeXTstation Color sell for \$4995 and \$7995, respectively. Part and parcel of the new machines, which include an upgraded version of the original Cube, are a collection of hardware improvements that boost processing speed and allow the ability to share data with other users:

- NeXTstation models come in a case only 2 1/2 inches high, with no expansion slots.
- The 15-MIPS, 25MHz 68040 microprocessor at the heart of each system is roughly three times faster than its predecessor, the 68030.
- Fast hard disks and a floppy drive replace optical media as standard mass storage devices.
- Twisted-pair Ethernet (10BaseT), which permits low cost networking over a telephone wire, joins the thin Ethernet (BNC) connector available on the original NeXT.
- The previous model's 25-pin SCSI connection has been upgraded to the improved 50-pin SCSI II standard.
- The black-and-white MegaPixel Display is now lighter and includes a built-in microphone.
- The new MegaPixel Color Display, when used with the NeXTstation Color, displays up to 4096 colors at 1120-by-832 pixel resolution.



The power of the Motorola 56001 DSP chip, introduced with the first Cube, is only beginning to be tapped by software developers and researchers. The chip processes a variety of signals in real time for applications such as speech and music synthesis compression, voice recognition, image processing, and the filtering of laboratory data in scientific and engineering applications. There was speculation that NeXT would choose the faster and more expensive 96002 DSP, Motorola's next-generation chip, but a lack of binary compatibility prevented that choice. The 56001 comes with 24KB of static RAM that may be upgraded with SIMMs to 576KB for more complex, memory-intensive signal-processing applications.

The SCSI connector conforms to the 50-pin SCSI II configuration, which permits longer cables with less noise interference than the 25-pin SCSI interfaces. An adapter cable sold by NeXT provides backward compatibility with the 25-pin SCSI interface. The data transfer rate of 4MB per second is the same as with the original Cube's 25-pin implementation, because the port is still SCSI I rather than SCSI II.

**Black and white and color.** I've used the original black-and-white Cube for the past year, and its crisp text and graphics have made it an absolute joy to work on. Like the original Cube, the black-and-white NeXTstation offers 2-bit, black-and-white graphics and a 17-inch MegaPixel Display, with keyboard and mouse interfaces and a speaker for playing back sound. The built-in microphone and an anti-glare screen are added bonuses.

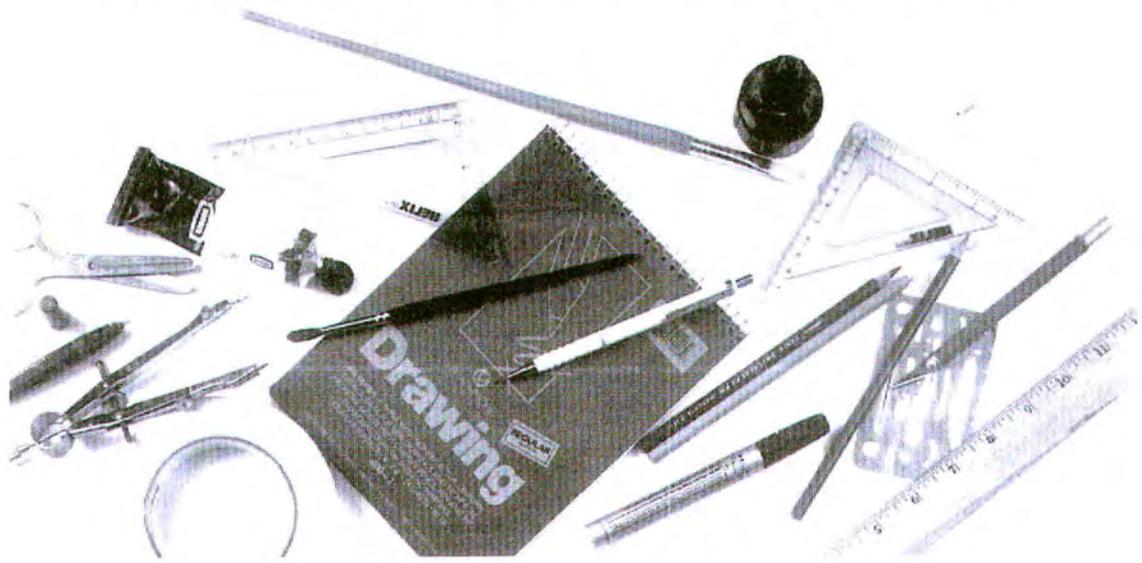
For many users, the black-and-white machine will be the best video choice, since black and white is actually easier on the eyes. And if you're dealing primarily with text and reports that will be printed on a black-and-white laser printer, what you see on the screen is really all you need.

The NeXTstation Color's 16-bit video controller can display 4096 colors simultaneously and creates the effect of even more colors through dithering. Although the NeXTstation Color is positioned as NeXT's low-end color solution, its color graphics surpass the 8-bit color common on most high-end PCs and comparably priced workstations. The machine is more than adequate for business graphics, including charts or color presentations. Graphics professionals producing video, slides, or other high-quality images might use the NeXTstation Color for preliminary design work and then move the project to the NeXTdimension. The NeXTdimension board implements a 32-bit color scheme that can produce 16 million simultaneous colors (see "True Color" in this special report).

The NeXT's use of Display PostScript, a device-independent imaging model, ensures that color applications will run on any of the machines without alteration or special configuration. Color applications are displayed in black and white on the black-and-white NeXTstation, in 16-bit color on the NeXTstation Color, and in full 32-bit color on the NeXTdimension.

The NeXTstation Color system board differs from the NeXTstation board in memory configuration. It has a video and memory controller and a Brooktree RAMDAC (digital and analog converter) that performs conversions of red, blue, and green signals on a single chip. The NeXTstation Color requires more main memory than the NeXTstation, a minimum 12MB, to ensure display perfor-

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mance. In addition, the system uses 1.5MB of video memory, which allows the entire screen definition to be stored in the frame buffer.

To support the increased processing demands of color, the NeXTstation Color uses a main memory architecture called interleaved memory, which allows the overlap of read and write operations—similar to the way the Macintosh IIx's "latched read and write" technique works. Interleaved memory requires different SIMMs (72-pin for color systems versus 36-pin for black-and-white), so the SIMMs can't be used in the NeXTstation or NeXTcube.

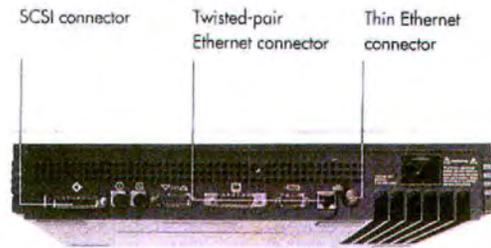
Because the NeXTstation Color was still in the preliminary design stage at the time of this writing, I was able to work with only a limited number of color demonstrations provided by NeXT. In those tests the NeXTstation impressed me with the same excellent performance as the other 68040 models.

**NeXT's best choices.** The NeXTstation, with a 105MB hard disk, MegaPixel Display, and 8MB of memory costs \$4995. The NeXTstation Color with a 105MB hard disk, MegaPixel Color Display, Sound Box, and 12MB of memory is \$7995. Even with the added cost of a larger, or second hard disk (probably a necessity for non-networked systems), both machines are priced much lower than comparable offerings from Apple and Sun. The selection of third-party applications remains limited compared to some other platforms, but impressive new products such as Lotus Improv and WordPerfect show that the situation is changing.

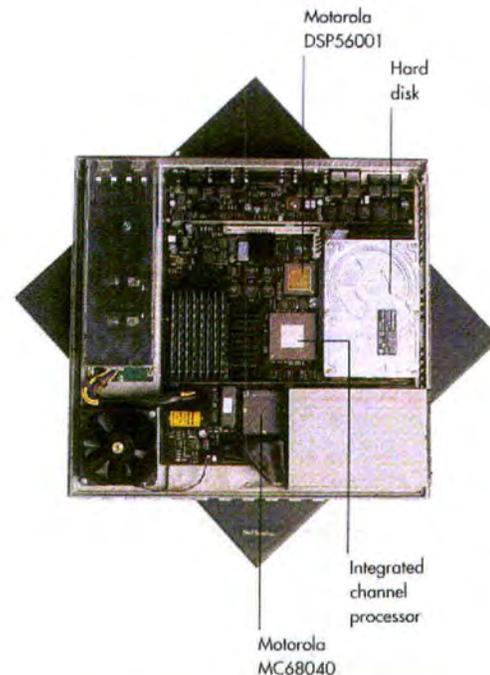
There is just one small dark cloud hovering over the NeXT products: Because of the various system board architectures, no upgrade path exists between the NeXTstation and the NeXTstation Color—a lack that could discourage buyers used to more modular, expandable systems. Owners of the NeXTcube can expand to a color system, but only to the leading-edge NeXTdimension. If black and white is all you need, however, and you don't require the expandability of the NeXTcube, the NeXTstation is an easy choice. It's an ideal system for a local area network environment or stand-alone users working primarily with office automation applications, desktop publishing, software development, or scientific applications.

Anyone considering a new system should keep in mind that all this new, impressive hardware comes with a substantial added bonus: NeXT's system software. With the NeXTstation and NeXTstation Color, you get state-of-the-art hardware and the elegance of the NeXTstep interface—a combination that's hard to resist. ☐

Nicholas Baran is the editor and publisher of Baran's Tech Letter, a newsletter covering NeXT Computers.



The system features a silent cooling system and a compact 120W power supply based on a new technology called parallel resonance switching. Note the ports for either thin or twisted-pair Ethernet. The SCSI port uses the SCSI II 50-pin connector, which is backward compatible with existing SCSI devices, if used with a NeXT cable adapter.



The NeXTstation system board is similar to the board in the NeXTcube. However, it does not include the NuBus interface connector to the NeXTBus. Note the absence of a floating-point coprocessor. Floating-point operations are integrated into the 68040. The NeXTstation Color system board includes 1.5MB of video memory and the Brook-tree RAMDAC digital/analog converter.

# True Color

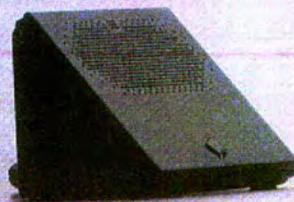
NeXTdimension's breathtaking color sets several standards for desktop video.

by Rick Reynolds

**P**redictions are a risky business, but we think that as more color NeXTcubes pepper the desktops of the industry the truth will gradually emerge, as plain and bold as the Cube itself: There's nothing these days like the NeXTdimension for power and value. You don't need a crystal ball to appreciate a superb 32-bit board with a 16-inch high-resolution color display, a solution that fuses together a half dozen of the latest advances in video technology in one color workstation. All you need do is take a look.

The NeXTdimension is for people who need more power than a personal computer can muster for handling realistic color images easily and quickly, without crashing their system. People like scientists and engineers who want the lush precision of both true color and a display resolution of 92 dots per inch (dpi) when viewing data. People like advertisers, magazine and catalog publishers, film and video editors. People who don't want to pay in gold bullion for a Silicon Graphics workstation, or who have already run up against the limits of the Macintosh. In short, a lot of people.

**Color made real.** NeXTdimension is either an upgrade, for those who already have the '030 NeXTcube, or a complete color workstation, for those who are buying it with a Cube now. In both cases, the key components of the NeXTdimension are the graphics board and the color monitor, though a full configuration would include the NeXTcube, the MegaPixel Color Display, the NeXTdimension graphics board, internal storage, the Sound Box, a keyboard, and a mouse.



The graphics board fits into one of the Cube's NeXTbus expansion slots, and the monitor fits neatly right on your desk. NeXTdimension runs under System 2.0, with the original '030 NeXTcube or with the new '040 NeXTcube. For an additional \$1495, users with the '030 can buy the upgrade to the '040. It's worth the cost. The new '040 motherboard will pick up some types of performance by a factor of three. Additional RAM will help as well. NeXTdimension requires the Cube to have 16MB of memory, but there's a noticeable improvement with 32MB, or 64MB if you can afford it. The same holds true for the NeXTdimension board itself: It comes with a standard 8MB, but can be expanded to 32MB. It works best with 16MB or more.

The 16-inch MegaPixel Color Display has a resolution of 1120 by 832 pixels (92 dpi), just like monochrome MegaPixel Display. Unlike the monochrome display, it doesn't come with a built-in microphone. NeXT put that feature in a separate Sound Box accessory, thereby allowing third-party monitors to work with NeXTdimension. The Sound Box is an integrated unit incorporating a speaker, a microphone, headphone jacks and RCA-style stereo output, a keyboard interface, a mouse interface, and support for all RGB-style monitors. Instead of a Sound Box you can run a monochrome MegaPixel right alongside your color MegaPixel to form one contiguous workspace.

**Hotspots on the boardwalk.** The NeXTdimension board is where most of the action is. A tour around the board reveals a RISC-based graphics coprocessor, a RAMDAC chip, and a high-speed compression chip, which, together with video input and output and 32-bit color Display PostScript, add up to an impressive bit of engineering. Let's examine the chips and video interfaces in turn.

The Intel i860 Reduced Instruction Set Computing (RISC) 64-bit chip runs at 33MHz and is rated by Intel at 80 million floating-point instructions per second. This means that the NeXTdimension board runs the color display at least as fast as the monochrome display, with some operations running even faster, preserving the snappy performance across the NeXT family.

Next on board are 4MB of VRAM (video memory) with support for double-buffered, 16-bit-per-pixel windows (these have not yet been implemented) and 8MB of DRAM, expandable to 32MB to increase the windowing capacity of the display. What this forest of acronyms means, quite simply, is that the NeXTdimension can simultaneously handle multiple "data-heavy" true color images as effortlessly as most personal computers handle windows of ordinary text. Brooktree Corporation's TrueVu RAMDAC makes it possible for each window to display in its own mode (black and white, grayscale, color, or video) while others display in theirs, whether the window is active or in the background. (On other platforms a window must be active to operate in video mode.) The RAMDAC accomplishes this through separate color maps for each window.

The compression chip included on the board is a CL550 Image Compression Processor chip, designed and built by C-Cube Microsystems, which uses the JPEG (Joint Photographic Experts Group) image compression algorithms, now a standard in the industry. Practically speaking, this chip gives you on-the-fly compression of video and bit-mapped images at user-selectable compression

ratios of up to 30 to 1. This means that full-color, full-motion video is actually possible. Capturing full-motion video means capturing a stream of data flowing into your computer at approximately 33MB per second, and slightly more for compact disc-quality sound tracks. On-the-fly compression of this data is essential. How big did you say your hard drive is? You get the picture.

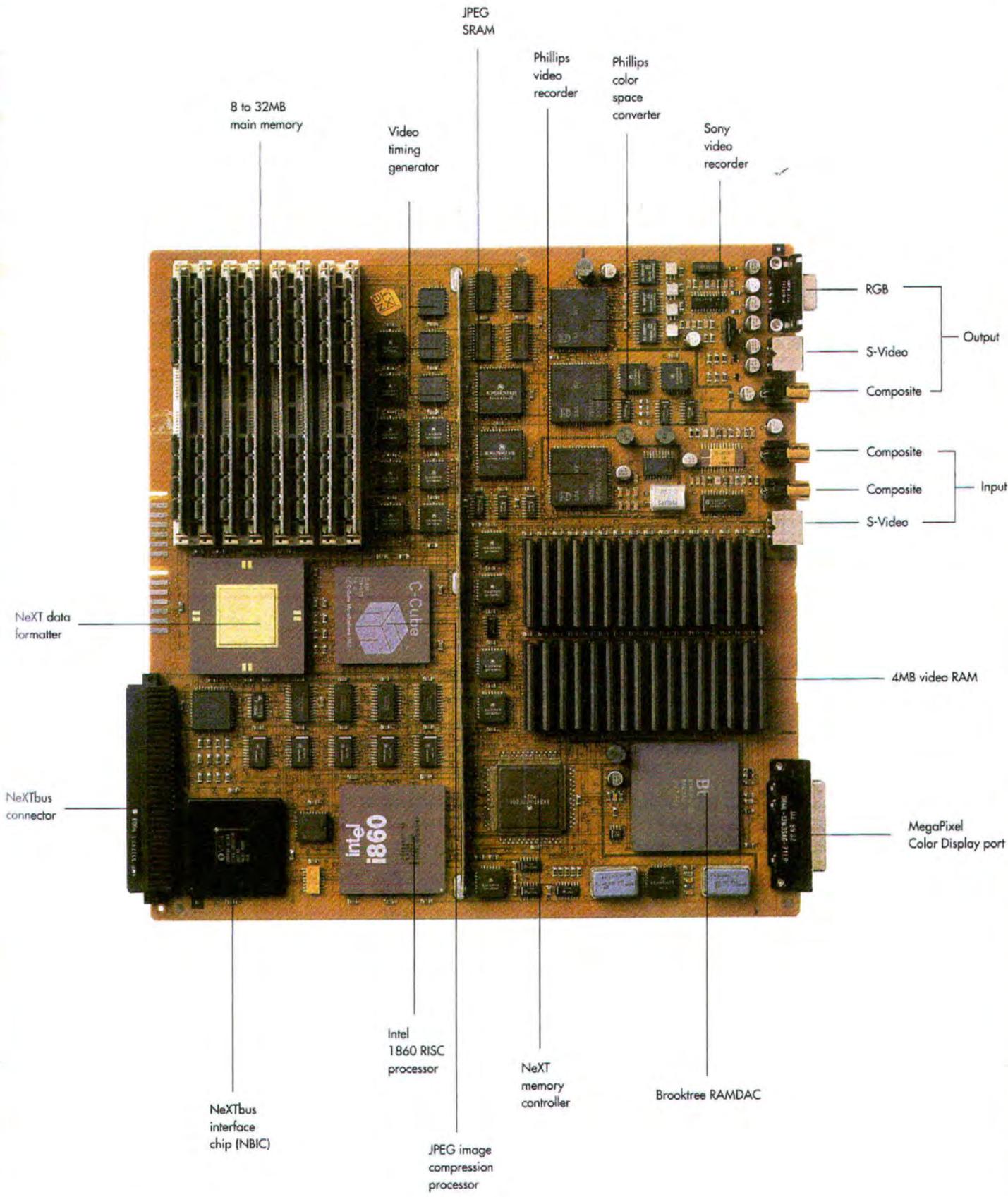
Finally, NeXTdimension supports video input and output to your VCR, laserdisc player, VHS, S-VHS, Hi-8, Beta, Camcorder, or still-video camera with out requiring additional boards. Couple this with the DSP (digital sound processor) chip on every NeXT motherboard, and you have the necessary ingredients for high-quality video and sound—a multimedia platform, in short, that works. Which brings us to performance.

**A real time for color.** Picture a laserdisc player displaying full-motion video on a NeXT in one window, while you open a dozen huge color images in others. Place some images behind, say, the window of a car displayed on the screen, and see the images through the window (an example of the use of NeXTdimension's 8 bits of alpha channel for transparency). Do this on a network, with other background processes running, and then throw windows on top of each other, over and over, and try to notice a delay when the screen redraws itself. Do this until the system crashes. We couldn't get it to crash. Now test this on another computer. You can't even run the test.

Performance is not simply a question of speed, or of robustness, though a NeXTcube with NeXTdimension has both. Performance also means integration of video hardware and color system software, something nearly impossible to get if you're patching your system together from numerous sources. The obvious point of comparison here is a Macintosh, though Apple's 24-bit graphics card can't handle real-time video. To get that, you need to go to an expensive external box such as the one you get with Radius TV, Radius's 30-frame-per-second NTSC and 25-frame-per-second PAL solution. The box does not provide on-the-fly compression, however, and the video signal is actually only 16 bits, though 24 bits are displayed on the monitor. Companies like SuperMac are still working to develop cards with on-board compression and coprocessors fast enough for 30-frame-per-second video.

And the problems don't stop there. A Mac IIx doesn't handle multiple 30MB color TIFF images well, has little multitasking ability (unlike the UNIX-based NeXT), and currently has no alpha transparency factor. The operating system has problems handling large hard drives without Apple's finicky Desktop Manager or BMUG's Desktop Secretary and is prone to INIT conflicts. And for high-powered networking, you're required to buy a plug-in Ethernet card if you want to improve your abilities for the network transfer of large files. The yet-to-be-released System 7.0 may handle some of these problems, but things like true multitasking may remain a sticky issue. With the Mac you're essentially coming up against the real barriers of a computer intended for personal use, rather than one designed to be an interpersonal workstation. The NeXTcube with NeXTdimension is in a different league from the Mac IIx, but it costs less than a patched-together Mac system with similar capabilities.

In the case of the NeXT interface, the video software is an elegant version





## The NeXTcube

The NeXTcube is the inheritor of the original chassis, a 12- by 12- by 12-inch black magnesium cube. Both the original NeXT machines and the new 68040-based models are called NeXTcube.

Both versions of the Cube have a heavy-duty power supply and two full-height bays. Both also have four NeXTbus expansion board slots, one of which is used for the logic board. The NeXTdimension fits into one of these NeXTbus expansion slots. Other boards for the expansion slots include high-end audio boards, mid-level color boards, and video-processing boards.

The old Cube came preconfigured with a 256MB read and write optical drive and one slot for a SCSI hard drive if desired (and we all desired). The new Cube sports a new faceplate to allow access to several devices at once. The Cube also comes with a list of configured elements to choose from: CD-ROM, read and write optical, 330MB through 1.4GB hard drives, or a 2.88MB 3.5-inch floppy drive.

The strong points of the NeXTcube configuration are the flexibility of configuration, the expansion capacity available through the three extra NeXTbus slots, and the SIMM slots for additional main RAM and DSP SRAM. The old Cube can easily be upgraded to the new NeXTcube technology. As future generations of motherboards become available beyond the '040, they will also be available to upgrade the old Cube.



of the usual simulated electronics equipment, and NeXTstep's color picker offers a choice of various color models, including RGB, CMYK, and HSB. Keep in mind that the NeXTdimension works with a full 32 bits of visual information, 8 bits apiece for the red, green, and blue channels, and a full 8 bits of alpha channel for transparency (the ability, for example, to "see through" the car window in the image discussed earlier). Keep in mind, too, that the NeXT uses the same description language, PostScript, for both display and printing, unlike the Mac, which uses QuickDraw for display. PostScript, as the current industry standard for imaging both graphics and text, has proved itself to be a flexible and evolving language—the abilities of PostScript 2, once it becomes available, will be reflected immediately on the NeXT monitors.

**Real-time results.** The workstation market won't feel the effects of the new '040 NeXTcube running NeXTdimension until some months after shipment, but from our first hard look, the platform is promising and exciting. Aside from the obvious color-hungry targets for the machine (such as magazine and newspaper publishers, scientists, and engineers), other markets include catalog publishers who handle long documents full of large color images too "heavy" for most desktop computers to handle, and advertising agencies, which need to massage high-quality color images daily. Expect to see key photo processing software migrating to the NeXT, just as Quark Xpress, Adobe Illustrator, and Aldus PageMaker are doing now. And of course, video editors, both corporate and professional, will use the new NeXT to develop multimedia presentations or portfolios of films and TV commercials. The robust environment of the NeXT, with its multitasking abilities, is a logical platform for these markets now that NeXTdimension can provide true 32-bit color.

Further implications of NeXTdimension (and upcoming solutions like it) move outside the specialized DTP and multimedia markets, however, and point to a deeper wedding of home television to computers. Up until now, this market has been the dream world of visionaries at places like MIT's Media Lab. With the breakthrough of a computer that can handle real-time video processing at NTSC speeds, you may have a real prototype for a computer TV of the future (see "Vanishing Point" in this issue for Nicholas Negroponte's views on the matter). That's a mass-market for a computer item: The same people who buy TVs. It's also a revolutionary computer that could change key aspects of your life.

Imagine, then, being able to buy one NeXT-like machine instead of both a computer and a TV for your home. Imagine seeing your favorite TV programs on it during dinner, and then turning off the outside TV signal after you're done watching it so that you can use it locally—as a computer. Or picture it set up to capture your favorite CNN newscasts or pay-TV cable movies on disk. The computer then becomes a true multimedia information center for the home, one that handles a television signal as easily as it handles a software program.

This is truly the next dimension in television, one that brings a key piece of the future right to the cutting edge of the microcomputer world. 

**Rick Reynolds** is executive director of the Bay Area NeXT Group and owner of a Macintosh and NeXT graphics service bureau in San Francisco.

# NeXTstep 2.0

NeXTstep Release 2.0 brings the goal of interpersonal computing even closer.

by Charles L. Perkins

Making a successful interpersonal computer boils down to one thing: enabling people at personal workstations to share information—be it text, graphics, sound, or a combination of these—simply and easily. NeXT hardware and the UNIX Mach operating system provide the raw capacity for this. From the '040 processor to the DSP, the NeXT is designed to handle all kinds of information efficiently. Mach provides the power of networking and file sharing. It's the job of NeXTstep, NeXT's graphical front end to UNIX, to make all that power transparently available to the person at the machine.

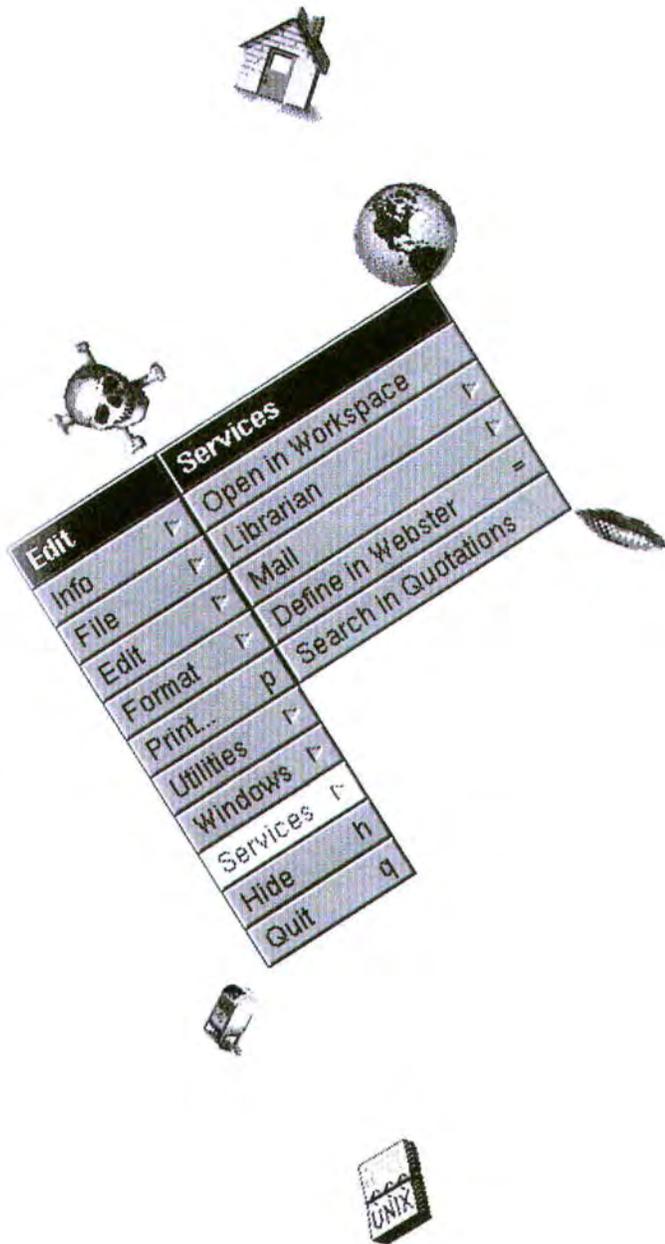
In his inventory of the original NeXT machine's wins and losses, Steve Jobs pointed to NeXTstep as the computer's pride. NeXTstep made UNIX something the average person could use and made it easy for third-party applications to achieve consistency with the look and feel of the NeXT environment. And significantly, NeXTstep included multimedia e-mail as an integral part of the system.

Release 2.0, introduced on September 18 with NeXT's new hardware, enlarges NeXTstep's foundation for interpersonal computing in a variety of ways. New features and improvements such as on-line fax and a streamlined mail system make sharing information even easier than before. And NeXTstep now expands the range of information you can share by supporting color, animation, video, and the image and sound compression hardware built into some of the new NeXTs.

Other improvements foster interpersonal computing simply by making the personal part easier. Menus throughout NeXTstep's Workspace Manager, bundled applications like NeXTmail and Digital Librarian, and third-party applications written to NeXT's 2.0 interface specifications, are more intuitive and consistent than 1.0 versions. Many more user preferences and controllable parameters are accessible from the interface directly, rather than only from the UNIX command line.

The new NeXTstep also irons out several wrinkles in interapplication operability. A new Services command makes developer-specified functions of one application available within any other. Throughout the system, users will be surprised by the interapplication options available by just dragging icons from one application to another. For example, to copy a file received in NeXTmail into a directory, you simply drag the icon into the appropriate folder in the Viewer window. To search it with Digital Librarian, you just drag it onto the Librarian's bookshelf.

Another key improvement: 2.0 is fast. Performance tuning in Release 2.0 cuts application start-up times almost in half, makes printing a background process, and allows for blink-of-an-eye switching among applications. And that's



## Applications

### NeXTstep

Workspace Manager, Interface Builder,  
Application Kit, Window Server

## Operating System (Mach, UNIX)

## Hardware (68040)

*NeXTstep resides between the UNIX Mach operating system and user applications, providing a graphical user interface, an application interface builder, a set of objects on which applications can call, and the Display PostScript imaging system.*

on a 68030-based system. The new 68040 machines run everything three times faster, speed up PostScript display drawing by a similar factor, and are an order of magnitude faster at floating-point calculations. For those infrequent times when something does take more than a few seconds, NeXT provides a spinning wait cursor to alert you that something is happening. In the meantime, you can move to a different application while the NeXT's multitasking system continues the operation in the background.

**The Workspace Manager.** The first version of NeXTstep presented a well-thought-out workspace, boasting an elegant menu system and the trademark application dock (which aligns user-designated key applications in a row of icons down the right side of the screen for instant access). Seams were apparent, however, in the Directory Browser (called the File Viewer in Release 2.0), which made the user jump through hoops to carry out such basic functions as copying files.

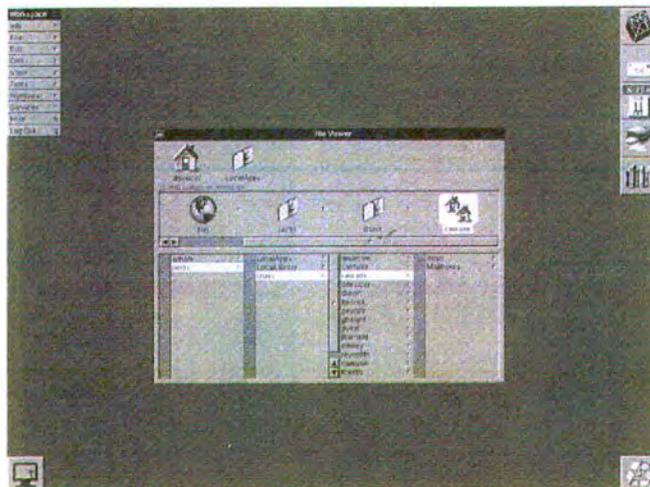
In Release 2.0, the Workspace Manager's File Viewer takes the leap toward a much more elegant graphical interface. The redesigned 2.0 model carries forward the vertical and horizontal file-listing structure from 1.0's Browser, but adds an iconic superstructure that makes navigation through a network and copying files much easier.

The row of icons that tops the file listing in 2.0's File Viewer gives users an at-a-glance reading of their path through the network. Clicking on an icon brings the user directly to the pictured file or folder; double-clicking opens it. Users can access files or folders quickly by dragging the icon onto the upper "shelf," where it stays available until it's dragged off the Viewer. The shelf also obviates the less-than-intuitive tactic, necessary in 1.0, of opening two Browsers in order to copy a file. To move a file, you need only drag it onto the shelf, navigate to the destination folder, then drag the icon off the shelf into its new home.

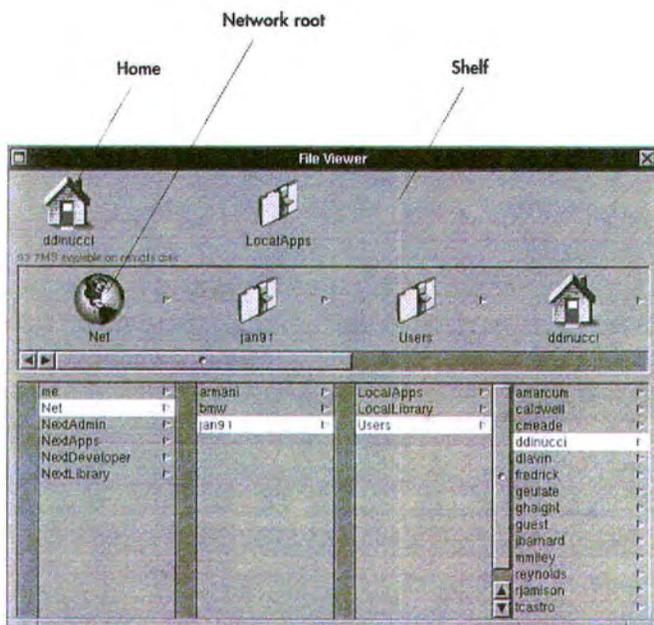
The strengths of this system are especially apparent on networked NeXTs. Users effortlessly navigate to any file on the network using the graphic path. The underpinning of the UNIX operating system shows its stuff when you try to copy a file in another user's directory. UNIX's system of permissions determines your read and write access, while the NeXTstep interface translates UNIX's error messages into visual metaphors and NeXT message panels.

A new Tools menu in the workspace provides several welcome accessories. A Processes command calls up a panel that lets you monitor or terminate applications easily. A new Finder finds files in any directory, using regular expressions or wildcards, like "\*.tiff." Inspectors enable the user to view the attributes of any file, associate document types with specific applications or override the default association, and compute the sizes of and change permissions for directories and their contents. A bonus feature of the Inspector lets you quickly view the contents of EPS and TIFF files.

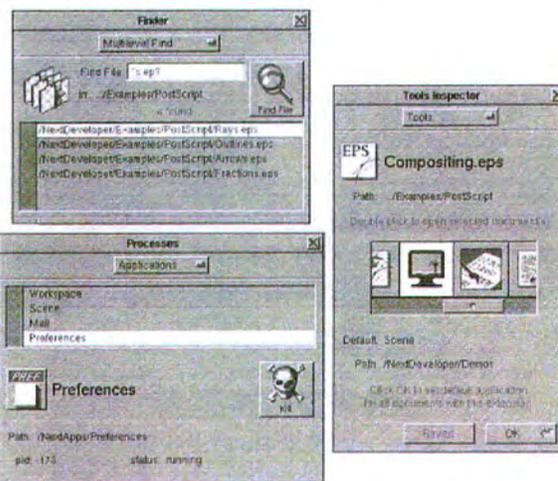
A new command, Services, can appear in the main menu of any application written to run under 2.0. The Services command allows the developer-



The Release 2.0 workspace is familiar from the earlier release. Users will see differences, however, in the menus and File Viewer.



An icon path above the file lists shows the path through the network to the selected file. Users can drag the icons of frequently accessed files and directories onto the shelf, where they are instantly available.



The Finder, Processes, and Inspector panels are all available through the Tools command in the Workspace menu. The Finder finds a file anywhere in the directory system. The Processes panel lets users interrupt and otherwise control applications and background processes. The Inspector panel lets you inspect the attributes and change the associated application for any file, and lets you inspect the contents of sound, TIFF, and EPS files.

designated functions of one program to be utilized by all other applications, present and future—another giant step toward an important goal in making computing interpersonal. At press time, this menu offered access to features of the Workspace Manager, Digital Librarian, Digital Webster, NeXTmail, and Quotations. However its real power will be exploited as third-party products link up to this powerful system of interapplication communication by “publishing” other services.

**The medium is the message.** Spearheading NeXT's claims to interpersonal computing is its mail system, which, when combined with the computer's networking abilities and outstanding multimedia capabilities, provides the NeXT with an unrivaled system for sharing information of any sort. The strength of NeXTmail has always been its ability to include formatted files of almost any type within a message. For example, if the sender wants to include a WriteNow or spreadsheet file, he or she need only drag the file icon into the NeXTmail message and drop it there. To read it, the recipient merely opens the NeXTmail message and double-clicks on the file icon. (To open the file, the recipient must have the right application, though it, too, could be sent via NeXTmail just as easily.) Network users can send graphics, text, and, most amusingly, Lip Service voice messages in this way.

In Release 2.0, NeXTmail has been enhanced with a mail filter for non-NeXT destinations, an archive for outgoing messages, a resizable Mailboxes window, and a return receipt that is sent when your mail is read. Messages can now display EPS and TIFF images, and you can drag files out of NeXTmail windows as well as into them.

Another major communication facility has been subtly added to the Print panel, in the form of a Fax button. This new option enables users to print the current document, or any part of it, to any specified fax. A ready-made cover sheet is even supplied.

**Bundled up.** Mail is only one of the key applications bundled with every NeXT system. The two system packages, the standard version and the extended version, are differentiated by the list of applications bundled with each (see the sidebar “Software 2.0”). To squeeze Release 2.0 onto the new computers' 105MB hard disks, NeXT has trimmed away some of the less crucial applications that were bundled with Release 1.0. The smaller package still includes WriteNow, Digital Librarian, NeXTmail, and Digital Webster, as well as most system tools. The extended version includes application development tools, including the revolutionary Interface Builder, plus a collection of the complete works of Shakespeare.

Digital Librarian, a text search and indexing utility, offers a new look and a substantial speed-up in Release 2.0. Users can load any document into the new “bookshelf” window in the same way they drag icons onto the shelf in the File Viewer. NeXT's user and technical documentation is already loaded in. Bookshelves can be saved and restored, and more than one can be open at

a time. The Librarian can quickly open special windows for rich text format files and UNIX manual pages. Luckily, almost all of Release 2.0's documentation is stored in RTF files, which open in a second or two—welcome relief from those interminable WriteNow start-ups that caused pervasive Release 1.0-documentation-avoidance syndrome.

Heartening signs of NeXT's advance toward its ultimate goal of a seamless, predictable interface are visible throughout the package of bundled applications. Many of the new features of the Edit application reflect the Application Kit's improved Text class. Here, and anywhere there is editable text, such as in NeXTmail, you can align paragraphs left, center, and right; use rulers for margins and tab stops (and copy these rulers into other text); underline, subscript, and superscript; spell-check; and navigate through and select text using a plethora of new arrow key commands. In addition, Edit provides a new structure parser that collapses portions of documents into icons that can be expanded later with a click—wonderful for outlines and source code browsing.

In Release 1.0, you were forced to leave NeXTstep behind and drop down fairly frequently to the UNIX command line to monitor processes and memory usage, search for files using regular expressions, change ownership of directories, and other such tasks. Release 2.0 handles most of these functions directly in the workspace, although actions such as changing the case-sensitivity of the File Viewer and some aspects of network administration still require you to take the dive into UNIX through the Terminal application. The old Terminal and Shell applications have been replaced by a new Terminal application that combines the capabilities of both. Based on the popular VT100 emulator called Stuart, the new Terminal offers nice preferences and printing options, and in general provides a simple but satisfying way to deal with UNIX.

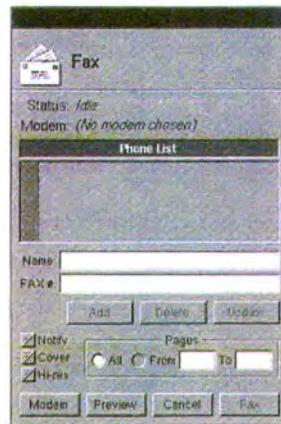
**Input/Output.** NeXTstep 2.0 supports a broad range of image and sound formats, including Group 3 FAX, various compressed TIFF formats, and a new CD-quality sound format featuring two-to-one compression with no loss of quality that records and plays in real time. (The compression ratio can be raised to six-to-one with some loss of fidelity.) Some new media formats, such as video and animation, are partially integrated into 2.0. Languages besides English are now supported throughout the whole system, and special keyboards and keyboard mappings can be used for non-English language input (a Kanji version is still under development).

Release 2.0 supports several new input devices, including pen-based input tablets. It also supports CD-ROM disk drives, in addition to the 2.88MB floppy drive, which Release 2.0 users can use to read and write 1.44MB and 720KB MS-DOS floppies—but not Mac disks—directly in the Workspace Manager.

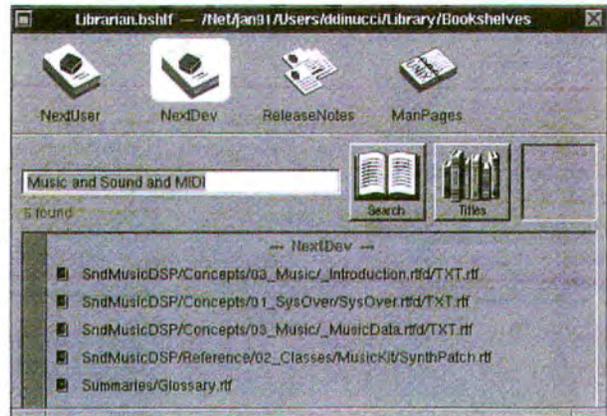
NeXTstep's new display output abilities again prove the advantage of using device-independent Display PostScript as the NeXT imaging model. All applications written for Release 1.0 will run on the new color hardware without modification. Likewise, 2.0-compliant applications require no special configuration



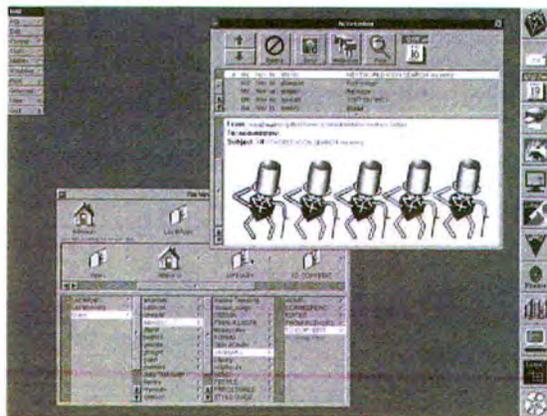
NeXTmail messages can include formatted files of any type, which the addressee can open by double-clicking the icon, or drag into his or her own directory. The Lip Service option lets you record voice messages for inclusion. New options in Release 2.0 let the sender strip NeXT-specific coding from messages for delivery to non-NeXT addresses and request a receipt.



A Fax button in the Print menu lets users send documents directly to specified fax numbers. NeXTstep even includes a preformatted cover sheet.



Digital Librarian's new interface includes bookshelves onto which users can drag any document they want to search.



Files received in NeXTmail can be dragged directly into a directory in the File Viewer. In the same way, any file can be dragged onto a bookshelf in Digital Librarian.

Edit	Services
Info	Open in Workspace
File	Librarian
Edit	Mail
Format	Define in Webster
Print...	Search in Quotations
Utilities	
Windows	
Services	
Hide	h
Quit	q

The new Services menu, which appears within any 2.0-compatible application, makes the power of one application available within all others. Currently only a few applications provide Services, but more should quickly become available.

## Software 2.0

NeXTstep 2.0 is available in two configurations. The slimmed-down standard version is preinstalled on systems equipped with 105MB drives. If your NeXT system is equipped with a 340MB or larger hard disk, it comes with the complete, developer-oriented extended version.

### Release 2.0

includes the following applications:

#### End-User Applications

Workspace Manager  
Edit  
Digital Librarian  
NeXTmail  
Preferences  
Preview for PostScript  
PrintManager  
*Webster's Ninth New Collegiate Dictionary*  
*Webster's Collegiate Thesaurus*  
WriteNow Word Processor  
DataVizBridge (DataViz)

#### Developer Tools

VT100 Terminal Emulator

#### System Administration Applications

MailManager  
NetInfoManager  
NetManager  
PrinterTester  
UserManager  
Installer

### Release 2.0 Extended

includes these additional programs:

#### End-User Applications

*Oxford Dictionary of Quotations*  
*William Shakespeare, The Complete Works*  
T<sub>E</sub>X Document Processing System (Radical Eye Software)

#### Developer Tools

Interface Builder  
Objective-C Language Compiler  
C++ Language Compiler  
Objective-C Class Definitions  
56001 DSP Tools  
GNU Emacs  
GNU Debugger  
BUG-56 Debugger (Ariel)  
Malloc Debugger  
AppInspector  
PostScript Tools  
Application Kit  
Music Kit  
Sound Kit  
On-line Technical Documentation

to display properly on either the grayscale MegaPixel Display or the new color displays. On a system with two monitors attached, it is even possible in Release 2.0 to drag windows from a grayscale display onto a color display and back again. All dithering and color conversion is performed automatically by the PostScript layer.

Release 2.0 provides a Color panel from which users can pick colors using a staggering variety of color models (RGB, HSB, CMYK, grayscale, and more) and drop them into the "color wells" that are scattered throughout the system. Unfortunately, not many applications have color wells yet—perhaps a side-effect of the fact that even on color monitors, the basic NeXT user interface maintains its distinctive grayscale look.

**Toward the goal.** The many improvements to NeXTstep bring the ideal of interpersonal computing closer in a number of subtle but important ways. Interpersonal computing is based on more than just e-mail or interoperating applications. It is based on the ability to manipulate information in powerful, intuitive ways. NeXTstep represents this ideal and is getting ever closer to realizing it. NeXT's interface allows users to "reach out and touch" information symbolically, in a natural, predictable way, on their own workstation and throughout a network. The NeXT's, and NeXTstep's, ability to handle multiple modalities—speech, music, graphics, and video—enables users to communicate in almost any form that best expresses the information. And interpersonal computing doesn't have to stop there. Future extensions could swap data with applications running on other systems, allow users to view each other's displays, and launch applications on other computers more easily.

Although NeXTstep doesn't provide the best available implementation of every function, the way its parts work, separately and together, and the degree of control it gives the user over the environment, are unprecedented. NeXT computers, combined with the NeXTstep interface, constitute a package with the rare ability to provide an easy interface for novices without restricting the freedom of more experienced users.

Despite all the improvements, NeXT alone cannot deliver on the promise of interpersonal computing. Real power will come only when third-party applications take advantage of the NeXT environment. Release 2.0-compliant applications that provide Services to other programs will be a big step. Until a critical mass of useful third-party applications appears, it is too soon to tell whether NeXT's vision of interpersonal computing will take root on desktops around the world. But with NeXTstep's easy tool-building and much-improved consistency and integration, NeXT has provided a compelling base.

Release 1.0 users who have optical disk drives can upgrade to Release 2.0 Extended for \$195. 

Charles L. Perkins, a NeXT developer and Ph.D. candidate at Harvard University, is a senior associate with Marble Associates in Waltham, Massachusetts.



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desktops around the  
nproved consistency

grade to Release 2.0

ersity, is a senior associate

“In the 1980s, personal computers  
accomplished their mission: to radically  
improve individual productivity.

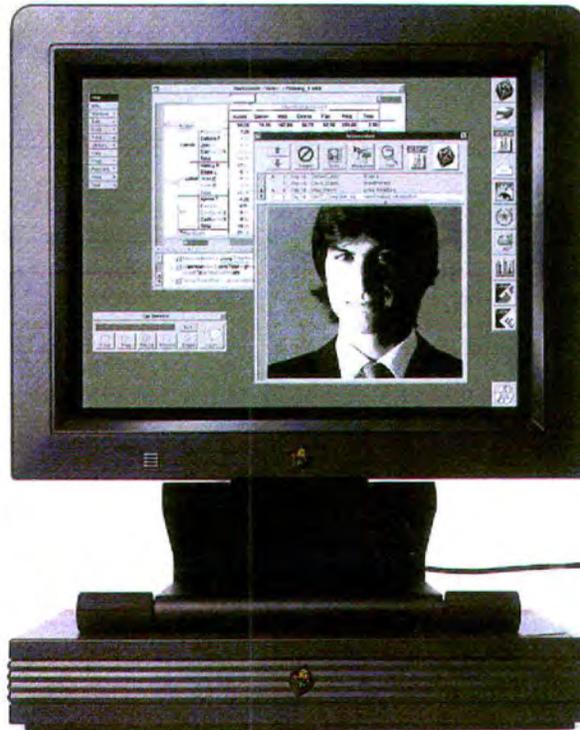
But that’s just not enough anymore.

## WHY THE WORLD NEEDS A NEW COMPUTER.

In the 1990s, competitive advantage  
will come from improving the productivity  
of entire groups, so they can stay ahead  
of a world that’s changing faster than ever.

The personal computer revolutionized  
the way we worked in the 80s.

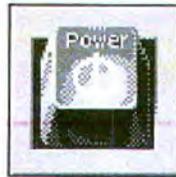
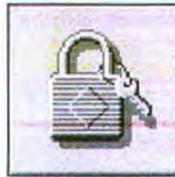
The next 15 pages may well change the  
way we work in the 90s.” —*Steven Jobs*



In the computer industry, we've grown used to seeing advances on an almost daily basis. But the true milestones haven't been quite so bountiful.

In fact, in the last 15 years, there have been only two:

The spreadsheet, which was responsible for launching the personal computer revolution back in the 70s. And desktop publishing, which fueled the graphical revolution of the 80s.



sophisticated. Organizations need better ways to tap the resources they already have.

# WELCOME TO THE NeXT WORLD.

And so the need for a third revolution becomes more and more clear.

No longer is it enough to

boost an individual's productivity and creativity (which is what you can expect with traditional computers running traditional applications).

There's infinitely more to be gained by empowering groups of people to work more productively and creatively together.

To make this happen, we have to invent a technology that radically enhances human-to-human interaction. A technology that

raises group productivity in as revolutionary a way as the spreadsheet and publishing raised individual productivity.

We have to turn personal computing into interpersonal computing.

To bring this new way of working to business and education, we created a computer company dedicated to the task. We called it NeXT, Inc. And we filled its ranks with many veterans of the preceding revolutions.

We started in the only logical way - by taking a long hard look at current technology.

In the personal computer, we saw a machine already stretched beyond its limits, not at all optimized for a connected world. We looked at workstations, but they were so complex, only our engineers could figure out how to use them.

Clearly, a machine designed for a world of interpersonal computing would have to be very different.

It would have to be built for networking, to make interaction effortless. It would have to offer



an e-mail system more advanced than anything we've used before. It would have to support true multitasking, so people could work naturally,

Librarian	Services
Info	Define in Webster
Bookshelf	Mail
Target	Open in Workspace
File	Search in Quotations
Edit	
Format	
Windows	
Services	



Even now, years later, these applications remain the two biggest reasons why people buy and use computers.

But in the 90s, we're facing challenges personal computers were never designed to meet.

There's less time to react. Competition is much more



even first-time users could sit c put it to work.

That's the th that resulted in NeXT™ comput it's the same thi that has allowed create a new cor affordable enoug used by everyor

The NeXTst computer.

We'd like to ta next 13 pages to the many extrao things it can do. of the even more dinary things it people do.

You'll see how the NeXTstator chip to be somet a strategic tool th actually revoluti ize the way an or ganization work: Whether that organization ope ates in a few roo

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system more  
advanced than  
anything we've  
used before.

It would have  
multitasking,  
work naturally,



doing several  
things at once.

And, if there's  
any lesson to be  
learned from the  
past, this new  
machine would  
have to be so per-  
fectly intuitive,

even first-time computer  
users could sit down and  
put it to work.

That's the thinking  
that resulted in the first  
NeXT™ computer. And  
it's the same thinking  
that has allowed us to  
create a new computer,  
affordable enough to be  
used by everyone:

The NeXTstation™  
computer.

We'd like to take the  
next 13 pages to show you  
the many extraordinary  
things it can do. And some  
of the even more extraor-  
dinary things it can help  
people do.

You'll see how we designed  
the NeXTstation from the first  
chip to be something new:  
a strategic tool that can  
actually revolution-  
ize the way an or-  
ganization works.  
Whether that  
organization oper-  
ates in a few rooms or

several different countries.

We'll show you how the  
NeXTstation offers a perfect  
environment for financial  
analysis and publishing. And  
how, at the same time, it

enables software developers to  
rethink the way we solve  
problems – to reinvent the spread-  
sheet, and eliminate the com-  
promises of desktop publishing.

We'll show you a machine  
less confining than any personal  
computer you've ever seen, yet  
even easier to use.

Welcome to the new world.



to display properly on either the grayscale MegaPixel Display or the new color

We say, "Here's a new computer." You say, "Let's see the software." It's a perfectly human reaction.

So rather than start by talking about processors and megahertz, we'd like to start by showing you the impressive things you can do with the NeXTstation. Today.

On this display is Improv™, from the creators of Lotus 1-2-3®. While at first glance it may look suspiciously like an ordinary spreadsheet, it could very well change the way people look at forecasting and analysis.

In Lotus' own words, "With Improv, we have literally

*Lotus Improv: a new era in spreadsheets made possible by NeXT technology. It lets you change views of data simply by dragging "tiles" from one location to another.*

1. Each tile represents a category of column or row headings. ("Measure," for example, is the category tile for the headings "Tons" and "Dollar Value.") Tiles placed above the spreadsheet determine the columns, and those below determine the rows.
2. The order of tiles dictates the spreadsheet's structure. "Quarter" headings are now listed under each "Material." Reverse the tiles and materials will be broken out under each quarter.
3. All formulas are listed in one place, not buried in cells. And being in English, they'll always make sense.
4. Improv spreadsheets can be a stack of "pages." Now each page is a year - but drag the "Quarter" tile here, and you'll have a page for each quarter's data.
5. The item dispenser lets you create new headings in a category quickly. Type "Jan" and get a sequence of months. Type "1990" and get a progression of years.
6. Improv can make even the most innocuous spreadsheet breathe fire. In seconds, you can turn data into editable 3D presentation graphics in many styles.
7. A single file can contain different views of spreadsheets and graphics, with a description of each. So at a glance, you'll know exactly what each view proves.
8. You can even attach voice memos to your work, to make a point more clearly - or passionately.

reinvented the spreadsheet - a job that was made much simpler by NeXT technology."

The revolution of Improv is

# IN OUR WORLD, LOTUS REINVENTS THE SPREADSHEET.

that once you've entered your data, you can easily rearrange it in countless new ways - and gain insights you could never get

from a traditional spreadsheet.

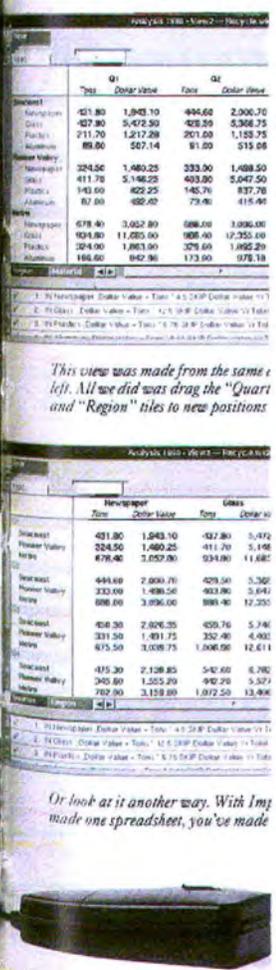
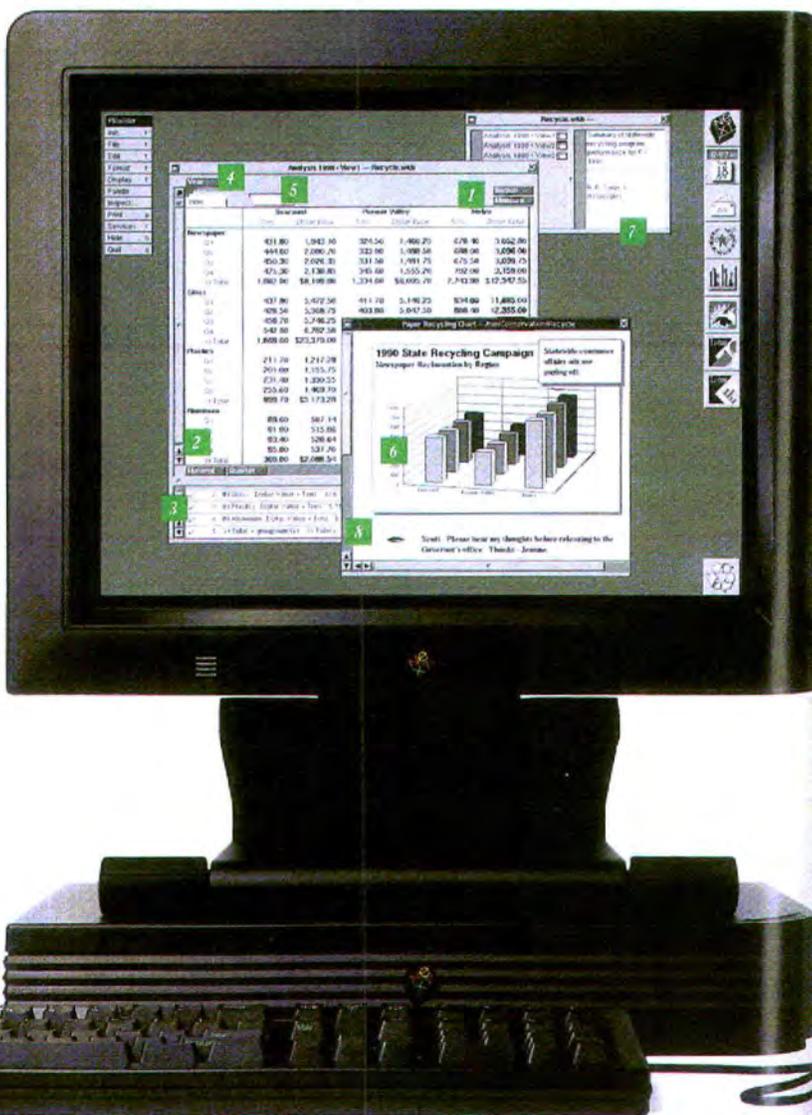
That's because Improv isn't structured like a traditional spreadsheet. To understand exactly how it works, take a look at the column and row headings in the sample screen.

Rather than use letters and numbers to describe data, it lets you use real words, like "Tons"

and "Dollar Value." you're comfortable

The benefit of the your formulas read Instead of seeing sc " =BD2\*BD3," you Value = Tons\*5.75."

And Improv lists mulas in one place, hiding them in indi So when you revisit spreadsheet months to make sense. Like looking at a spreadsheet been designed by s

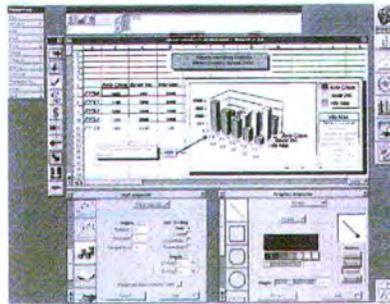


ial spreadsheet. se Improv isn't a traditional understand ex- Sactly how it works, take a column and row sample screen. ise letters and cribe data, it lets rds, like "Tons"

and "Dollar Value." Or anything you're comfortable with.

The benefit of this is that now your formulas read like English. Instead of seeing something like "=BD2\*BD3," you see "Dollar Value = Tons\*5.75."

And Improv lists all your formulas in one place, as opposed to hiding them in individual cells. So when you revisit a complicated spreadsheet months later, it's sure to make sense. Likewise if you're looking at a spreadsheet that's been designed by someone else.



Ashton-Tate breaks new ground in the NeXT world with PowerStep: a program based on the conventional spreadsheet model. It offers three-dimensional presentation-quality graphics, voice annotation and the "icon bar," which lets users create icons and assign them to time-saving macros.

It also becomes much less likely that your spreadsheet will contain costly hidden errors.

Consider this revolutionary if you wish. But it's only the warm-up to the real quantum leap.

Unlike any spreadsheet you've ever dreamed of (unless you happen to work for Lotus), Improv allows you to move your column and row headings from one part of the spreadsheet to another, even interchange them – and without the slightest hesitation, the spreadsheet will automatically rearrange itself.

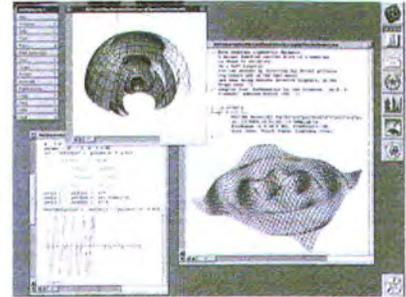
All you do is use the mouse to click one of the category "tiles" located along the edges of the spreadsheet – such as "Region" or "Material" – and drag it to a new location.

In this way, you get completely different views of your work and reach new conclusions – all with a single set of data.

Improv was born with other talents as well. It can turn your

spreadsheet data into sparkling presentation graphics. It can also read files that have been created with Lotus 1-2-3 and write its own files in 1-2-3 format, so you can easily share data with people working on other platforms.

As the development team at Lotus will happily confirm,



Mathematica is included with NeXT computers purchased for higher education. Many programs can summon its talent when they need extra computational firepower.

breaking new ground in software is many times easier in the NeXT world. (We'll get more into that a few pages from now.) And they're not the only ones who have noticed.

Ashton-Tate has now released PowerStep,™ which adds new dimensions to the conventional spreadsheet model, such as voice annotation and a much broader use of icons.

Some of the industry's most respected names in analytic and database software, Oracle® and SAS, have also developed programs for NeXT computers.

But rest assured, there's much more to come.

Starting on the next page.



	Q1	Q2	Q3	Q4
	Tons	Dollar Value	Tons	Dollar Value
Material	431.80	1,843.10	444.60	2,000.70
Region	437.50	5,472.50	425.50	5,308.75
Material	211.75	1,217.28	251.00	1,155.75
Material	86.60	507.14	81.00	515.85
Material			93.40	528.64
Material				96
Power Valley	324.50	1,460.25	333.00	1,488.50
Material	411.70	5,146.25	403.80	5,047.50
Region	142.00	807.25	145.70	827.70
Material	87.50	486.40	73.90	415.91
Material				78.00
Material				108.75
Material				1,405.00
Material				142
Material				170
Material				178

This view was made from the same data you see to your left. All we did was drag the "Quarter," "Material" and "Region" tiles to new positions in the spreadsheet.

	Q1	Q2	Q3	Q4
	Tons	Dollar Value	Tons	Dollar Value
Material	431.80	1,843.10	437.50	5,472.50
Power Valley	324.50	1,460.25	411.70	5,146.25
Material	87.40	3,056.80	834.90	11,685.89
Material				304.69
Material				1,155.75
Material				140.78
Material				837.78
Material				1,800.78
Material				1,336.55
Material				126.29
Material				742.48
Material				1,498.63
Material				1,409.70
Material				123.00
Material				2,070.59

Or look at it another way. With Improv, when you've made one spreadsheet, you've made them all.

to display properly on either the grayscale MegaPixel Display or the new color

When we started our company, we had the luxury of being able to stand back and take a fresh look at desktop publishing – an application that didn't even exist when most computers were designed. So ours could be

the first machine literally born to publish.

The goal was to do away with the compromises and limits inherent in existing systems. And to create a platform that would allow software companies to create products that are more sophisticated, and even easier to use.

We also wanted to be com-

patible with the industry as it now exists, so you can use your current output devices and the files you've already created.

Since the PostScript® imaging language is the one standard the industry agrees on, we built

# PUBLISHING FINDS AN ENVIRONMENT IT CAN THRIVE IN.

it into every NeXT computer. And not just for printing, but for on-screen imaging as well.

Having one imaging system throughout allows NeXT to fulfill what must be the most frequently broken promise in

computer history: true "What You See Is What You Get."

When you kern display type on the screen, what you get out of the printer doesn't come as a shock. Pages end where you expect them to. Measurements are more exact.

(Think how many trees' worth of "test pages" this could save you in a year.)

And what you see can be breathtaking. With the combination of Display PostScript® and the ultra-high-resolution NeXT MegaPixel Display, screen images are always paper crisp.

Type is sharp at any size or degree of rotation.

With true multitasking, NeXT computers let you run any number of applications

**Statewide recycling program begins with the paper flow**

**Dollars Saved by Recycling**

The amount of... (text partially obscured)

**Simulation of Geothermal Surfaces**

**Simulation of Geothermal Surfaces**

**Annual Report 1990** **Community Access, Inc.**

**Frame** FrameMaker® is a comprehensive publishing package that's appropriate whether you're producing a short memo or a greater metropolitan phone book. It contains all the tools you'll need for word processing (including advanced indexing capabilities), graphics and layout.

**WordPerfect** On the NeXTstation, the WordPerfect Corporation has succeeded in creating the industry's most advanced word processing package. The NeXT version of WordPerfect offers multiple columns, text wrapping and complete file compatibility with WordPerfect on other systems.

**TOPDRAW** TopDraw® is one of the easiest programs you'll ever use, yet it's far more advanced than other drawing programs. It offers sophisticated drawing tools, along with extensive controls for type. It also allows you to drop in scanned images (TIFF format), then scale, crop, rotate and even mask them.

The NeXT Laser Printer offers the most resolution at the same timetages of that go cutting and pas Applications cooperate with each contributi best. Without e layout, you can and ask for a de Digital Webster tion program ca the layout is upc most recent ver:

Adobe PostScript fonts give you results, on screen and paper. NeXT ship with 13 type styles, while n PostScript gives you access to 26 m from: the entire Adobe Font Fo.

ory: true "What You  
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 ern display type  
 what you get out of  
 isn't come as  
 end where you  
 . Measurements are  
**NT** more exact.  
 (Think how  
 rth of "test pages"  
 you in a year.)  
 ou see can be  
 With the combina-  
 PostScript® and  
 resolution NeXT  
 play, screen  
 ys paper crisp.  
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 multitasking,  
 uters let you run  
 of applications



The NeXT Laser Printer offers 400-dots-per-inch resolution, compared to the 300 dpi offered by most. At the same time, it offers the most revolutionary price ever placed on PostScript laser printing: \$1795 (suggested retail price).

at the same time. But the advan-  
 tages of that go far beyond mere  
 cutting and pasting.

Applications can actually  
 cooperate with each other—  
 each contributing what it does  
 best. Without ever leaving your  
 layout, you can select a word  
 and ask for a definition from  
 Digital Webster.™ Your illustra-  
 tion program can make sure  
 the layout is updated with the  
 most recent version of the art.

Not only does NeXT technol-  
 ogy allow programs to work  
 together, it helps people work  
 together. Writers, editors, illus-  
 trators and designers can each  
 contribute their part and route  
 documents electronically—using  
 the capabilities built into every  
 NeXT computer.

Never has a machine been so  
 perfectly suited for the demands

of publishing. And, as you can  
 see below, the industry has been  
 quick to respond. Some of  
 the most popular names in pub-  
 lishing have already released  
 software packages that fully ex-  
 ploit NeXT technology.

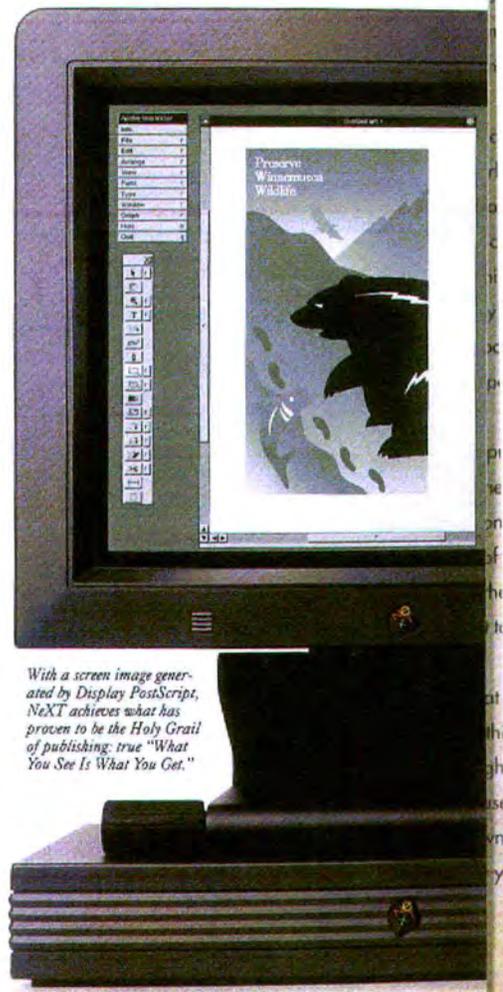
The more you learn about  
 NeXT computers, the more you'll  
 appreciate this fact:

There's a tremendous differ-  
 ence between a computer that  
 can simply handle publishing,  
 and one that's virtually built for it.

Community Access, Inc.  
 2011 State St.  
 Almond, NY 10011



**ADOBE** Adobe Illustrator® is perfect for design-  
 ing pages with finely detailed illus-  
 trations. It lets you modify the shapes of fonts, even create  
 your own typefaces. And, being a PostScript program in a  
 PostScript world, it does many things — like zooming —  
 with unprecedented speed.



With a screen image gener-  
 ated by Display PostScript,  
 NeXT achieves what has  
 proven to be the Holy Grail  
 of publishing: true "What  
 You See Is What You Get."



Draw™ is one of the easiest pro-  
 grams you'll ever use, yet it's  
 a powerful drawing program. It offers  
 drawing with extensive controls  
 crop in scanned images  
 , rotate and even mask them.

Adobe PostScript fonts give you professional  
 results, on screen and paper. NeXT computers  
 ship with 13 type styles, while the Adobe Plus  
 Pack™ gives you access to 26 more. And coming  
 soon: the entire Adobe Font Folio.™

The previous revolutions in personal computing – the spreadsheet and desktop publishing – were created with a single desk in mind. As were the computers built to support them.

But now we find we can accomplish more, and react more quickly, when people work together. And so, the revolution of the 90s:

Interpersonal computing.

It's a new way of working that can dramatically enhance the capabilities of an entire department, an entire company or an entire university,



enabling people to tap each other's strengths to meet new challenges.

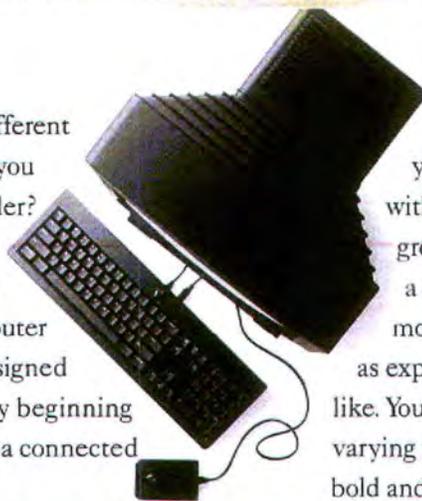
Unfortunately, connecting machines is no guarantee of connecting people. Which is why NeXT computers were designed specifically for the interpersonal world.

And just what makes our

machines different from others you might consider?

For one thing, every NeXT computer has been designed from the very beginning to be part of a connected workplace.

All the hardware you need to tie into a high-performance



NeXTmail lets you communicate with one person, or a group of people, with a single click of the mouse – and do so as expressively as you like. You can send text in varying fonts and sizes, bold and italics. Include

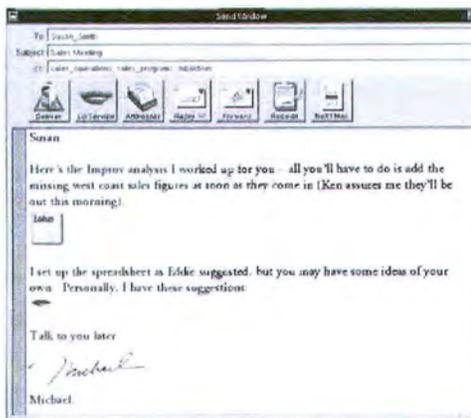
## PERSONAL COMPUTING BECOMES INTERPERSONAL COMPUTING.

graphics or scanned images. Attach

entire documents (of unlimited length). You can even include voice messages using the microphone built into the MegaPixel Display.

And, despite its level of sophistication, NeXTmail is so intuitive, most people won't ever open the manual.

Now imagine a company arranged by department, each using a number of NeXTstation computers and



NeXTmail is a far cry from boring terminal-type e-mail. You can choose any size or style font for your text. You can also add graphics, attach documents (or folders of documents), even include voice memos.

Ethernet network is built in.

Second, ours are true multitasking machines, so communications can be spontaneous, no matter what application you're currently working with.

Third, all NeXT computers come with NeXTmail™ easily the most sophisticated form of electronic mail available on any computer today.



NeXT computers make it possible to punctuate a message with your own voice. Just call up Lip Service.™ It works like a simple tape recorder, so all you have to do is click "record" and start talking – the microphone is built into the NeXT MegaPixel Display.



the NeXTcube server. By links, any one company can interact with another – whether in the same world or different continents.

In fact, when connections are tied to NeXTmail, different zones become meaningless in the NeXTmail can virtually instant



With a fax modem, your NeXT document directly from the sky on earth – where it can be 200-dots-per-inch quality.

person isn't their

Now the commonized electronic the real revolution in personal computing sudden challenge you can put together a special team to it – without being held back by a rigid structure of org charts or office politics.

Consider, for example, a product rollout. A connected electronic can handpick the

eXTmail lets communicate ne person, or a of people, with gle click of the e – and do so sively as you n send text in ts and sizes, ics. Include graphics or scanned ages. Attach (of unlimited ven include s using the ult into the play.

s its level of NeXTmail is ost people a the manual. e a company partment, mber of omputers and



to punctuate a message Lip Service™. It works rder, so all you have and start talking – the microphone is built into the NeXT MegaPixel Display.

the NeXTcube™ computer as a server. By linking the departments, any one person in the company can interact with another – whether the two are in the same workgroup or on different continents.

In fact, when remote locations are tied together via NeXTmail, differences in time zones become almost meaningless in the scope of a project. NeXTmail can be delivered virtually instantly, even if a



With a fax modem, your NeXT computer can send a document directly from the screen to any fax machine on earth – where it can be replicated at a remarkable 200-dots-per-inch quality.

person isn't there to receive it.

Now the company is organized electronically, and that's the real revolution of interpersonal computing. When a sudden challenge arises, you can put together a special team to meet it – without being constrained by a rigid structure based on org charts or office layout.

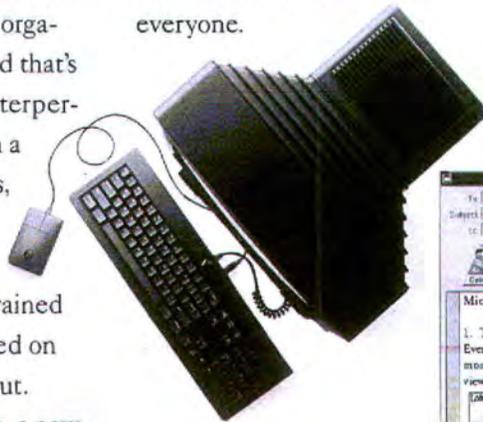
Consider, for example, a new-product rollout. With every desk connected electronically, you can handpick the best people



for the job, from engineering, marketing, research and creative. NeXT computers negate the physical distance between people, so everyone can stay up to date on issues, share new ideas and cut down on needless meetings.

But interpersonal computing is much more than NeXTmail.

Software like Who's Calling?,™ from Adamation, can provide a central system for tracking clients. Records that are used by many people in the office can all be stored in a single NeXTcube, so the most current information is available to everyone.



We wrote the documentation for NeXTmail knowing that few people would ever have to read it. NeXTmail is as intuitive as it is sophisticated. And, thanks to true multitasking, it's never more than a click away.

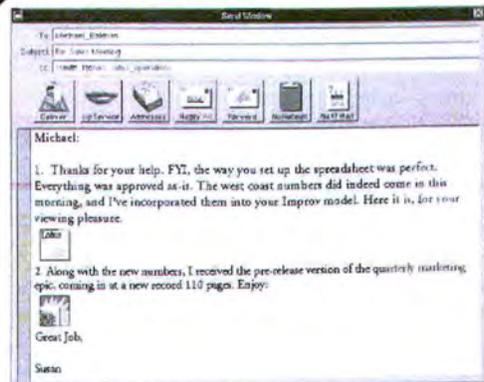
PaperSight,™ from Visual Understanding Systems, makes it easy to maintain a "group memory" – a history of each department's work. With this software running on the NeXTcube computer, you can store the group's documents centrally, cutting down on paper files and making it vastly easier to locate previous work.

We should also point out that NeXT interpersonal computing makes a cost-effective solution for any size workgroup.

Using the NeXTcube as a server eliminates the need to put costly storage devices on individual desktops. And NeXTstation computers don't require any additional investment in networking hardware.

Interpersonal computing can make a fundamental change in the way an organization works.

All you need is a computer that's up to the task.



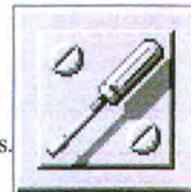
to display properly on either the grayscale MegaPixel Display or the new color



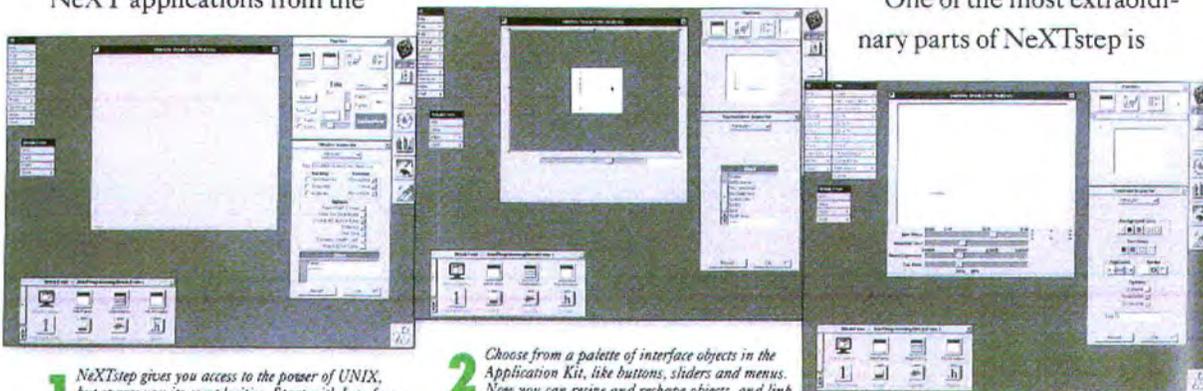
Earlier in this brochure, we showed you some remarkable NeXT applications from the

On one level, NeXTstep is the user interface that makes all NeXT computers so very intuitive and visually interesting. On another, it's a development environment that revolutionizes the way software is conceived and created. In fact, it's the entire reason why the

of their WordPerfect software. The NeXTstep environment is an object-oriented world. It's purely graphical, making UNIX® easier to work with than DOS, OS/2®, Macintosh® or Windows™ environments. And it runs on every NeXT computer.\*



One of the most extraordinary parts of NeXTstep is



**1** NeXTstep gives you access to the power of UNIX, but spares you its complexities. Start with Interface Builder, which makes short work of what used to be the most time-consuming task: constructing an elegant user interface.

most popular names in business software, including Lotus®, Ashton-Tate®, WordPerfect® and Adobe®.

Now, if it seems like the applications appearing on NeXT computer systems are more sophisticated than the ones you're currently using, and at the same time easier to use, you've already grasped the essence of one of our biggest breakthroughs: NeXTstep®.

**2** Choose from a palette of interface objects in the Application Kit, like buttons, sliders and menus. Now you can resize and reshape objects, and link those that relate to each other.

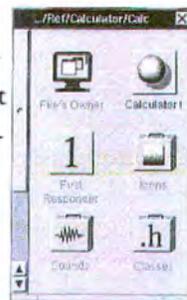
companies we just mentioned could create such extraordinary software in a fraction of the time it would have taken with other computer systems.

But even more revolutionary is the fact that NeXTstep is just as accessible to you.

So, for example, if you're creating customized software for people who take care of personnel, customer service or payroll, you can use the same tools Lotus used to create Improv, and WordPerfect used to create the NeXT version

**3** Arrange the interface so it looks exactly as you want the finished application to look. Even if you're a non-programmer, at this point you've successfully "prototyped" an application you can give to a professional.

Interface Builder™, which lets you create an elegant application

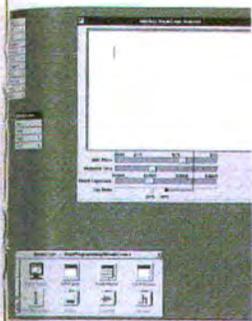


interface using little more than the mouse.

You can choose from a palette of interface objects (such as menus, buttons and sliders) provided by the Application Kit™. Then edit, link and arrange them the way you want them to appear in your finished application.

In addition, you can easily build new palettes of objects that

you design yourself. So with Interface Builder, you can rapidly generate a graphical front-end to a corporate database. You can create some fast prototypes



**4** Now, using the mouse, link objects graphically - so a user's action in one window triggers a response in another. You can create links to your own custom database or employee

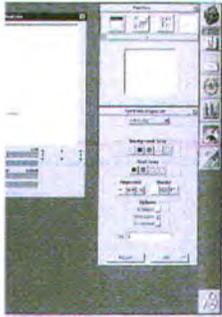
applications - which makes it that much easier to create software with the power you will ultimately use it for.

And the interface you create, which may have taken you more time previously, now takes less than 5% - a tremendous saving that could put a serious dent in your backlog of projects. Most important, the applications you create are much simpler and more powerful. They're real, industrial-strength applications - every one of them as good as the applications you can buy off the shelf, and even better.

Perfect software. step environment oriented world. phical, making to work with than



T computer.\* e most extraordi- NeXTstep is



ice so it looks exactly as you application to look. Even if rammer, at this point you've an application you can give

der,™ which lets you ant application rface using little e than the mouse. u can choose from ette of interface cts (such as menus, ons and sliders) ided by the Appli- n Kit.™ Then edit, ge them the way n to appear in your cation. you can easily ettes of objects that

you design yourself. Or add your own customized objects to the NeXT Application Kit.

So with Interface Builder, you can rapidly generate a graphical front-end to a corporate database. You can also do some fast prototyping of new

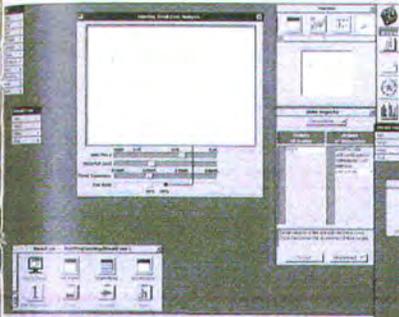
Applications you develop with NeXTstep are modular, too, so you can reuse portions whenever you see fit. And they're

# CUSTOM SOFTWARE IS CREATED IN A FRACTION OF THE TIME.

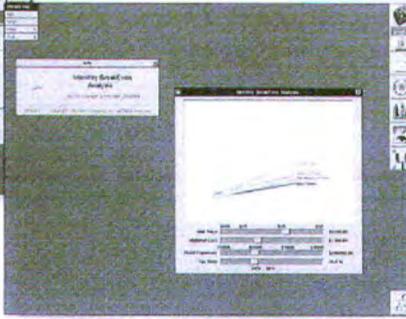
extremely easy to maintain. Now, when you update, there's no need to rewrite your whole application – you simply update the parts you want to change.

In the words of the NeXT Development Team at Lotus, "NeXTstep is the best development environment available on any personal computer today." There has really never been an environment anything like NeXTstep. And no machine is built to support it like a NeXT computer.

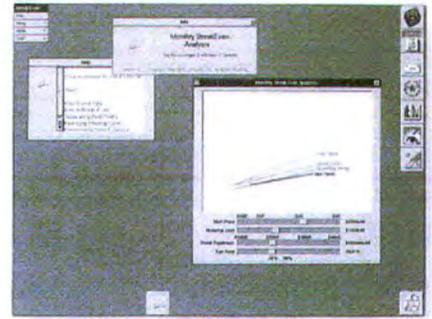
\*The NeXTstep development environment is included with the NeXTcube, and is available for the asking with the NeXTstation.



4 Now, using the mouse, link your objects graphically – so a user's action on one can trigger a response in another. You can even create links to your own custom objects – such as a customer database or employee records.



5 When you have everything the way you want it, throw the testing switch and Interface Builder will let you run your interface through its paces.

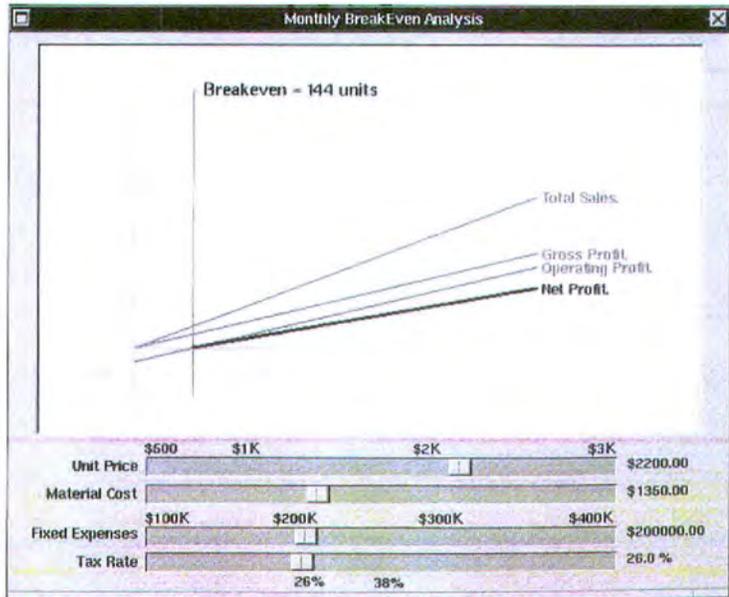


6 Congratulations. You've just completed your interface in record time. Perhaps now your backlog of requests will look less intimidating.

applications – which makes it that much easier to test your software with the people who will ultimately use it.

And the interface you create, which may have taken 90% of your time previously, now takes less than 5% – a streamlining that could put a serious dent in your backlog of projects.

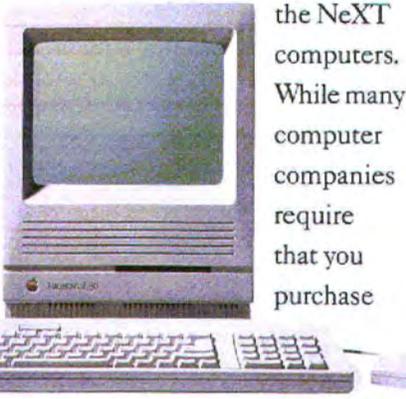
Most important, the programs you create are much more than simple information managers. They're real, industrial-strength applications – every bit as fast as the applications you buy off the shelf, and every bit as complete.



With NeXTstep, you can create a real, industrial-strength application in a fraction of the time it would take in other environments – using the same tools the major software companies use to create their NeXT applications.

Back in the old days (the 80s), people were willing to forgive the computer unable to venture beyond its own desktop. But in the era of interpersonal computing, connectivity is absolutely mandatory.

Rest assured, we were mindful of that fact when we designed



GatorBox® from Cayman Systems, lets you connect a NeXT network to a Macintosh network. GatorShare™ software lets you share data between the two, or use the NeXTcube to store files and applications for both networks. GatorMail™ lets you send e-mail between networks - NeXT machines using NeXTmail, and Macintosh computers using GE Software's QuickMail® or Microsoft® Mail.

# OUR WORLD CONNECTS TO YOUR WORLD.

the NeXT computers. While many computer companies require that you purchase

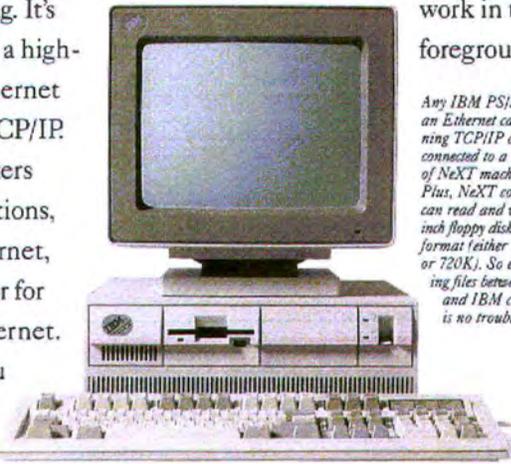
an expensive network card for every machine you want to tie together, everything you need to connect NeXT computers is built right in. (You're on your own for the cable.)

And the equipment we've included isn't merely for low-speed networking. It's for connecting to a high-performance Ethernet network using TCP/IP.

NeXT computers have two connections, one for thin Ethernet, and the other for twisted-pair Ethernet. So whichever you use, there are no hidden costs.

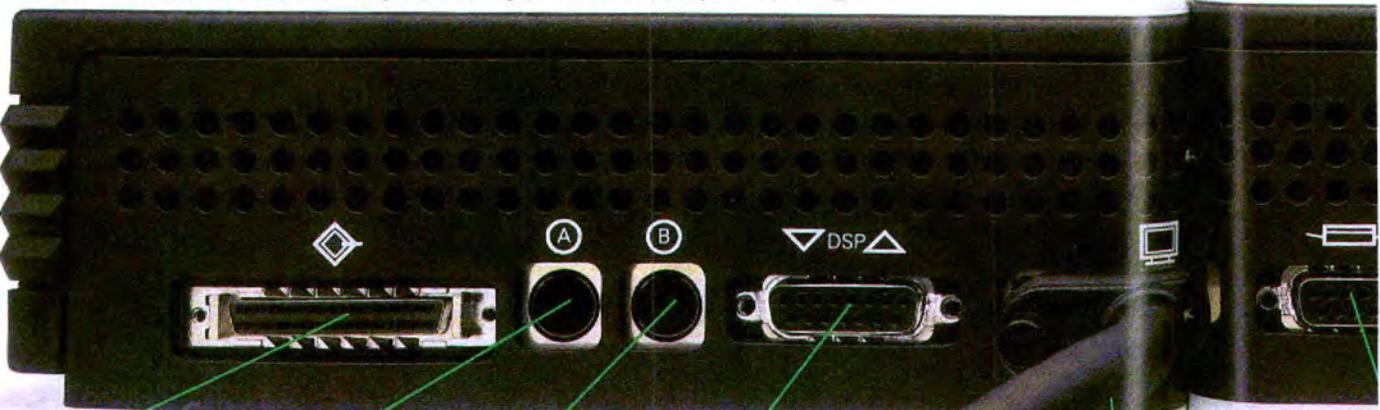
Even our system software has been optimized to perform in a connected workplace.

NeXT technology is based on UNIX, widely acknowledged as the best system for networking. It's also optimized for multitasking, so your NeXT computer can attend to networking matters in the background while you do real work in the foreground.



Any IBM PS/2® with an Ethernet card running TCP/IP can be connected to a network of NeXT machines. Plus, NeXT computers can read and write 3.5-inch floppy disks in IBM format (either 1.44MB or 720K). So exchanging files between NeXT and IBM computers is no trouble at all.

This is the NeXTstation - actual size. It's only two-and-a-half inches tall, but in performance overshadows computers many times bigger.



SCSI: a high-performance port that lets you add devices like scanners, disk drives and tape backup units.

A serial port lets you connect a modem - then, with MicroPhone™ from Software Ventures, you can connect to a world of electronic service bureaus, from Dow Jones® to CompuServe®

With a second serial port, you can also connect to a fax modem, or, using an additional interface, the world of MIDI (if you don't know what that means, ask the nearest musician).

Here's your direct connection to the NeXTstation's Digital Signal Processor, where you can plug in high-performance serial devices for video and sound, as well as sophisticated laboratory instruments.

A single cable connects to the MegaPixel Display, carrying not just display information, but data for keyboard, mouse, speaker and microphone.

There's a separate port for NeXT 400 dpi Laser Printer, leaving the serial and SCSI ports open for other devices.

If that work IBM® PC file be it. NeXT c and write flopp

NeXT computers connect to Ethernet using TCP/IP and Or you can connect directly tion via the SCSI port with or 3270Vision. Communicat lets you connect to DEC ma ing DEC VT220™ terminal

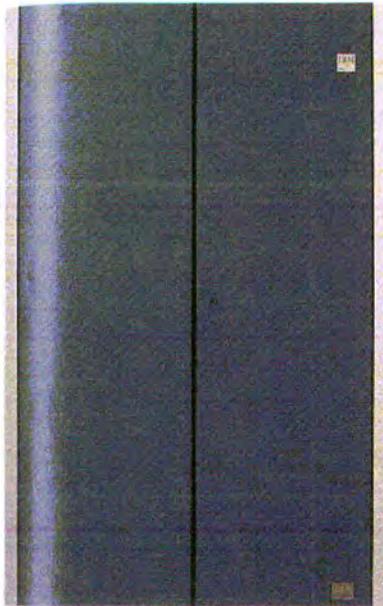
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Any IBM PS/2® with an Ethernet card running TCP/IP can be connected to a network of NeXT machines. Plus, NeXT computers can read and write 3.5-inch floppy disks in IBM format (either 1.44MB or 720K). So exchanging files between NeXT and IBM computers is no trouble at all.

If that work should require IBM® PC file compatibility, so be it. NeXT computers can read and write floppy disks in DOS

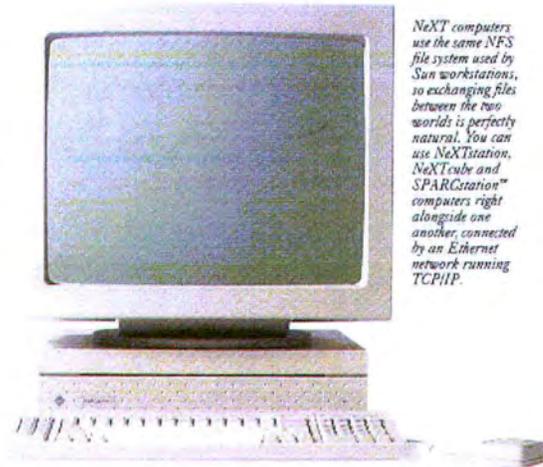


NeXT computers connect to IBM 3270 mainframes via Ethernet using TCP/IP and 3270Vision™ from Conexions. Or you can connect directly through a 3270 coax connection via the SCSI port with InSession3270™ from Avatar or 3270Vision. Communicae™ from Active Ingredients, lets you connect to DEC mainframes via Ethernet by offering DEC VT220™ terminal emulation.

and OS/2 formats (144MB or 720K), so you can take a data disk created on one of your IBM machines and place it directly into your NeXT computer. Or vice versa.

As for file compatibility on a network, NeXT computers observe the NFS® (Network File System) standard.

In fact, our machines can connect without problems via network to whatever technology you currently employ – from IBM PCs/compatibles, Sun® and

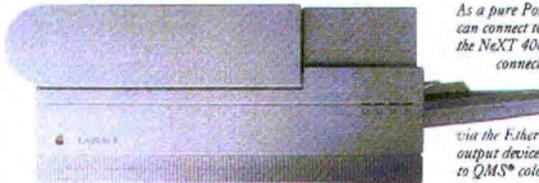


NeXT computers use the same NFS file system used by Sun workstations, so exchanging files between the two worlds is perfectly natural. You can use NeXTstation, NeXTcube and SPARCstation™ computers right alongside one another, connected by an Ethernet network running TCP/IP.

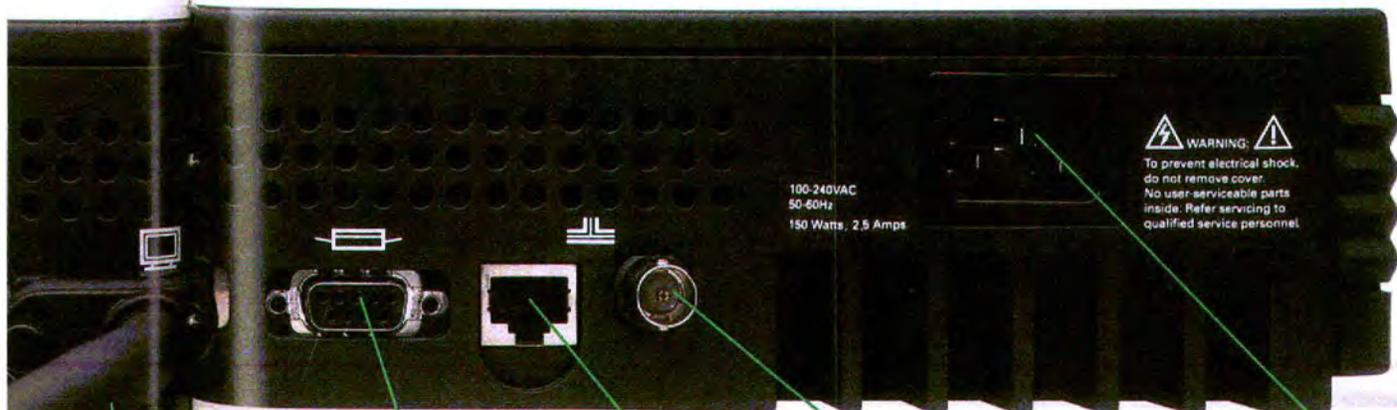
Macintosh computers to IBM and DEC® mainframes.

So no matter how your office is set up today, or what technology you already have in place, NeXT computers won't just fit in.

They'll stand out.



As a pure PostScript machine, a NeXT computer can connect to a world of output devices beyond the NeXT 400 dpi Laser Printer. You can also connect to an Apple LaserWriter® through a serial port, or to professional typesetting machines (such as the Linotype L100, L300 and L330) via the Ethernet or RS423 port. All PostScript output devices are fair game, from slide makers to QMS® color printers.



**WARNING:**  
To prevent electrical shock, do not remove cover. No user-serviceable parts inside. Refer servicing to qualified service personnel.

100-240VAC  
50-60Hz  
150 Watts, 2.5 Amps

A single cable connects to the MegaPixel Display, carrying not just display information but data for keyboard, speaker and microphone.

There's a separate port for the NeXT 400 dpi Laser Printer, leaving the serial and SCSI ports open for other devices.

Some call it twisted-pair Ethernet, others call it ordinary phone wire. But here's where it plugs in. Since most new offices are pre-wired with extra phone lines, this connection can drastically cut the cost of networking. It's based on the standard called 10 BASE-T.

A thin-Ethernet connection (meeting ISO standards, of course) is also built in, so, for smaller networks, you can just run Ethernet cabling from one machine to the NeXT.

Insert electricity here. The NeXTstation automatically adapts to any type of current, anywhere in the world – no software switching or special hardware required.

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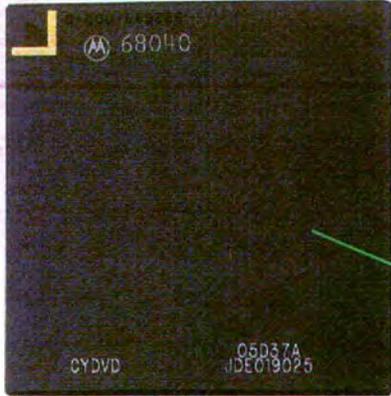
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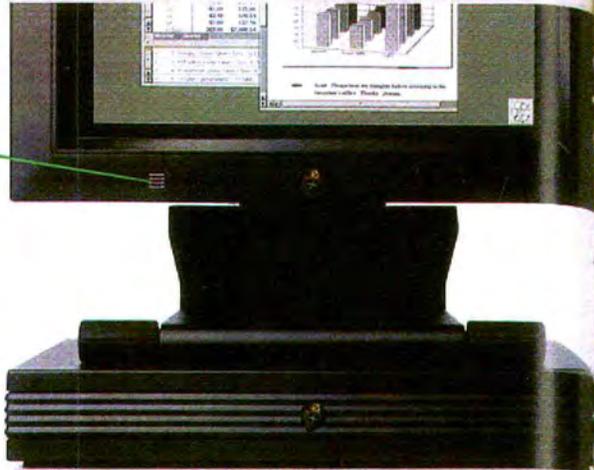
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to display properly on either the grayscale MegaPixel Display or the new color



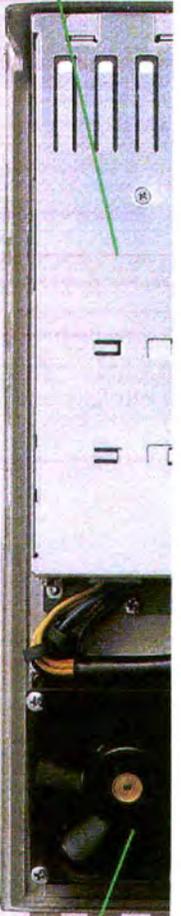
Sound is an integral part of the NeXT world. Which is why a microphone is an integral part of the NeXT MegaPixel Display.

Motorola's newest microprocessor, the 68040 (040 for short), is the heart of the NeXTstation. At 15 MIPS, it combines the best technical features of CISC and RISC technology, all in one brutally powerful chip.



The MegaPixel Display is standard, providing ultra-high resolution at 1120 x 832 pixels. Because Display PostScript generates the image, what you see here is exactly what will print.

We don't expect Parallel R. But it is a revolution as power into a very small sp NeXTstation can be plugg



Yes, the NeXTstation has a fan if we didn't tell you. Thanks design, all you hear is silen

## WHAT MAKES A NeXT COMPUTER A NeXT COMPUTER.

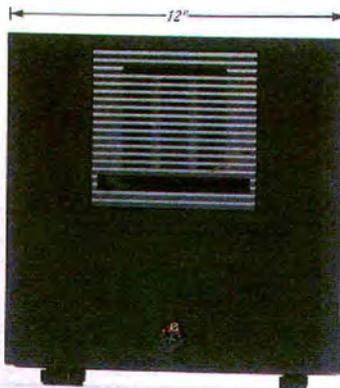
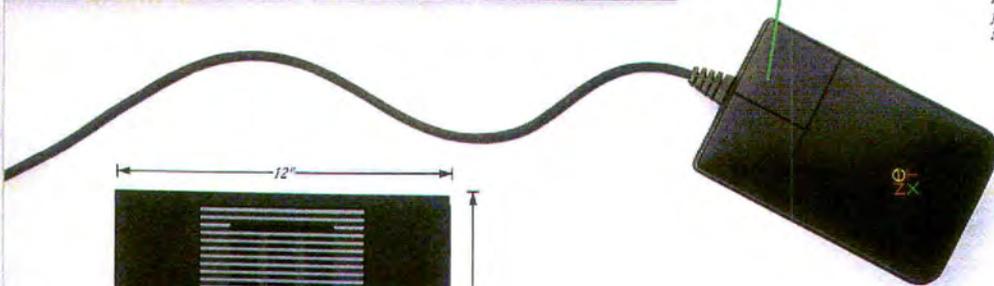


You'll never search for another switch again. On a NeXT computer, you control everything from the keyboard, including system power, sound volume and display brightness.

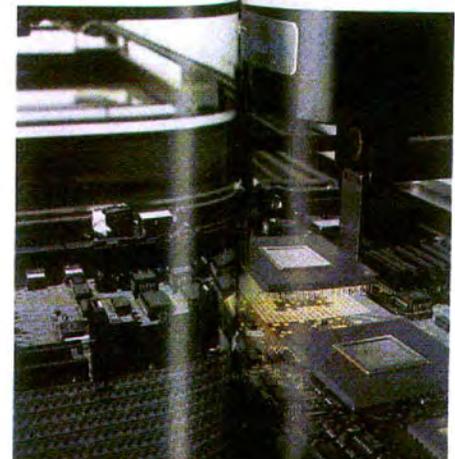
The right mouse button can be enabled so when pressed, the current menu appears on screen wherever you happen to be. (A major boon on screens as big as ours.) If you're a lefty, mouse button functions can easily be reversed.



Only NeXT makes a Digital Signal Processor chip part of the basic computer architecture. This chip's ability to crunch huge arrays of numbers makes CD-quality sound possible. It also helps in compressing data and sound files so they can be more easily sent via NeXTmail.

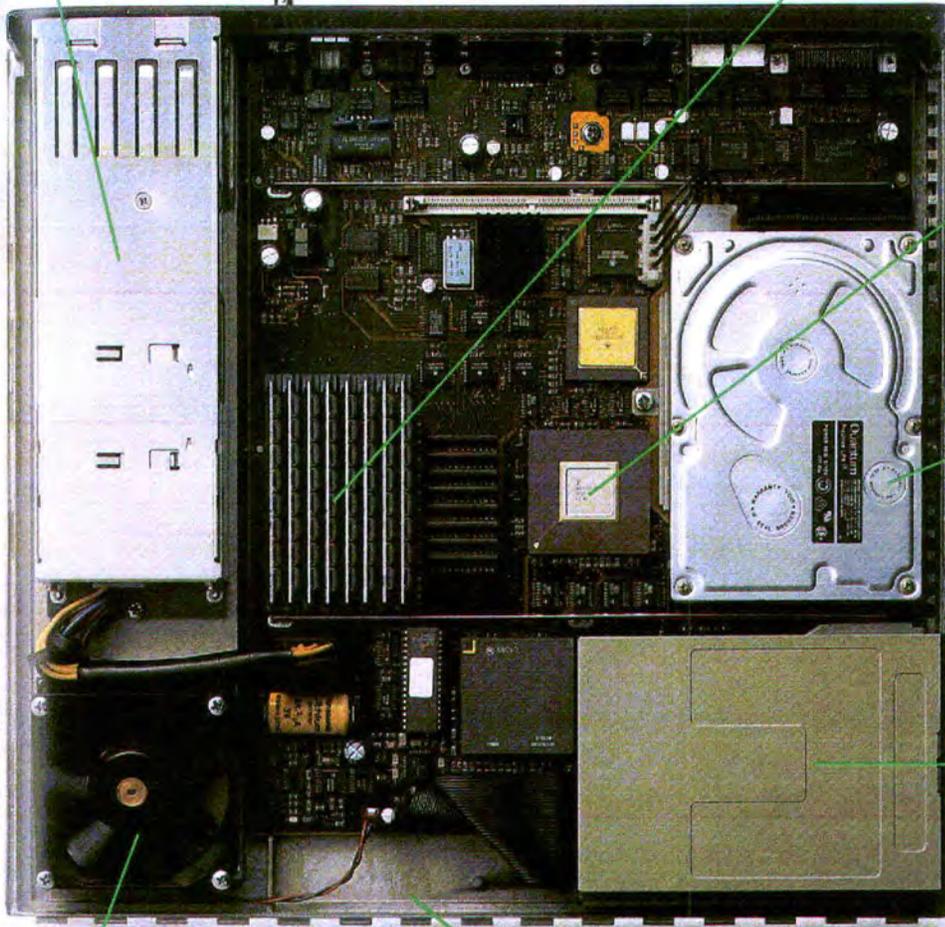


Though significantly slimmer, the NeXTstation has the same computing power of the NeXTcube. But then, the NeXTcube has a few things to offer, too: like an optional optical drive that stores 256 megabytes on a single disk, up to 2.4 gigabytes of hard disk storage, up to 64 megabytes of RAM and three NeXTbus™ slots for worlds of new power.



We don't expect Parallel Resonance Switching to become a household phrase. But it is a revolution as power supplies go — packing a great deal of power into a very small space. And it's completely self-adapting, so the NeXTstation can be plugged in anywhere in the world.

The NeXTstation starts out with a generous eight megabytes of RAM — more than enough for all but the most demanding user. And it can be expanded all the way to 32 megabytes.



Small world. Using VLSI (Very Large Scale Integration) technology, our engineers have built nine separate input/output processors onto a single chip. So many important functions can be taken care of without distracting the main processor.

Don't worry about storage space. Standard in the NeXTstation is a 105-megabyte hard disk — onto which we've already installed an impressive bundle of software (including WriteNow®, Digital Webster, NeXTmail and all system software). But if you're a real glutton for storage, we also offer a 340-megabyte hard disk.

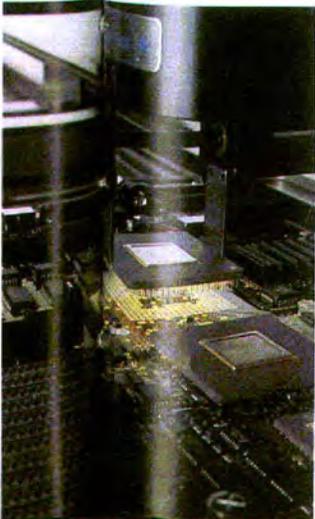
There's a floppy drive built into every NeXT computer. But in our world, a single 3.5-inch floppy disk can store a voluminous 2.88 megabytes of data — an industry first.

Yes, the NeXTstation has a fan, but you wouldn't know if we didn't tell you. Thanks to some innovative cooling design, all you hear is silence.

The NeXTstation's internal components are housed in light weight, but incredibly strong magnesium. Which eliminates the need for heavy shielding inside, and provides ample strength to support large displays.

1 x 832 pixels, what will print.

Processor architecture arrays of possible and sound via



It takes an extraordinary factory to build an extraordinary computer. Untouched by human hands, NeXT machines are produced by an uncompromising team of robots in Fremont, California (supported, of course, by a terrific team of carbon-based units).



Thanks to the Digital Signal Processing chip (portrait elsewhere on this page), NeXT computers can produce digital stereo sound with the fidelity of a compact disc. The speaker is built into the MegaPixel Display, as are left and right output jacks for connecting to an external audio system, if you wish.



Our machines can read and write data not only in NeXT format, but in DOS and OS/2 formats as well (1.44MB and 720K). So, for example, moving data between Lotus Improv on a NeXT computer and Lotus 1-2-3 on an IBM machine can be perfectly painless.

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In the NeXTstation, we have squeezed the most possible computer into the least possible space. We've also squeezed the most possible computer into the least possible price.

\$4995 includes everything. Even those traditional computer "extras," like a keyboard and monitor.

Your NeXTstation comes equipped with eight megabytes of memory, a built-in 2.88-megabyte floppy drive and Ethernet. It also comes with a 105-megabyte hard disk, onto which we have

taken the liberty of installing a formidable package of software, including WriteNow, NeXTmail and Digital Webster (and, if you happen to be in higher education,

we've also included *Mathematica*). So all you have to do is plug it in and you're ready to go to work.

You even get a free trial subscription to NeXTWORLD™ magazine, to keep you up to date.

And just to make our case all

the more compelling, we're going to send a free copy of the extraordinary spreadsheet program, Lotus Improv\* (a \$695 value), to everyone who purchases a NeXTstation

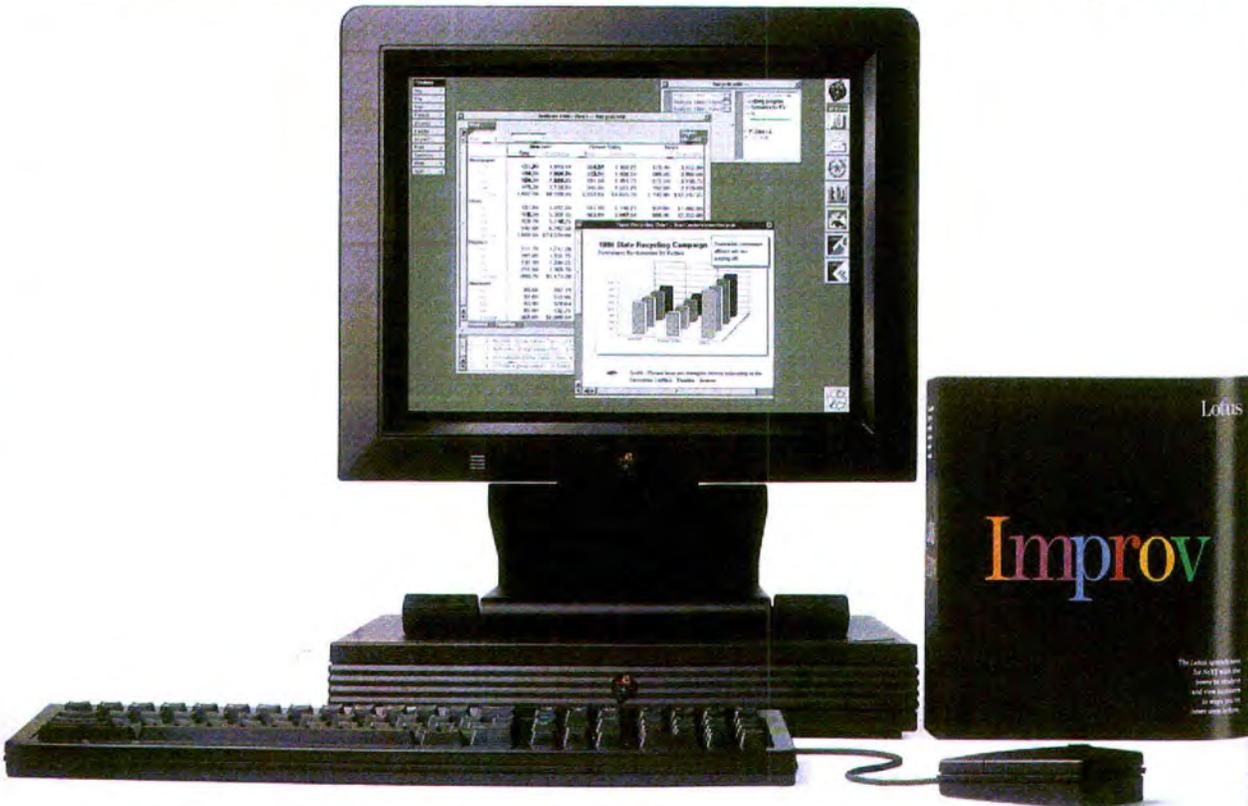
or NeXTcube computer by 3/31/91.

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who opt for our 040 upgrade board.

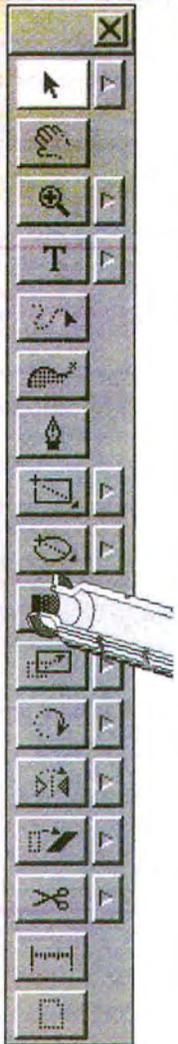
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\*Lotus Improv will be delivered when available to owners of all NeXT computers and 040 upgrade boards purchased and registered between now and March 31, 1991.

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# Key Software

NeXT's gourmet software menu now features meat-and-potatoes entrées to satisfy corporate appetites.

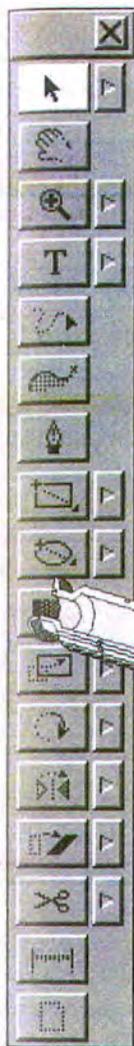
by Bruce F. Webster

I'm convinced that if any firm introduced the world's fastest, cheapest personal computer—say, a desktop Cray for under \$1000—one of the first questions would be, "Yes, but does it run Lotus 1-2-3?" It's an unavoidable question. Even at the leading edge of technology where NeXT's breakthrough user interface and vision of group productivity dwell, folks want what's familiar, safe, and standard. This doesn't do much to promote diversity or innovation, but it does keep corporate MIS types happy. As a result, machines get bought, and computing revolutions quietly transpire. Which explains why September's NeXT renaissance featured Lotus and WordPerfect CEOs Jim Manzi and Alan Ashton up on stage, instead of the concert violinist who played a duet with the computer at its debut in 1988. NeXT acknowledges—indeed, has never denied—that it needs mainstream applications to make corporate sales inroads.

Among the myriad software classifications, only three really matter: word processing, spreadsheets, and database management. To sell a workstation as a general-purpose office tool, you need competitive, compatible products in each of these categories; if you don't have them, you're dead. You can and should have others—communications, software development, graphics, and so on—but those alone cannot carry a system, as was demonstrated by the torpid sales that dogged NeXT's first year and a half. In this article we'll look at how well NeXT software satisfies business needs in every category, and particularly in the big three.

**Word processing.** The preferred phrase may be "desktop publishing" (DTP) or, if you're really hip, "workgroup publishing," but what businesses need is old-fashioned word processing. You know, putting lots of words onto lots of sheets of paper, with a little dressing up along the way—a column of text here, a graphic there, maybe a different font or two. And NeXT ads and the *Seybold Report* notwithstanding, the NeXT's choices for word processing (not to mention DTP) have been limited and nonstandard.

NeXT comes with WriteNow, an entry-level word processor that more or less gets the job done, but that most users will drop as soon as something better comes along. The only other option has been FrameMaker 2.0, a high-end DTP system that, though quite powerful, suffers from a less-than-limpid user interface. You don't have to be a rocket scientist to figure out on your own how to use FrameMaker, but it sure doesn't hurt. Between it and WriteNow yawns a barren wasteland, product-wise.





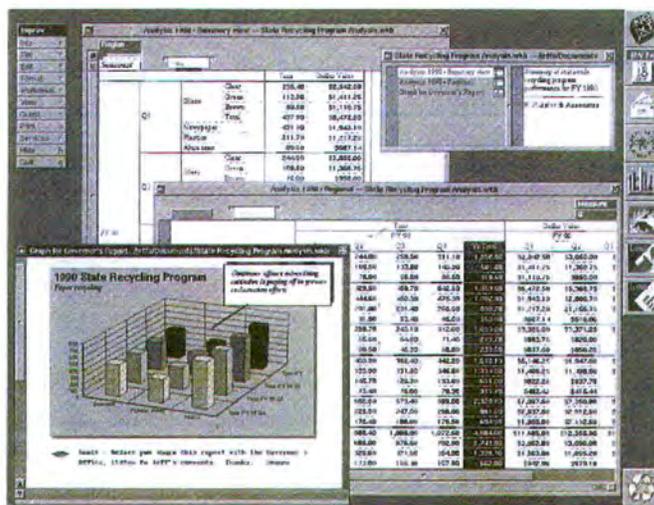
has created PowerStep, a powerful product that has been overshadowed by all the attention focused on the more spectacular Lotus Improv. PowerStep has at its core a classic spreadsheet with a NeXT-compliant interface and great performance on the '030. It should really scream on the '040. It also offers broad graphical functionality and a powerful macro language. This combination gives PowerStep significant presentation capabilities. And it reads and writes Lotus 1-2-3 files.

But Improv is getting the lion's share of attention, and rightfully so. Lotus explains that with Improv they set out to reinvent the spreadsheet. The result certainly gives them the right to brag. Column letters, row numbers, and cell formulas, the main source of frustration for spreadsheet users, are all gone. In their place are rows and columns labeled in plain English, and an independent list of formulas that use those labels, making Improv, in essence, a relational spreadsheet. For example, suppose you have rows labeled UNITS BOUGHT, UNITS SOLD, WHOLESAL PRICE, RETAIL PRICE, EXPENSES, GROSS SALES, and NET PROFITS. In the formula panel, you would enter the following formulas: "EXPENSES = UNITS BOUGHT \* WHOLESAL PRICE" "RETAIL PRICE = 1.4 \* WHOLESAL PRICE" "GROSS SALES = UNITS SOLD \* RETAIL PRICE" "NET PROFIT = GROSS SALES - EXPENSES"

Now, no matter how those rows grow or shrink in size, and no matter where they appear in your spreadsheet, the appropriate calculations always take place. Other innovative features abound. You can easily rearrange a spreadsheet by moving around small tokens that represent row or column categories. You may open multiple windows to a spreadsheet, allowing you to view (and change) data in several different ways simultaneously. And, naturally, Improv will read and write Lotus 1-2-3 files directly—an ability tremendously attractive to the corporate market. And to sweeten the deal, NeXT bundled a copy of Improv with every NeXT system and upgrade sold by the end of 1990—a move that is great for NeXT, good for Lotus, and unfortunate for Ashton-Tate.

**Databases.** So, you ask, where's dBase IV for the NeXT? That's a good question. For all the commotion in other product categories, things have been awfully quiet in database management. Sure, Ingres, Oracle, and Sybase have all announced NeXT projects, but the screen shots in the Fall 1990 product catalog show terminal-like windows sitting in the middle of the NeXT screen. Even when these SQL-based products acquire NeXTstep-based front ends, they'll be better suited to the heavy-duty applications that get frequent attention from database specialists. But what about departmental or personal projects? Where are FileMaker, Clipper, FoxBase, Helix, and 4th Dimension?

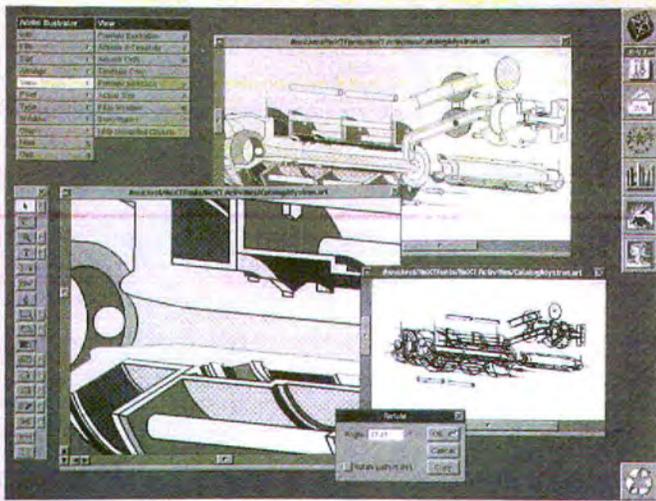
It seems as though the NeXT, with its large display, graphical object orientation, and rich memory and mass-storage standards, would be a natural environment for a top-notch database. But if anyone is developing such a product, they're being very secretive about it. Such a situation may not be a big disadvantage at this stage; businesses that rely on database technology and already have large, established databases will be reluctant to move them to any other platform, including the NeXT. But in the long run the lack of stand-alone data-



**Lotus Improv**

Lotus's Improv supports several views of a single set of spreadsheet data. Users can cycle between views with the Model Browser, shown top right.





#### Adobe Illustrator

The NeXT version of Adobe Illustrator has all the features of the latest Macintosh version. The NeXT's Display PostScript imaging model provides precise on-screen renderings of illustrations.

base products could seriously hurt NeXT. In the meantime, recognizing the demand for custom database interfaces in large corporations, both NeXT and some third-party firms are developing ways to use the powerful NeXT development environment to create front-end applications. Professional Software has released the Objective DB Toolkit, a library of SQL interface objects for NeXT's Interface Builder. Sybase, for its part, is offering the NeXT Database Developer's System, which includes the five-user NeXT SQL Server (previously bundled with NeXT system software Release 1.0), and the Database Kit, an object library jointly developed by NeXT and Sybase.

There is at least one end-user database announced: DataPhile from Stone Design Corporation. This is a flat-file database system that should prove sufficient for most simple needs but is insufficient for business and corporate database requirements.

**Graphics.** Although not one of the big three categories, programs for creating graphic images—particularly vector-based draw programs—are a mainstay of more than one computer environment. NeXT, with its vector-based Display PostScript interface, would seem like a natural for drawing packages. Surprisingly, there hasn't been a flood of applications. But the products on the horizon look pretty good.

So far, Media Logic's TopDraw has pretty much had the NeXT draw market to itself. It offers a page-oriented, object-based drawing environment with a number of special effects. Adobe, in the meantime, has been preparing a version of Adobe Illustrator 3.0 for the NeXT, which should be out by the time you read this. The biggest difference between the NeXT version of Adobe Illustrator and those found on other platforms is that no special Preview mode is required, since the NeXT display is rendered using PostScript.

Supporting both drawing and word processing programs are a few collections of clip art (ClickArt from T/Maker and Klip It from Adamation), any number of fonts from Adobe and the Font Company, and two text manipulation packages: TextArt from Stone Design Corporation and TouchType from Right-Brain Software.

In a class by itself is Diagram! from Lighthouse Design (see the review in this issue). Billed as a "digital whiteboard," Diagram! lets you quickly lay out diagrams, flowcharts, and organizational charts. Items in a diagram can be linked to other diagrams, as well as to external documents and applications, causing them to be displayed or launched when the item is selected.

**Interpersonal computing.** NeXT agrees with John Donne that no man (or woman) is an island, and thus sees interpersonal computing as a key concept of the nineties. The idea is obvious, at least once it has been explained: People need better tools to coordinate and facilitate group work. What is less clear is how a third-party developer sets about creating applications that promote interpersonal computing. If you drag connectivity and communications under that blanket term, then you can discuss some existing and planned products. However, true groupware—applications specifically designed for multiple simultaneous users—remains more elusive. The new NeXT systems have a high degree of built-in connectivity. They read and write 3.5-inch DOS disks, and come

with built-in Ethernet hardware, DataVizBridge software that allows Mac-to-NeXT transfers, and a couple of serial ports. NeXT's new NetManager software greatly simplifies setting up and administering a multi-NeXT network, and NeXT-mail facilitates multimedia communications from NeXT to NeXT, as well as plain vanilla e-mail transfers to and from other systems.

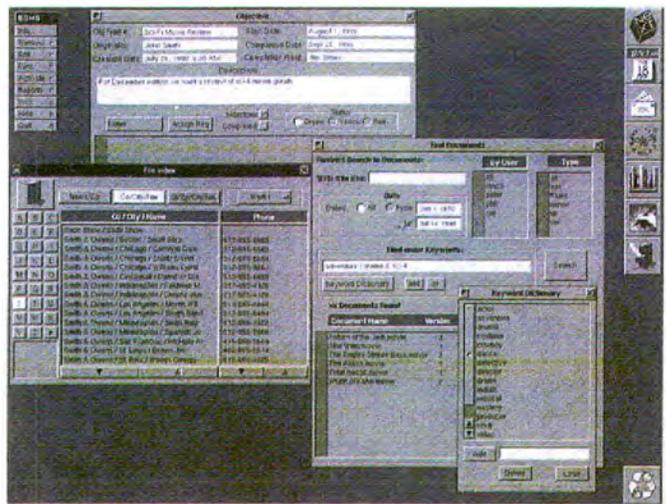
In addition to all this, several third-party products extend the NeXT's capabilities. Cayman Systems' GatorBox links the NeXT to an AppleShare (Macintosh) network through Ethernet; GatorShare software lets a NeXT system act as a file server for a Macintosh network. On the PC side, Novell has announced vague plans to support the NeXT, while Atlantix's Access software, which ties together UNIX, DOS, and minicomputer networks, represents a firmer commitment. Two firms, Avatar Corporation and Conexions, are offering that ubiquitous tool of mainframe connectivity, the 3270 terminal emulator. Communica, a communications program with extensive DEC terminal emulation capabilities, has been out for a while but is less than overwhelming in interface design and functionality. Software Ventures Corporation has announced MicroPhone II for the NeXT, a product that promises to be powerful and easier to use, but which won't appear until early 1991.

The really interesting connectivity product is SoftPC 2.0 from Insignia Solutions. SoftPC 2.0 emulates a 80286-based system with an EGA display running DOS. SoftPC may let the NeXT qualify as a DOS system for organizations with such a requirement, where NeXT's direct support of DOS diskettes should help tremendously.

As for true groupware, well, there aren't many contenders, currently. The three most visible firms are Adamation, Boss Logic, and Visual Understanding Systems (VISUS), and they are linked by two common threads: contact lists and document management. Adamation is best known for Who's Calling?, the program that helped NeXT land one of its largest customers for the original Cube, the William Morris talent agency. Who's Calling? lets users create and update a contacts list over a network, automatically sharing information as it is entered. Boss Logic is offering Contact!, a product with much the same scope.

A more interesting Boss Logic application is the Boss Document Management System (BDMS), which will allow over-the-network searching, checking-out, and updating of documents of all types. Built into BDMS is a project management system that tracks the status of documents being created or revised. In contrast, VISUS's Professional PaperSight is geared more toward information storage and retrieval, with a special emphasis on scanning hard-copy documents, organizing and annotating them, and producing new copies (via printer or FAX machine) on demand. A stripped-down version, PaperSight, is available for those with fewer needs (and less money). Not surprisingly, VISUS also offers a line of scanners and FAX modems that supports the PaperSight applications.

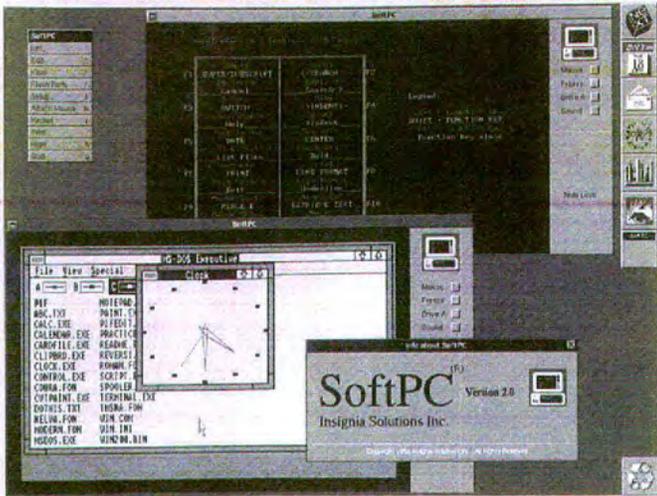
**More to come.** Despite the frenzy of product announcements, NeXT covers only two out of three of the major bases when it comes to application areas. NeXT system buyers will find excellent solutions for their word processing and spreadsheet needs, and a growing number of graphics, connectivity, and specialized applications, but not much in the area of database management.



#### Boss Document Management System

The Boss Document Management System addresses the implications of NeXT networking. BDMS provides the structure for implementing organization-tailored systems to track documents shared by a workgroup.





**SoftPC 2.0**  
*Insignia Solutions' SoftPC gives the NeXT the ability to run DOS applications, an important boon for multiplatform offices.*

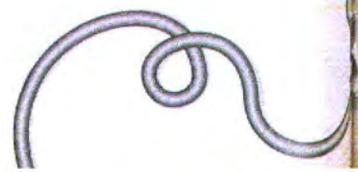
This weakness notwithstanding, NeXT has turned an important corner. Not only have several PC-to-NeXT barriers fallen, but at least one application—Improv—offers a compelling reason to buy a NeXT system over any other—something that has been lacking until now. This doesn't mean that NeXT is out of the woods, but the trees do seem to be thinning a bit.

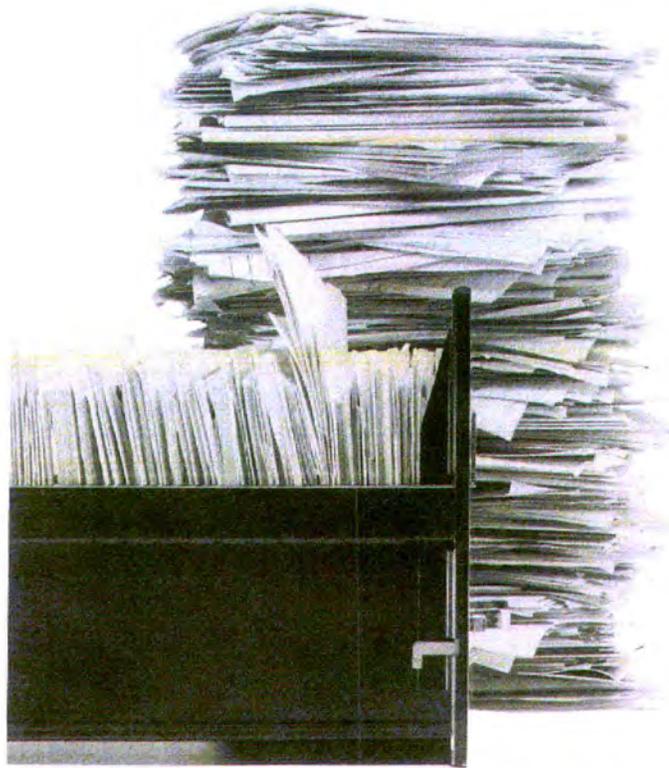
A whole new category of software specifically designed for NeXT-style computing is Services. Services are objects from larger applications or self-contained programs that can be called from the Services menu in any program written for NeXTstep Release 2.0. This interapplication communication—making important functions available no matter what application you're in—is a component of interpersonal computing that is as important as e-mail. Although as of this writing the only services available were from the bundled applications NeXTmail and Digital Librarian, it's a good guess that many more will soon spring up.

Most important, NeXT has dropped the barriers for software developers, with cheaper systems, much cheaper distribution media, and, they hope, a rapidly expanding installed base. Thirty-three developers showed products at the September 18 introduction of the new machines, and at press time 100 new products were expected by year's end. NeXT counts over 1000 registered developers. The growing number of developers, combined with the ease of programming the NeXT, could release a flood of software into the market in 1991, filling in more gaps and holes. The NeXT will then be left to stand or fall on its own merits, rather than on what software programs are or aren't around. By then, the corporate users may well look at the latest '486-based DOS computer and ask, "But does it run Improv?"

*Bruce Webster is author of The NeXT Book (Addison-Wesley, 1989).*

*A list of third-party products available for the NeXT is included in Dock Soup in every issue of NeXTWORLD. As the products mentioned in this article become available, you will find ordering information for them there.*



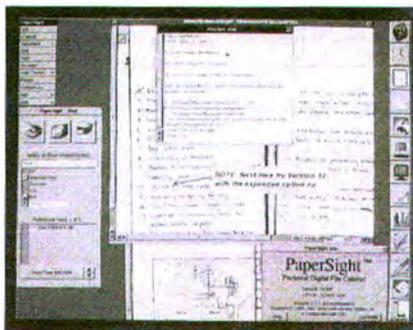


# The NeXT™ Solution To The Paperless Office: PaperSight.™

Now there's a way to put the power of your NeXT machine into document image management.

PaperSight is a new environment to manage the flow of documents and information in your office. It is the first complete document image management system for the desktop.

It does all the right things. Using scanned data, your paper documents can be filed and then quickly retrieved, viewed and annotated. Or use OCR to convert files for other applications, including word processing and spreadsheets. All of the NeXT capabilities are available and



enhanced by PaperSight including voice notes, interprocess communications, and fax input and output. The Visus FaxDaemon is on every NeXT you buy.

The software is modular and can be upgraded into departmental systems, just by adding more NeXT machines with PaperSight.

For more information on PaperSight, call 412-488-3600, FAX 412-488-3611, or write Visual Understanding Systems, Inc. 2100 Wharton Street, Suite 701, Pittsburgh, PA 15203.



Circle 5 on reader service card

# NeXTWORLD's Reviews Policy

**P**roducts are the crucial intermediary between the user and the task the user wants to accomplish. Great products are crucial to the success of the NeXT community. We review products both to provide information about current products and to help improve future ones.

Our reviews strive to answer the following three questions:

- What do products in this category attempt to do? This question frames the task the user needs to accomplish.
- What are the goals of this product according to its manufacturers, and how well does it accomplish those goals; that is, within its category, what specific problems does this product solve?
- Ideally, what might this product and category do? In other words, we judge the product also against an absolute concept of excellence rather than a relative one. In answering this question NeXTWORLD will serve as an advocate for change.

Our ratings will be based almost entirely on the first two criteria. The third will be used to suggest improvement and as a qualifier for our highest rating.

We will try to avoid grade inflation. Very few products will be awarded five cubes, and a good product will get three cubes, not four.

Our reviews will be independent, impartial, and fair. They will reflect the combined judgment of the reviewer and the editorial staff. Unlike opinion pieces, bylined reviews are backed by, and are the responsibility of, the editorial staff.

As always, we invite feedback. Write us, send e-mail, or phone.

*Note:*

*In the first few issues, we will take the unusual step of reviewing and rating pre-release software. In our judgment our readers need to have information about these crucial products as early as possible. They were reviewed normally, but product ratings were not downgraded based on defects that the manufacturer has indicated will be corrected before shipping. Beta products reviewed here should reach market by the time the magazine appears.*

## The NeXTWORLD rating system



**Best of Breed.** Solves a user's problem in innovative ways. Meets the highest goals for the category.



**Excellent.** Very good by today's standards, but we can envision better.



**Good.** Has some problems, but solves others.



**Fair.** Merely adequate. Has some bugs.



**Poor.** We don't recommend it.



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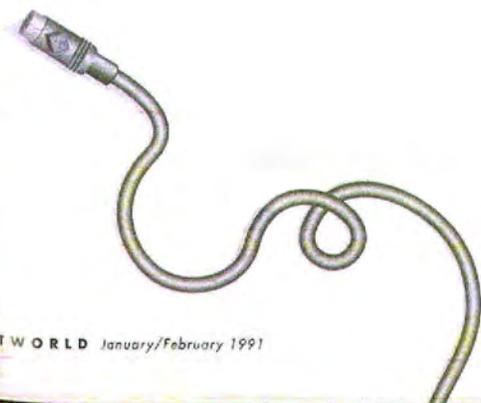
by



## Spreadsheets: The NeXT Generation

The three NeXT spreadsheets stake out their territories.

by Robert Lauriston



NeXT WORLD January/February 1991

People don't buy computers just because they want to get their hands on a neat new gadget. (Actually, some of us do—but even we need to provide a more mature excuse to our boss or the IRS.) Unless you're a programmer, you buy a computer to help you communicate and manage information. The success of PCs and Macs stems from the wide variety of inexpensive, off-the-shelf word processors, database managers, graphics programs, and other productivity tools they offer.

For the NeXT to make its way out of the backwaters of academia and engineering and into the mainstream of the computer marketplace, it has to offer a similar choice of powerful tools. Although all kinds of applications are important, those most crucial to the NeXT's success are probably those that are most important to corporations—word processors and spreadsheets. (Fortune 500 companies account for over half of all computer software purchases.)

To see how the NeXT stacks up against its competition in the spreadsheet sweepstakes, we'll look at three programs. PowerStep is a somewhat Excel-like program from Ashton-Tate, whose spreadsheet resumé includes MultiMate and Framework on the PC and Full Impact on the Mac. This product is positioned as the basic spreadsheet for the average Joe. Informix's Wingz is almost identical to its Mac product, which has also been ported to PCs, Sun workstations, and other platforms. It's for those that need a basic product with additional capabilities in custom applications and graphics. Improv, from Lotus, is a radically different spreadsheet, whose various versions of 1-2-3 dominate the PC spreadsheet arena and are becoming dominant on a slew of other platforms. Their product is for the user seeking a basic spreadsheet plus powerful modeling and analysis.

**Spreadsheet evolution.** To understand where these programs fit into the spreadsheet universe, let's turn the clock back a few years, to the first electronic spreadsheets. VisiCalc, Lotus 1-2-3, and the other pioneers patterned themselves after the paper-based spreadsheets money managers had

## BUSINESS

### PowerStep

📊📊 (beta)

A capable spreadsheet, equipped with most of the power features pioneered by leading PC and Mac spreadsheets, marred by an Interface-Builder-gone-wild design.

Price to be announced.

Ashton-Tate Corporation, 21010 Hamilton Ave., Torrance, CA 90509. 800/437-4329, ext. 3717

### Wingz 1.1

📊📊📊

A powerful, English-like programming language and stunning 3D graphics put this spreadsheet out front for users who care about those things. However, rudimentary file links and 2D files that make modeling difficult, and a clunky interface, make this a less than stellar entry.

\$699

Infomix Software, 16011 College Blvd., Lenexa, KS 66219. 913/599-7100, 913/599-7350 fax

### Lotus Improv 1.0

📊📊📊📊 (beta)

With a revolutionary model custom-made for data analysis, Improv is an essential spreadsheet for anyone doing financial modeling. In its first release, however, it lacks such basic important features as an undo command and a macro language.

\$695

Lotus Development Corporation, 55 Cambridge Parkway, Cambridge, MA 02142. 617/577-8500.



been using for ages. Since electronic recalculation of formulas was so much faster than working it out by hand, spreadsheet programs were quickly adopted for budget planning, bookkeeping, tax calculations, inventory control, and many other tasks. These pioneers offered a few basic graphs for analysis but didn't give you much control over their appearance. Spreadsheet data and charts couldn't be printed side by side and had to be stored in separate files. (Several popular programs still suffer from such limitations.)

These early programs were enormously useful, but complex applications meant sprawling worksheets. Navigating your way around a spreadsheet with hundreds (or even thousands) of rows and columns was a real headache, and though smart users managed the task with macros, the sheet-of-paper metaphor started to wear thin.

Second-generation programs, like Excel, solved this problem by letting you break a spreadsheet up into a group of linked, bite-size files. File links also helped to consolidate or "roll up" a group of similar spreadsheets, such as profit-loss statements from various regional divisions of a company. Instead of combining the data from each region's spreadsheet into a master file, formulas in a summary worksheet could simply reference the data in the regional report files—and stay up to date as the subfiles changed.

Second-generation spreadsheets also offered better and more flexible output. The limited repertoire of graphs was expanded, and users got more control over the appearance of charts and reports, with a variety of fonts and colors, free-floating text labels, arrows, and drop shadows. The best second-wave programs let you paste live, hot-linked graphs right into a block of spreadsheet cells, simplifying operation and making it much easier to create sharp-looking reports.

That pretty much defines the state-of-the-art spreadsheet, though in the most recent programs both worksheets and graphs have gained a third dimension. 1-2-3 3.0, 1-2-3/G, and Supercalc5 stack up groups of row-and-column worksheets to form 3D, multi-page files. This eliminates the complexity of working with a group of files, and also lets you organize complex data more simply. For instance, a 3D budget worksheet might have a row for each account, a column for each quarter, and a page for each of several regions. This lets you forget about unwieldy file-linking formulas and just use simple formulas with 3D ranges. On

the graphics side, perspective-view 3D charts, pioneered by Wingz, dress up drab data and make a stronger impact. Three-dimensional graphs also make it easier to spot trends within a large set of data.

**Common ground.** PowerStep, Wingz, and Improv all keep up the NeXT standard for powerful graphics and easy data exchange. All automatically create charts, including labels and legends, from selected spreadsheet data. Any of them will let you create elaborate reports and presentations that include spreadsheet data, graphs, formatted text, and graphics. All let you paste in text and PostScript graphics copied from other programs and can import data from other spreadsheets via 1-2-3 (.wk1) or delimited text files. However, none of the three programs imports 1-2-3 macros or provides links to external databases.

Since no NeXT spreadsheet standard exists, the two most popular spreadsheet programs, Lotus 1-2-3 release 2.2 and Excel 2.1, are used as the baseline for evaluating these programs. Unless specifically stated otherwise, the NeXT spreadsheets were found to have all the abilities of the PC and Mac standbys. These three will first be judged by how well they measure up to this basic standard for the category, and then by their performance against their individual market claims.

**PowerStep.** Ashton-Tate calls PowerStep "the next people's spreadsheet." They see it as the NeXT's answer to 1-2-3—a straight-ahead, workaday spreadsheet for the average user. True to that goal, PowerStep breaks no new ground, but combines many of the best features of old favorites 1-2-3, Excel, and Quattro Pro. It gives you most of what you expect in a basic spreadsheet, including a sophisticated macro language, top-notch file links, and a good variety of charting and presentation tools. However, other crucial features, such as a macro recorder, report headers, and context-sensitive help, are missing. (In fact, the only help offered is a 25MB set of WriteNow files of the program manuals, which you can load into the NeXT's Librarian program.) The only thing particularly NeXT-specific about PowerStep is its interface, which could serve as a good example to programmers of how *not* to use Interface Builder. It's overly complicated and confusing.

PowerStep's icon bar epitomizes the program's haphazard, Interface-Builder-gone-wild design. Only a few basic functions are present and clearly indicated (erase, move, save document). A couple more (insert rows/columns, delete rows/

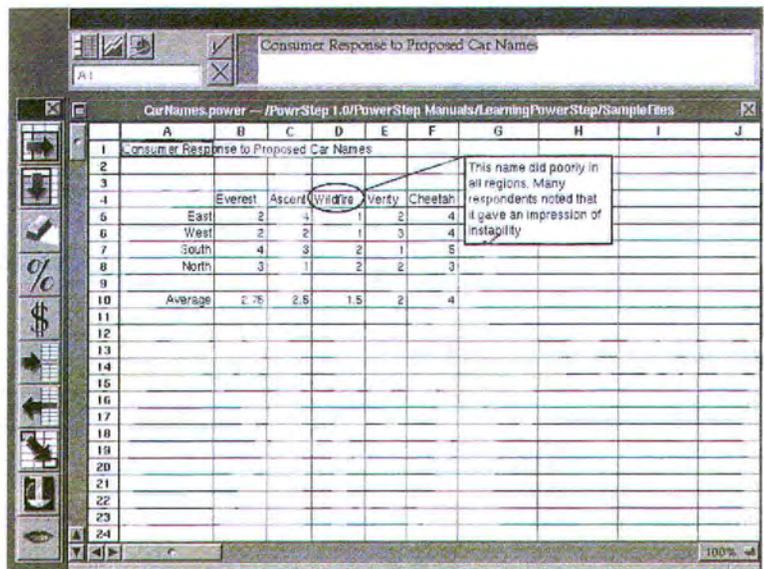
columns) are so ambiguously symbolized that it's easier to pick them from the menus. The rest of the bar is an arbitrary selection of less useful commands, such as formatting cells as percent with two decimal places. A much more sensible icon bar would offer functions to create charts, paste formula functions, and bring up the cell format panel.

Other elements of the program's interface follow the same sorry course. Drawing objects and lines, which most programs make quite simple with palettes, is confusingly split between menu choices and a bewildering variety of Inspector panels. These interface issues are especially important in the face of the product's goal of being an easy-to-use basic tool in the NeXT application dock.

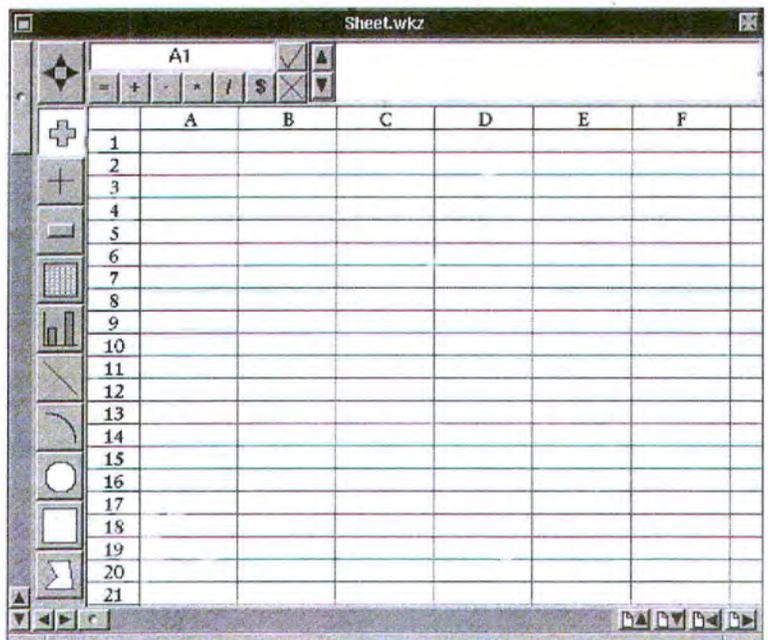
Once you get past its confusing interface, PowerStep proves a capable spreadsheet with most of the power features pioneered by leading PC and Mac spreadsheets. Though files are strictly 2D, point-and-shoot file links make it easy to break complex models into manageable chunks. Spreadsheets and graphs update themselves instantly as linked data changes, and you don't have to load all linked files into memory the way you do in many programs. PowerStep's rich programming language lets you customize the program's menus and write your own functions, so power users can create bullet-proof, easy-to-use applications for those less technically adept. However, since there's no learn mode or macro recorder, even the simplest macro requires a laborious typing of commands.

You can create slick presentations with PowerStep, though it's not as easy as it should be. You can paste a graph anywhere in a spreadsheet and resize it at will, but if you need to change its data range, you have to delete it and start over. The 3D charts include not only the standard bars, but ribbon, wireframe, and area types, and changing their perspective is delightfully simple—you just drag a corner with the mouse and the graph rotates. (Lotus and Informix could learn a lesson here.) Unfortunately, the associated labels stay horizontal, and it can be nearly impossible to make long labels readable. In contrast to the awkward drawing process, creating rich text or Lip Service annotations is simple and straightforward.

There's a lot of power in PowerStep. But it's not the Everyuser spreadsheet Ashton-Tate promises, and to match the standards set by popular spreadsheets on other platforms it needs better



A PowerStep screen uses the standard row-and-column metaphor. The tool palette and the editing panel are separate from the spreadsheet window to give flexibility in arranging the workspace.



The familiar Wingz main screen is common to Wingz versions on every platform. Note the easy availability of drawing tools.

	Q1	Q2	Q3	Q4
Sales	\$2,000,000	\$2,000,000	\$1,750,000	\$1,750,000
Cost of Goods	\$1,000,000	\$1,000,000	\$900,000	\$900,000
Gross Profit	\$1,000,000	\$1,000,000	\$850,000	\$850,000
Operating Expenses	\$500,000	\$500,000	\$500,000	\$500,000
Operating Income	\$500,000	\$500,000	\$350,000	\$350,000
Interest Expense	\$100,000	\$100,000	\$100,000	\$100,000
Income Before Tax	\$400,000	\$400,000	\$250,000	\$250,000
Taxes	\$100,000	\$100,000	\$100,000	\$100,000
Net Income	\$300,000	\$300,000	\$150,000	\$150,000

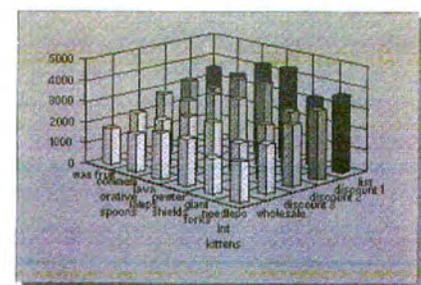
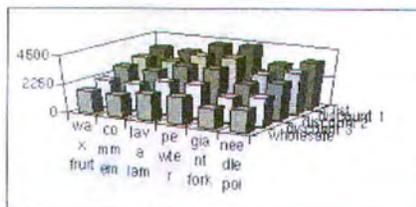
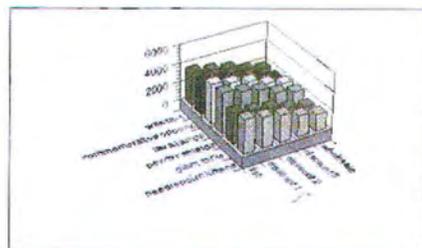
	Q1	Q2	Q3	Q4
Sales	\$2,000,000	\$2,000,000	\$1,750,000	\$1,750,000
Cost of Goods	\$1,000,000	\$1,000,000	\$900,000	\$900,000
Gross Profit	\$1,000,000	\$1,000,000	\$850,000	\$850,000
Operating Expenses	\$500,000	\$500,000	\$500,000	\$500,000
Operating Income	\$500,000	\$500,000	\$350,000	\$350,000
Interest Expense	\$100,000	\$100,000	\$100,000	\$100,000
Income Before Tax	\$400,000	\$400,000	\$250,000	\$250,000
Taxes	\$100,000	\$100,000	\$100,000	\$100,000
Net Income	\$300,000	\$300,000	\$150,000	\$150,000

	Q1	Q2	Q3	Q4
Sales	\$2,000,000	\$2,000,000	\$1,750,000	\$1,750,000
Cost of Goods	\$1,000,000	\$1,000,000	\$900,000	\$900,000
Gross Profit	\$1,000,000	\$1,000,000	\$850,000	\$850,000
Operating Expenses	\$500,000	\$500,000	\$500,000	\$500,000
Operating Income	\$500,000	\$500,000	\$350,000	\$350,000
Interest Expense	\$100,000	\$100,000	\$100,000	\$100,000
Income Before Tax	\$400,000	\$400,000	\$250,000	\$250,000
Taxes	\$100,000	\$100,000	\$100,000	\$100,000
Net Income	\$300,000	\$300,000	\$150,000	\$150,000

	Q1	Q2	Q3	Q4
Sales	\$2,000,000	\$2,000,000	\$1,750,000	\$1,750,000
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Operating Expenses	\$500,000	\$500,000	\$500,000	\$500,000
Operating Income	\$500,000	\$500,000	\$350,000	\$350,000
Interest Expense	\$100,000	\$100,000	\$100,000	\$100,000
Income Before Tax	\$400,000	\$400,000	\$250,000	\$250,000
Taxes	\$100,000	\$100,000	\$100,000	\$100,000
Net Income	\$300,000	\$300,000	\$150,000	\$150,000

These illustrations show how Improv's new free-form structure operates. In the top left screen, note the English row and column labels and separate, plain-English, easy-to-follow formulas. Note also that the spreadsheet contains only cells that contain data. With the second screen, notice the move to 3D, with regions added in the upper left corner. This screen shows data for the Eastern region. Arrows are used to navigate between regions. The third screen adds a fourth dimension: years. The tags in the upper right show that the horizontal axis is organized by years, divided by quarters. The last screen shows the real power of Improv. The Quarter tag was simply dragged from the upper right to the lower left, creating a new view comparing quarterly earnings for two years. If the formulas had been affected, they would have been automatically updated.

A common 3D graph shows Wingz's graphics superiority. Wingz (at left) is the only spreadsheet that correctly rotates the text as you rotate the graph. PowerStep (center) provides great flexibility in moving the graph for clarity, but only certain configurations allow clear viewing of the labels. This isn't one of them. Improv (at right) also has trouble in this area.



presentation and report tools, a macro recorder, context-sensitive help—and above all else, a simpler interface.

**Wingz 1.1.** Informix claims that Wingz offers the most advanced graphics, presentation, and programming tools of any spreadsheet, yet is so easy to use that even novices can customize the program to their own liking, or write complex, button-driven applications.

It's true that Wingz is in some ways the most powerful spreadsheet available on the NeXT or any other platform. It covers all the basics (though its file-linking talents are substandard) and adds dazzling 3D charts and an English-like programming language to customize menus or build HyperCard-style applications. There's nothing about Wingz that is unique to the NeXT, though—it's nearly identical to versions of Wingz for PCs, Macs, and Sun and HP/Apollo workstations. It's an advantage to be able to share Wingz files with users on those other platforms, and Wingz is the only one of the three programs reviewed that can import or export Excel files. Informix's claims are greatly exaggerated on one point, though: Wingz's klunky interface, lousy online help, and sketchy documentation make it relatively hard to use.

Wingz has one of the most awkward interfaces available on the NeXT. For instance, there's no centralized font panel. Instead, you pick the typeface from a scrolling list, then set each attribute (size, color, style, and so on) with a separate menu. Cell, chart, and graphic formats all follow this scattered approach. Another odd element is the program's use of two cursors. If you have the worksheet cursor selected and click on a chart, rich text, or graphic object, nothing happens; ditto if you have the object cursor selected and click on a cell. Lots of other programs are clever enough to deal with complex documents without putting you through that kind of rigmarole. There's an undo command, but it only works part-time; it's grayed out after many commands. These design flaws make Wingz harder to learn and, by making common tasks needlessly difficult and time-consuming, remain a constant irritation even once you've mastered the program.

On-line help is limited. Context-sensitive help is available only for menu items, and there's no find command to help track down information. There is an alphabetical list of help screens, but it's not always easy to find what you want. You can refer to the written documentation or, if you have

38MB of free disk space, you can load disk files of Wingz's manuals into the Librarian for easy reference.

Except for the clunky interface, Wingz's graphing features are outstanding. It provides the widest selection of graphs of any spreadsheet, including over half a dozen 3D charts and unusual polar, contour, and X-Y graphs. You can paste a graph anywhere and can snap graphs, rich text fields, or graphic boxes to the cell grid for a clean, sharp layout. You can rotate 3D graphs and alter their perspective in several ways. Best of all, the text labels also rotate in space, making Wingz's 3D graphs far more readable than the competition's. You can also add the usual assortment of lines, ovals, rectangles, graphics, and text, but unfortunately no sound.

Wingz's other strong suit is its programming language, HyperScript. A learn mode lets you quickly whip out a basic program of Wingz commands, which can be used as a macro without further changes. But you can also switch into the HyperScript editor and use the stored commands as a basis for an application complete with its own menus, dialog boxes, visual or sound alerts, and other features (you can even incorporate C routines and other external functions). If you've mastered HyperTalk, BASIC, or some other programming language, HyperScript won't be much of a challenge. If you haven't, however, be warned that it's not quite as simple as recording and editing a macro: You have to master a slew of logical tests, variables, subroutines, if-then-else branches, and so on.

Complex modeling is made difficult by Wingz's 2D files and rudimentary file links. Although you can reference a cell or range in an external file in a formula, all linked files must be open. Even then, you have to be sure to recalculate all linked sheets to be sure the data is up-to-date. This severely limits the links' usefulness.

As a general-purpose spreadsheet, Wingz leaves a lot to be desired. It's too hard to use, particularly if you want to build complex models. But if creating the best graphs or some types of custom applications is a high priority for you, Wingz is probably worth the trouble.

**Improv.** It's not just hype when Lotus says it has reinvented the spreadsheet. Improv's easy financial modeling, plain-English formulas, and multiple views of a single set of data have set the standard for the next generation of spreadsheets. Unfortunately, in its rush to market, Lotus

## How intuitive are you?



### PowerStep

- copy cells down
- copy cells right
- delete, shift cells up/left
- insert, shift cells down/right
- move cells



### Wingz

- create button
- create text field
- select cell cursor
- select object cursor

Some of the icons above are self-explanatory—but some aren't. Can you match the listed functions to the proper icon? For extra credit, explain in 500 words or less why Wingz needs two cursors.

skipped over some basic features, like macros and undo. Nevertheless, Improv's breakthrough abilities—currently available only on the NeXT—make it a must-have program for financial managers, even if they need another spreadsheet to handle some of their more mundane tasks.

Why is Improv such a breakthrough? Let's use our 3D worksheet example, where we had a row for each account, a column for each quarter, and a page for each of several regions. That's a simple and efficient way to break down data by three criteria. But what if you wanted to break your data down not only by those three criteria, but also by year and department? That's where Improv takes over: It lets you keep on defining data categories even after you've run out of physical dimensions in which to display them. Let's say you create a year category across the top of the four quarters. New quarter columns appear for each new year you add. Next you might create a new department category to the left of the account labels; again, every time you add a new department, it will be subdivided into all the individual accounts.

Improv's categories let you build spreadsheets faster, but that's just the beginning. The real breakthrough is how they let you rearrange your spreadsheets after the fact. In our example, the rows break down departments into accounts, columns break down years into quarters, and there's a separate page for each region. That's fine for perusing the budget, but what if you want to compare travel expenses between departments, or look for seasonal variations between regions? In other spreadsheets, you'd have to build another section of the spreadsheet to break out regional totals by quarters—a tedious job.

Improv makes the task trivial. You simply drag a few category tiles from one corner of the spreadsheet window to another, and bang, you've got a new view of your data. You can open additional windows to get several views at once, and you can name and save views for reuse later, which means that different people can access the same data in different ways. For instance, a single Improv spreadsheet, shared across a NeXT network, could look like a line-item budget to a departmental manager, a profit-loss statement to an executive, and a balance sheet to an accountant.

Improv also makes it much easier to write, read, and understand formulas. Categories and detail items are more powerful than range names.

For example, Improv is smart enough to apply "LIST PRICE - DISCOUNT = COST" separately to every part in an inventory; in a conventional spreadsheet, you'd need a separate formula for each part. All formulas are consolidated into a single window, so you never have to track down a chain of formulas from cell to cell. When two formulas overlap (as when you're totaling a group of columns and one of them contains row totals), Improv prompts you to choose one or write another.

Documentation and on-line help measure up to Lotus's traditional high standards. You can get help for any menu choice, panel, or other screen element by just clicking on it. The help screens are numbered and indexed like a book, so you can page through a section and know for sure you've read all the information on that particular topic. However, there's no disk version of the full documentation for use with Librarian.

Improv's charting and presentation features are merely average by today's standards. You get the standard range of chart types, plus 3D bars—though without diagonal labels they can be pretty unreadable. Since Improv worksheets have no fixed format, Improv includes a separate module for laying out reports. (If you pasted a graph into your worksheet, where would it go when you changed the view?) You can add text, graphics, and Lip Service sound to reports not only with Improv's built-in tools or by copying and pasting, but by dragging file icons from the Viewer onto an Improv report. There's one major flaw in Improv's presentation power: Although you can hot-link report graphs to spreadsheet data, cells of spreadsheet data pasted on the report are not updated as the spreadsheet changes. Another serious problem is that you can't zoom in for a close-up view of the report module to help make fine adjustments.

There are only a couple of pieces missing from the package, but they're doozies. Improv's worst fault is its lack of an undo command. When you're learning your way around a new and unfamiliar environment, you're sure to make mistakes. The way Improv spreadsheets are designed means that a single mistake can easily screw up an entire file, so undo is crucial. The other major problem is that there are no macros. Although many common macros are made obsolete by Improv's new features, it's irritating not to be able to automate repetitive tasks or customize commands, and without a programming language you can't create custom applications.

Despite the faults of this initial release, Improv can pay off for anyone who creates complex financial models, or spends a lot of time rearranging data for different analytical tasks. Its plain-English formulas also make it easier to learn and understand than its predecessors. Lotus should be commended for attempting to take full advantage of the NeXT platform. But until Lotus fills in the gaps in Improv's feature set, you may not want it to be your only spreadsheet.

**Not an easy choice.** So which of these spreadsheets should you use? First off, pass on PowerStep, at least in this version. It falls short of today's spreadsheet standards on several counts, and doesn't offer any innovations to make up for it. Improv and Wingz are both mixed bags: On the one hand, each has some unique and powerful tools; on the other, each comes up short on some of the basics. That means there's no single, overall best choice. Which is the best for you depends on the way you use a spreadsheet.

If complex financial models are your bread and butter, Improv, with its free-form structure and multiple views, wins hands down—and may well merit the purchase of a NeXT, if you don't have one already. Though it's overkill for simple tasks and you'll curse its lack of macros, Improv is probably also your best bet as a general-purpose spreadsheet. Just be sure to hit that Save command as often as possible, since returning to an earlier version of the file is the only way you'll be able to undo your errors. Also, Improv is the first of a really new generation of spreadsheets and has a lot of room for growth in future releases. The others are merely extensions of traditional second-generation spreadsheets.

If you need maximum-impact charts, you'll want a copy of Wingz, regardless of whether you use it for anything else. If you don't need complex models and you streamline its menus by creating keyboard shortcuts for the commands you use most often, Wingz could make a very serviceable everyday spreadsheet.

Unless you already own a NeXT, there is one additional reason you might pass up Wingz in favor of Improv. Wingz runs on PCs and Macs, whereas Improv is available only on the NeXT. So Improv offers you one more practical, mature, businesslike excuse for why you've just got to have a NeXT. ☐

Robert Lauriston is a self-employed computer industry pundit in San Francisco, California.

# 3270Vision

by Daniel Powers

Many large companies have concluded that the NeXT is an exciting machine and could indeed change the way they look at and do business. Their next question is, "How can the NeXT access data on my IBM mainframe?" To solve this problem, Conexions has designed a family of products that provide mainframe connectivity.

3270Vision and its companion product, 3270Coax, allow the NeXT to emulate the popular IBM 3270 terminal. An emulator makes a mainframe think it is talking to a simple terminal, but the user retains all the advantages of a powerful workstation, such as multitasking and cutting and pasting information to other applications.

3270Vision is software for connection through the serial line. 3270Coax provides a direct connection from the SCSI port to an adapter box and then to an IBM 3174 or 3274 controller. It accommodates up to five terminal sessions, managing requests on a first-come, first-served basis.

I couldn't believe how neat it was to see an IBM host session on my NeXT. 3270Vision includes most of the features I consider important and desirable. First and foremost, it works. It establishes a standard session with an IBM mainframe. Another important feature is that it lets users alter the size of their windows. A menu option brings up a slider for varying the size of the font and the window. This is handy if you have many windows open on your screen. Full NeXT-step editing, cutting, and pasting are supported.

The straightforward approach to 3270 keys really makes this product stand out. Most terminal emulators require unnatural finger combinations to mimic special keys on the 3270 keyboard. Included in 3270Vision are 3270 Keys menus, command-key equivalents, and even a full 3270 keyboard. Users can point to any key on the keyboard and the corresponding key sequence will be sent to the host session. The full keyboard looks great and is a testimony to the power of Display PostScript.

The most notable shortcoming is the absence of an OIL (Operator Interface Line) at the bottom of the window. The OIL is reserved as a status line on all 3270 terminals and displays important

information. Another missing piece is a file transfer utility. Both of these problems will be eliminated in an upcoming version, which we saw in Alpha.

All in all, Conexions has the beginnings of a great product. IBM mainframe access may not seem too exciting to some users, but to the majority of the computer world, it is a financial and business necessity. ☐

Daniel Powers helps manage the Workstation Hardware Engineering unit in the Computer Science Department of the Travelers Insurance Company in Hartford, Connecticut.

## CONNECTIVITY

### 3270Vision

☐☐☐☐ (beta)

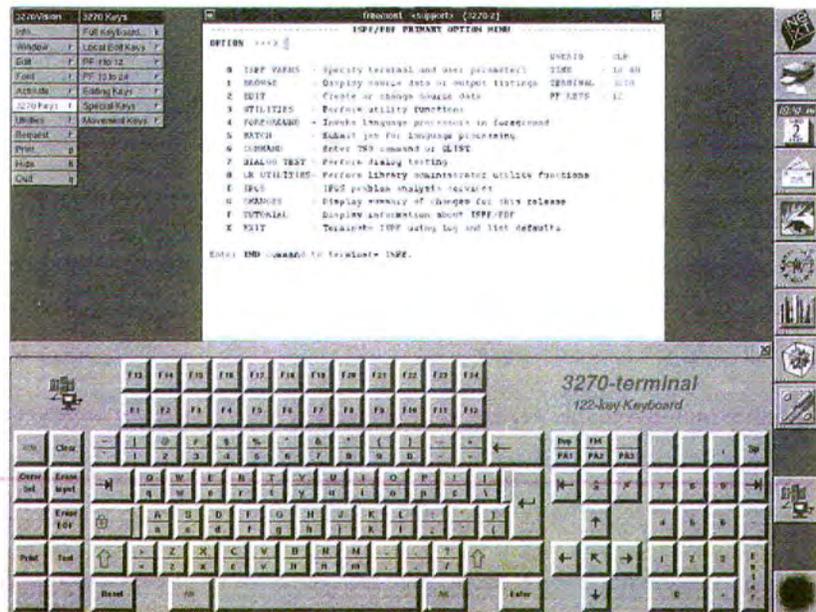
A powerful 3270 terminal emulator that allows IBM mainframe connectivity from the NeXTstep environment.

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# TouchType and Create!

by Rick Reynolds

**P**ostScript, as a programming language, provides fast, powerful ways to manipulate type and graphics. Unfortunately, however, it is so complex that it is used by relatively few people. TouchType and Create! are, in essence, killer front ends for calls to PostScript operators.

The NeXT's unique work environment—running many applications simultaneously and using a common imaging model—makes it practical for an application to focus on doing one small thing well. The NeXT user can create custom working environments by keeping several of these tools open at once. TouchType and Create! are two of these focused applications, made to complement other publishing applications. TouchType gives tight control over display type. Create! provides tools for adding special effects to graphics and text.

**TouchType.** TouchType is made to manipulate large-size type for book covers, titles, logos—any situation in which you need precise control over your type. RightBrain Software takes this limited task and delivers in spades. The program only takes up 2.32KB, and you cannot possibly get lost using it.

Kerning (controlling the horizontal spacing between letters) is TouchType's main mission, although the program can do a lot more than that. Kerning is adjusted through a kerning tool slider, as well as through a kerning menu with quick-key equivalents, by selecting a combination of characters and tapping the cursor keys (my favorite), or even by grabbing letterforms with the mouse and simply moving them as if they were drawing objects.

If you have never really caught on to why some people are so picky about kerning, using this program is a guaranteed route to understanding that obsession. After two hours with TouchType, I had become a compulsive kerner.

You can also control leading (the vertical spacing between lines of type) or change the baseline of one or more characters within a word. Even with characters spread all over the page, TouchType remembers the order, making editing easy.

The interface of the program shows many innovations. For example, when a character is selected, it is changed to an easy-to-spot gray,

instead of being given a bounding box or anchor points. One interface drawback is the program's use of arcane keystroke combinations for what should be shortcuts.

I have one major problem with this package. The first time this application is started up *from each user account*, an incredibly presumptuous automatic e-mail function is called to register the use with RightBrain Software. This is completely beyond the user's control. It is, however, the only serious drawback of this otherwise straightforward and satisfying application.

**Create!** Create! is designed for making graphic objects and assigning PostScript effects to them. In some ways Create! works like a paint program, but it is set apart by its use of Display PostScript, which allows for richer effects. This is the first such full-featured color paint program for the NeXT platform. (Create! is a superset of TextArt, released in 1989.)

One use of Create! is to make free-standing graphics, logos, or illustrations, but its real power is to make elements that drop into other documents. If you decide you need to jazz up a project you're working on in another NeXT program, you can run Create! simultaneously to add special effects to your text, or create and add graphic elements. Stone Design provides a library of objects to start with.

Create! uses the standard NeXT color picker to set color attributes, then goes further. By selecting a range of tones defined by two colors, you can ask Create! to shade the values in between, using a selection of algorithms. In contrast to the pared-down essentials of TouchType, Create! makes it easy to forget what you are doing and just go off and have fun. Fun effects like neon and alpha-channel transparency are part of the package.

Create! is a must for any color machine, but it is also useful in black and white. This product was reviewed very early in its development cycle and had no significant drawbacks. We are assigning four cubes to the product now, but when we can evaluate it after release, this rating may rise to the rare five cubes. 

**Rick Reynolds** is executive director of the Bay Area NeXT Group and owns a Macintosh and NeXT graphics service bureau in San Francisco.

## GRAPHICS

### TouchType



"Accessory software" for creating and controlling display type for book covers, titles, logos, and other projects. Simple to use and powerful.

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RightBrain Software, 20 Medway Road, Woodside, CA 94062. 415/851-1785, 800/472-7246



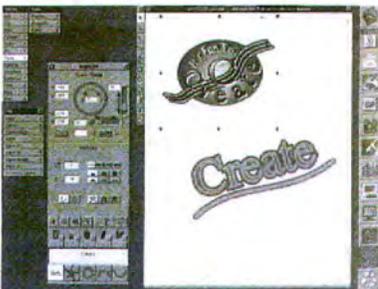
### Create!



A full-featured Color PostScript drawing and paint environment for manipulating and adding special effects to graphic objects and text.

\$495; low-cost upgrade for TextArt owners.

Stone Design Corporation, 2425 Teodoro NW, Albuquerque, NM 87107. 505/345-4800



# Diagram!

by Rick Reynolds

**D**igram! is a graphics application for people who need to think and draw at the same time. Whether you're doing business presentations, desktop publishing, or graphic design, Diagram! is an easy-to-use program that produces fast, professional results—even for those of us who can boast little to no artistic talent. This versatile "digital whiteboard" is a flexible application that may change the frequency and ease with which you use diagrams.

A diagram, drawn either by hand or by computer, is a visual aid that conveys the relationships between people, processes, or any other discrete entities. A computer-generated diagram usually draws the related units as objects and designates the relationships between the units with connecting lines. Diagram! follows this approach.

Diagram! doesn't look like your average drawing package because the toolbox is noticeably absent. Instead, you are given a ready-made palette of objects and primitives to copy into your window and manipulate. (Diagram! also lets you define your own objects.) Starting a diagram is astonishingly simple—merely drag objects onto a fresh page and label them, then connect the objects with lines. This is a remarkably fast and productive way for novices to produce professional-looking graphics. The user interface is generally simple and intuitive.

Once you copy an object, label it, and draw a line from the label text to the object, the line becomes firmly anchored to that object. If you decide to shift things around in your diagram later, the lines remain connected to the objects they are anchored to. In any other program, you would be forced to create the lines all over again.

Another major advantage: Diagram! allows you to establish hot links between the drawing objects on your canvas and documents outside the application, making it a passable hypertext tool. For example, an Improv spreadsheet could be attached to a product management plan. (Clicking the link symbol would show the spreadsheet.)

There is also a voice annotation feature.

Diagram! works just as well on a color platform. The standard NeXT color picker can set any color attributes, just as you would expect.

On the downside, Diagram! may give the user

a little too much freedom. The process would be easier if templates were included to handle some routine diagrams. It would be less confusing if the icon for the hot link looked more like a standard NeXT icon and less like a picture element. Also, the name of the "file linked to" should appear with the link. But these are small kinks in an otherwise smoothly operating system.

How will Diagram! change the way you do graphics? If your standard *modus operandi* has been to use clip art, you can still maintain the speed and professional quality you are accustomed to, but you can have more control. If you usually scribble a sketch on a piece of paper and hand it to an assistant to "do on the computer," you may be able to whip out a final version yourself, in half the time. In either case, keep in mind that the power behind this product makes it more than merely a replacement for your old graphics package. Diagram! is a better way to think about and outline a process—be it an organization or a manufacturing line—and convey your thoughts clearly to others. ☐

Rick Reynolds is executive director of the Bay Area NeXT Group and owns a Macintosh and NeXT graphics service bureau in San Francisco.

## GRAPHICS

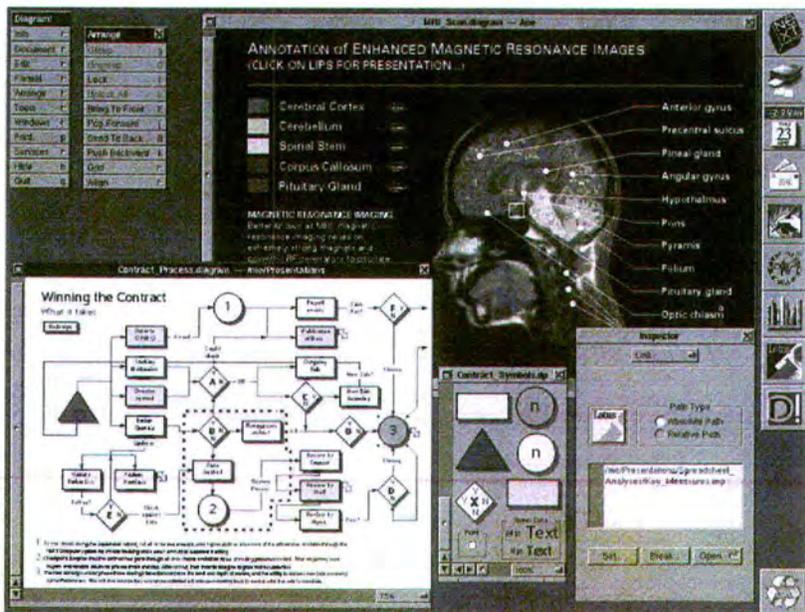
### Diagram!

☐☐☐☐ (beta)

A "digital whiteboard" that creates everything from organizational charts to annotated illustrations.

\$399 (shipped on floppies)

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Dear Friend,

In 1982, David Hall and I started a business called PC Connection here in Marlow, NH (pop. 564). We sold peripherals and software exclusively for the IBM PC and backed every sale with toll-free technical support.

In early 1984, we founded MacConnection. It was the first mail-order company for the Mac and has set many new standards in computer mail-order, including money-back guarantees and \$3 overnight shipping (*you can actually get same-day delivery between midnight and 3:15 a.m.*).

By 1987, we were #2 on *Inc.* magazine's list of 500 fastest-growing privately-held companies. And today, our company has grown from just two employees (David and myself) to about 300—all in this small New Hampshire town. In fact, that's our corporate headquarters in Marlow's historic "Christmas Trees Inn" shown below.

Now we're bringing our eight years of mail-order expertise to NeXT computers. Like our other divisions, NeXTConnection has its own sales and support staff and every product is backed by toll-free technical support. Your order will ship overnight for just \$3. And it will arrive in a tight-fitting box, cushioned with clean and recyclable newsprint. You'll find our very first collection of software and peripherals for NeXT computers on the following pages.

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NeXTConnection



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### LIGHTHOUSE DESIGN

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Diagram! includes a full array of drawing tools and

lets you do formerly tedious jobs (like decision trees or PERT diagrams) with only a couple of keystrokes. Store frequently used drawing objects in symbol palettes and customize any object quickly. Once you connect objects (like labels or captions), they stay connected no matter how you move them around. Diagram! also allows you to add voice annotation so your drawings can talk to your audience. And they can even respond with their own comments and feedback. This is definitely the next step in drawing technology. Also available on optical disk.

Want to get your hands on a lot of great NeXT shareware? The **Big Green Disk** gives you more

than 400 megabytes of software, utilities, games, and other useful files on a single optical disk, including bundled GNU programs, MIT's X windowing system and hundreds of UNIX programs. And for each Big Green Disk sold, Lighthouse Design will contribute \$5 to environmental charities.

### Lighthouse Design ... 60 day MBG

8621 Diagram!..... **intro. price \$209.**  
8660 Diagram! (optical disk only) **intro. price 339.**  
8663 Big Green Disk (optical disk only)..... **249.**

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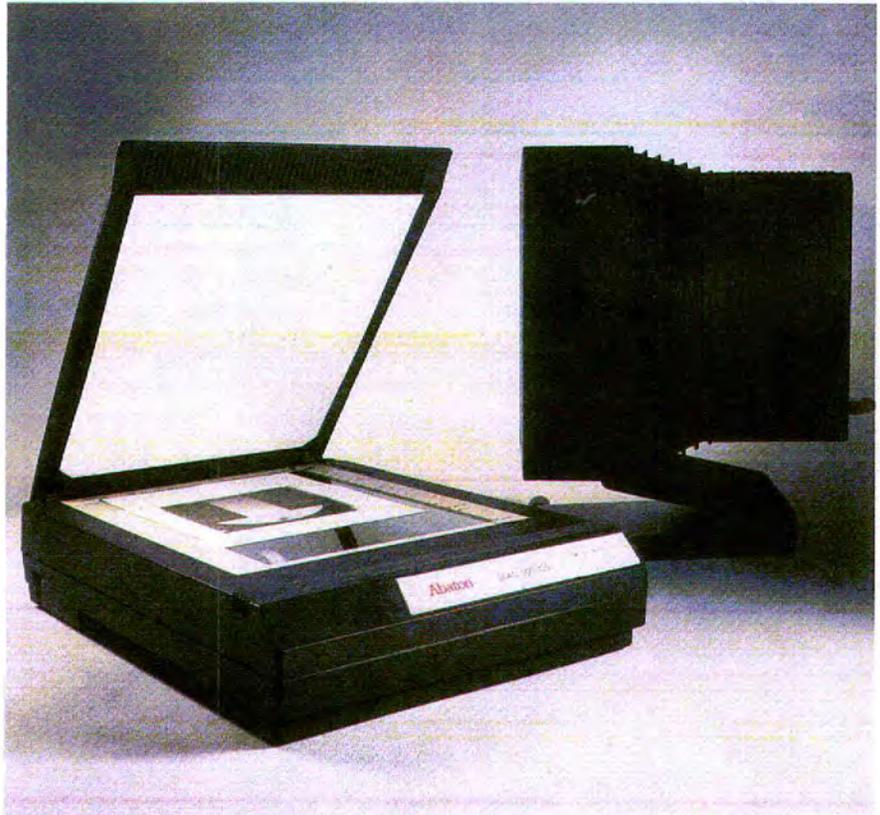
**ABATON**

**Tip the gray-scale in your favor.** Abaton's **Scan 300/GS** is a 300dpi 8-bit scanner that can deliver 256 shades of gray for quality reproduction of even continuous-tone photos. Five different scanning modes (for line art, halftone, and gray-scale images) give you the clarity you need. The included software lets you precisely control brightness and contrast. You can even preview images before scanning. And the large flatbed design (with a removable lid) lets you easily scan oversized documents.

**Get your communications together.** What's the next horizon in communications? The **InterFax** which gives you NeXT fax and modem capabilities in one unit. Send and receive faxes at 9600bps to just about anyone, anywhere with ease. The built-in 2400bps modem is loaded with features, including automatic data-to-voice switching, built-in diagnostics, and much more. And with MNP-5 data compression, you can send files at an effective rate of up to 4800bps. And it comes with the communications software you need to automate all your fax and modem routines.

**Abaton ... 30 day MBG**

- 8620 Scan.300/GS (includes optical disk) . . \$1499.
- 8665 InterFax . . . . . 539.



**DIGITAL INSTRUMENTATION TECH.**

**Rapid Transfers.** Your NeXT can share files with other personal computers when you have **FloppyWorks**. This easy-to-use file-transfer software works with any NeXT floppy drive and can format, read, and write Mac, MS-DOS, NeXT, and OS/2 disks. With its intuitive interface, files from the hard disk and the floppy disk are displayed side by side (like the browser). And the built-in filters (translators) let you import or export data from all sorts of applications. Supported file formats include RTF, TIFF, WriteNow, WKS, WK1, SYLK, .wkz, .eps, .ps, and ASCII. It's the software you need for serious file sharing.

Don't have a floppy drive? Just connect DIT's **CubeFloppy 2.9** to your NeXT via the SCSI interface and start reading and writing other popular computer formats (under NextStep 2.0). CubeFloppy 2.9 is compatible with NeXT's Automounter so it's the easy, convenient way to add a floppy drive to your NeXT.

**Digital Instrumentation Tech.**

- 8656 FloppyWorks . . . . . \$185.
- 8661 CubeFloppy 2.9 w/FloppyWorks . . . . . 579.
- 8662 CubeFloppy 2.9. . . . . 499.



Call 1-800/800-NeXT to order.

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209.  
339.  
249.

# NeXTConnection



## SUPERFLOPPY

**Flexible floppy options.** Make sure your NeXT can take advantage of the latest floppy technology with **SuperFloppy**. This 2.88 Meg drive delivers twice the capacity of current "high-density" drives and features a SCSI interface for quick connection to your NeXT. It accepts standard 720K DS/DD, 1.4 Meg HD, or 2.8 Barium Ferrite disks so it gives you the hardware compatibility you need to transfer data across different platforms (MS-DOS, OS/2, Unix, and even Mac files via MS-DOS). You also get advanced features like automatic sensing of disk capacity, auto eject/intake, and an external rotary dial for SCSI address selection along with NextStep 2.0 compatibility. Definitely a SuperFloppy for any NeXT system.

### Peripheral Land

8547 SuperFloppy 2.88. . . . . \$449.

## TEXTART

**Go wild with words!** Use **TextArt** special text effects to create exciting logos and headlines and add flash to brochures. Wrap text around circles or arcs, rotate or skew it, fill letters with a variety of patterns, and add shadows, outlines, and color (with precise gray-scale control). You can also transform text into just about any pattern or shape. All just by clicking buttons and moving sliders. What you see on screen is exactly what you'll get from your PostScript printer right on screen, and you can zoom in for a closer look. Plus you can combine TextArt images with any PostScript or TIFF graphics. As *MacWEEK* (4/3/90) said, "If you use a NeXT system in the design of sophisticated layouts or logos, TextArt will become indispensable."

### Stone Design

8658 TextArt . . . . . \$319.

## PRODUCT INDEX

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8620 300/GS Scanner (optical disk) . . . . .	\$1499.
8665 Interfax. . . . .	539.
<b>Adobe</b>	
8622 Plus Pack (optical disk) . . . . .	299.
<b>Digital Instrumentation Technology</b>	
8659 CubeFloppy Plus (w/FloppyWorks) . . . . .	639.
8661 CubeFloppy 2.9 (w/FloppyWorks) . . . . .	579.
8662 CubeFloppy 2.9. . . . .	499.
8656 FloppyWorks . . . . .	185.
8657 On Duty . . . . .	209.

<b>Frame Technology</b>	
8241 FrameMaker . . . . .	\$799.
<b>Lighthouse Design ... 60 day MBG</b>	
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8660 Diagram! (optical disk) . . . . .	339.
8663 The Big Green Disk (optical disk) . . . . .	249.
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2793 DS/HD 1.44 MB Diskettes (Qty. 10) . . . . .	27.
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1107 1 MB x 8 80ns SIMMs . . . . .	call
<b>Moustrak ... 60 day MBG</b>	
8548 Black 9" x 11" Mouse Pad . . . . .	9.
8576 Black 7" x 9" Mouse Pad . . . . .	8.

<b>Pacific Microelectronics</b>	
8244 Hard Drive Enclosure . . . . .	\$469.
<b>Peripheral Land, Inc.</b>	
8547 SuperFloppy 2.88 (requires cable) . . . . .	449.
8673 ST4385N 320M Ext. Hard Drive . . . . .	call
8675 ST4350N 300M Ext. Hard Drive . . . . .	call
<b>Sony ... 60 day MBG</b>	
3298 DS/HD 1.44 MB Diskettes . . . . .	22.
<b>Stone Design</b>	
8658 TextArt . . . . .	319.
8666 TextArt (optical disk) . . . . .	549.
<b>Toshiba</b>	
8641 2.88 MB Floppy Disk . . . . .	19.

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Circle 14 on reader service card

## Cyberspace: The Shock of Entry

Late in 1978, a Wall Street bank asked me to assess its first application of advanced information technology to clerical work. It had dramatically restructured its approach to the production of several key products, such as loans and letters of credit. Clerks who had performed one small operation in a long paper chain were, for the first time, using computer technology to accomplish all the functions associated with a single product. Visiting the bank's offices, I witnessed a sight that would eventually become so familiar as to defy notice—an entire floor of people seated at their partitioned workstations, staring into the screens of desktop terminals. At that time the experience was still peculiar enough, for both the clerks and their managers, as to provoke concern. The clerks seemed to have more difficulty adapting to these conditions than anticipated, and the first phase of the new effort resulted in sky-rocketing error rates. Managers believed that they had enriched the clerical job, and they could not explain the sense of malaise that had swept over the back office. I proposed to interview a broad sample of clerks and managers and to determine the sources of these troubles.

The technological change was one among many subjects we discussed during these interviews, but it was the one for which their responses were the most puzzling. Many people voiced distress, describing their work as "floating in space" or "lost behind the screen." They complained that they were no longer able to see or touch their work. Many felt that they no longer had the necessary skills or understanding to function competently. I did not know how to make sense of these comments, but I could not stop thinking about them either. . . .

A vision came together for me. . . . I realized that the people I had been interviewing were on the edge of a historical transformation of immense proportions, as important as that which had been experienced by the eighteenth- and nineteenth-century workers.

*Shoshana Zuboff, In the Age of the Smart Machine: The Future of Work and Power (Basic Books, 1988)*

The combined technologies of the telephone, computer, and television have merged into an integrated information and communication system that transmits data and permits instantaneous interactions between persons and computers. . . . We have for the first time an economy based on a key resource that is not only renewable, but self-generating. Running out of it is not a problem, but drowning in it is.

*John Naisbitt, Megatrends: Ten New Directions Transforming Our Lives (Warner Books, 1982)*

It is thought that the masses may be structured by injecting them with information. . . . Quite the contrary. Instead of transforming the mass into energy, information produces even more mass . . . the final result being precisely an atomised, nuclearised, molecularised mass. . . .

*Jean Baudrillard, In the Shadow of the Silent Majorities or, The End of the Social and Other Essays, Semiotext(e) Foreign Agents Series (Columbia University, 1983)*

Sloughing off every layer of macrocosmic apparatus, the computer will ultimately collapse to a pinhead that can respond to the human voice. In this form, human intelligence can be transmitted to any tool or appliance, to any part of our environment. Thus the triumph of the computer does not dehumanize the world; it makes our environment more subject to human will.

Giving up the superficial comforts of a human-scale world, mankind moves to mind scale. In the image of his Creator, he exalts the truly human—and godlike—dimension of his greatest gift from the Creator: his creativity. Giving up the material idols and totems in his ken, he is gaining at last his promised dominion over the world and its creatures.

*George Gilder, Microcosm: The Quantum Revolution in Economics and Technology (Simon & Schuster, 1989)*

[Smart machines] have a seductive appeal to the scientific imagination, which has freely borrowed them as models of the universe at large, often reshaping our experience of the world to make it fit that model. And in this there can be the real danger that we fall prey to a technological idolatry, allowing an invention of our own hands

to become the image that dominates our understanding of ourselves and all nature around us.

The computer is the latest episode in this scientific infatuation with mechanistic metaphors borrowed from smart machines. Once again, in the age of Newton, the scientists need to be reminded that the organisms (human beings) which came before mechanisms are far more remarkable pieces of work than the tools they may occasionally invent when they are not spending their time singing songs, making jokes, telling tales, or worshipping God.

*Theodore Roszak, The Cult of Information: The Folklore of Computers and the True Art of Thinking (Pantheon Books, 1986)*

As far back as four years ago, the group of scientists about Dr. Rosenblueth and myself had already become aware of the essential unity of the set of problems centering about communication, control, and statistical mechanics, whether in the machine or in living tissue. On the other hand, we were seriously hampered by the lack of unity of the literature concerning these problems, and by the absence of any common terminology, or even of a single name for the field. As happens so often to scientists, we have been forced to coin at least one artificial neo-Greek expression to fill the gap. We have decided to call the entire field of control and communication theory, whether in the machine or in the animal, by the name *Cybernetics*, which we form from the Greek [word for] steersman, . . . also . . . refer[ring] to the fact that the steering engines of a ship are indeed one of the earliest and best-developed forms of feedback mechanisms.

*Norbert Wiener, Cybernetics: or Control and Communications in the Animal and the Machine (MIT Press, 1948 and 1961)*

Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation, by children being taught mathematical concepts. . . . A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding. . . .

*William Gibson, Neuromancer (Ace Books, 1984)*

**In Context** is a selection of readings from published works that shed light on the intersection of life and technology. We welcome contributions from readers. Please send them to *In Context*, NeXTWORLD, 501 Second Street, San Francisco, CA 94107, MCI NeXTWORLD, or send e-mail to [nextworldmiley@uunet.uu.net](mailto:nextworldmiley@uunet.uu.net).

# The NeXT World

Edited by Dan Lavin and Declan McCollough

Welcome to The NeXT World, a forum for the NeXT community at large. Through this department you can hear the buzz of the community and find the information you need to become an active member in it.

The NeXT community is an invaluable pool of information about the NeXT computer. NeXT user groups (NUGs) and on-line news groups provide a place for computer users to help other computer users. Participants contribute a rich variety of information, based on their own experience, to help you with the puzzles you face at your own computer and enrich your knowledge about the platform.

User groups are organizations of people who come together regularly to share what they know and to learn from speakers and other members. They typically hold monthly meetings, publish a newsletter, distribute public-domain software, and provide an electronic bulletin board and educational programs.

Large and small NeXT user groups have been established around the world. The Boston Computer Society NeXT Users Group is the largest and oldest. Founded in October 1988, it now boasts 900 members. BCS meets monthly in conjunction with the MIT user group, publishes the monthly newsletter *What's NeXT*, and provides many other services.

The Bay Area NeXT Group (BaNG) is the hometown team for NeXT. Founded last spring by Robert Nielson, BaNG has hosted some of the most exciting meetings to be found. Where else can you ask a question about NeXTmail and have Bryan Yamamoto, its author, raise his hand and answer from the audience? BaNG meets monthly at Stanford and also produces a newsletter.

Erica Leibman at the Georgia State Users Group publishes the *NeXT Users Journal*, originally known as the *BUZZNUG Journal*, a monthly newsletter of 50 pages or more that provides detailed technical information about the NeXT. The *NeXT Users Journal* is free to anyone and available on the Internet.

In this issue, The NeXT World presents a complete list of the NeXT user groups in operation at press time. You can get more information about any of these groups by contacting the person listed with the supplied address. In future

issues, we will publish highlights from user group meetings and newsletters.

More informal "meetings" take place on line, on the `comp.sys.next` newsgroup on the Internet. In its basic form, a newsgroup is a collection of public messages submitted by participants of the group for all to read. The `comp.sys.next` newsgroup is the primary forum for information about NeXT and NeXT computers.

Most universities and large corporations have a link into the Internet. Started as a private network under the aegis of the Department of Defense, the Internet has, during the last five years or so, begun to accept links and traffic from major corporations and research organizations. The Internet now links over 100,000 computers.

The exceptional thing about `comp.sys.next`, however, is not its impressive size, but that out of this seemingly chaotic web of networks and computers, a strong NeXT community has emerged. This community is dynamic; it encourages newcomers to ask questions, while simultaneously serving as a discussion group exploring the limits of technology. The newsgroup receives regular contributions from users at major universities, dozens of hardware and software companies, and even from within NeXT itself. Quite often it yields tantalizing glimpses of the future.

If your company or organization has access to the Internet, ask your system administrator how to access `comp.sys.next`. Once involved, you can read news, post messages, and send private mail to anyone else on the Internet. For those who don't have access to the Internet, the `comp.sys.next` section of The NeXT World summarizes the highlights of recent exchanges on the network.



## NeXT User Groups

Here is a list of the major operating NeXT user groups, organized by region. For more information on NeXT user groups, send e-mail to [usergroup@next.com](mailto:usergroup@next.com) or call 800/848-NEXT.

### UNITED STATES

#### Alaska

Arctic Circle NUG  
Aaron Morse  
P.O. Box 900-641  
University of Alaska  
Fairbanks, AK 99775  
907/479-2247  
e-mail: [fsapm@alaska.bitnet](mailto:fsapm@alaska.bitnet)

#### California

BaNG (Bay Area NeXT Group)  
Rick Reynolds  
P.O. Box 8858  
Stanford, CA 94309  
415/243-9140  
e-mail: [BaNG-request@meta-x.stanford.edu](mailto:BaNG-request@meta-x.stanford.edu)

SCaN (Southern California NeXT Group)  
Michael Mahoney  
Dept. of Computer Science and Engineering  
California State University, Long Beach  
Long Beach, CA 90840  
213/985-1550  
e-mail: [mahoney@grafix.cse.csulb.edu](mailto:mahoney@grafix.cse.csulb.edu)

SNuG (San Diego NUG)  
Nicholas MacConnell  
1135 Stratford Ct.  
Del Mar, CA 92014  
619/481-7535 or 619/565-9738  
e-mail: [hinn@next.com](mailto:hinn@next.com)  
newsletter editor: Bruce Webster

#### Colorado

rmNUG (Rocky Mountain NeXT Users Group)  
Dave Hieb  
4521 Wellington Rd.  
Boulder, CO 80301  
303/530-2560  
e-mail: [davehiebb@boulder.colorado.edu](mailto:davehiebb@boulder.colorado.edu)

#### District of Columbia

NeXT Special Interest Group  
Hugh O'Neill  
P.O. Box 39036  
Washington, DC 20016  
703/938-NeXT (Joel McClung)  
e-mail: [joel@next.com](mailto:joel@next.com)

#### Georgia

BuzzNUG (Georgia Tech NUG)  
Erica Liebman  
1150 Collier Road NW Apt L-12  
Atlanta, GA 30318  
404/352-5551  
e-mail: [erica%kang@gatech.edu](mailto:erica%kang@gatech.edu)  
newsletter editor: Erica Liebman

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# comp.sys.next

Comp.sys.next is a compilation of the most interesting recent exchanges on comp.sys.next, the NeXT newsgroup on the Internet. The topics covered here represent a select sampling of the past few months' on-line discussions. Watch this space in the future for more information from the Internet, or join us on line.

The Internet community's reactions in the wake of NeXT's September 18 new-product announcement were unexpectedly mixed. Everyone agreed that the price was outstanding, but many expressed doubts as to whether or not Motorola could deliver the 68040 chip in quantity for a few months.

In comparison, early in November, Sun announced the 28 MIPS, 4 MFLOPS SPARCstation 2 with a list price of \$14,995. Sun's machines were shipping immediately after their introduction date, whereas NeXT's are shipping months after the September announcement. However, the SPARCstation 2's rather poor price/MIPS rating (\$535 versus the NeXTstation's price/MIPS of \$333) could convince users to postpone their computer purchases until NeXT can begin volume shipments. A borrowed NeXTstation, on loan from NeXT, reportedly came in 4.5 times as fast as the original NeXT computer in PostScript drawing performance and other processor-intensive benchmarks. The comp.sys.next participants think that the NeXTstation may be worth the wait.

Also in November, readers were delighted to hear about Businessland's incredible price discount on old NeXT computers: \$2195 for a floor model with 8MB of RAM, a MegaPixel Display, keyboard and mouse, a 40MB swapdisk, and a one-year warranty (optical drives were \$600 extra). A Businessland representative confirmed that over 500 systems were being liquidated in order to make room for new NeXTcubes and NeXTstations. Newsgroup readers were elated by this offer; in fact, many who were considering purchasing a NeXTstation abandoned their plans in favor of a Cube at Businessland's discount prices.

## Illinois

Chicago NUG  
Bill Parod  
Northwestern University  
627 Dartmouth Place  
Evanston, IL 60208  
708/491-5368  
e-mail: parod@baris.acns.nwu.edu

## Massachusetts

Boston Computer Society (BCS) NeXT SIG  
Dan Lavin  
BCS NeXT Group  
One Center Plaza  
Boston, MA 02108  
617/969-6555  
newsletter editor: Michael Burress

## Minnesota

Minnesota NUG  
Mike Tie  
Math and CS Department  
Carleton College  
One North College Street  
Northfield, MN 55057  
507/663-4067  
e-mail: mtie@carleton.edu

## New Mexico

Los Alamos NeXT Users Group  
Dwight Barrus  
Group C-6, MS-B272  
Los Alamos National Laboratory  
P.O. Box 1663  
Los Alamos, NM 87545  
505/667-8870  
e-mail: dmb@lanl.gov

## New York

GUN (Gotham Users of NeXT)  
Tim Reed  
Objective Technologies  
7 Dey St. #711  
New York, NY 10007  
212/227-6767  
e-mail: treed@object.com  
Group e-mail: gun@object.com

## Ohio

Columbus NUG  
Chuck Dyer  
The Ohio State University  
1971 Neil Ave.—IRCC  
Columbus, OH 43210  
614/292-4843  
e-mail: dyer-c@osu-20.ircc.ohio-state.edu

## Texas

Austin NUG  
Lorne Wilson  
950 Capitol of Texas Highway N. #300  
Austin, TX 78759  
512/343-1111  
e-mail: pensoft@lorne@cs.utexas.edu

DANG (Dallas Area NeXT Group)  
Dirk Hardy  
Hofbauer Information Systems  
5080 Spectrum Dr., Ste. 912W (Lock Box #21)  
Dallas, TX 75248  
214/385-2991  
e-mail: blackbox@ktilroot@uunet.UU.net

hAng (Houston Area Next Group)  
John R. Glover  
E.E. Department  
University of Houston  
Houston, TX 77204-4793  
713/749-1820  
e-mail: glover@uh.edu

## Washington

University of Washington NUG  
Corey Satten  
University of Washington  
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Seattle, WA 98105  
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## INTERNATIONAL

### Australia

OzNeXT (Australian NUG)  
Paul Davis  
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Queensland 4229 Australia  
075/952 291, 953 3220 fax  
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### Canada

Vancouver NeXT Group  
Lionel Tolan  
Computing Services  
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NeXTView, quarterly newsletter  
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paiker@whistler.sfu.ca

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Robert Lin, editor  
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Canada V6P 2P3  
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e-mail: rlin@cs.ubc.ca

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Montreal, Quebec  
Canada H3H2N2  
514/939-0382  
e-mail: paulhus@calvin.cs.mcgill.ca

Ottawa NUG  
Hugo DeRosier  
19 du Muguet  
Hull, Quebec  
Canada J9A 9Z7  
416/236-0609 (NeXT office)  
e-mail: phume@next.com



## France

French NUG  
Thierry Charles  
32, Rue de Porto—Cit. Mian  
34000 Montpellier  
France  
33/67-64-07-97  
e-mail: 73020.2442@compuserve.com

## Japan

NeXus (Japan NeXT User Society)  
Katsuhiko Ohashi  
4-4-2, Ebara  
Shinagawa-ku  
Tokyo, 142 JAPAN  
Fax: 81-03-351-0880  
e-mail: NeXus-office@ell.go.jp  
newsletter: NeXus Memo

## NeXT SPECIAL INTEREST GROUPS (SIGs)

### Classroom

NeXT Courseware SIG  
e-mail: send the following text message to  
MAILSERV@gac.edu:  
Subscribe next-classroom <your name>

### Frame-mail

FUN (Frame Users Network)  
e-mail: framers-request@ard.com

### Mathematica

Mathematica Special Interest Group  
e-mail: mathgroup-request@yoda.nca.uiuc.edu

### Medical

NeXTMed SIG  
e-mail: NeXTMed-request@ulnar.biustr.washington.edu

### Music

NeXT Music SIG  
e-mail: next-music-request@usc.edu

**Network and Security Management  
for Installed Labs and Large Installations**  
e-mail: next-lab-request@cs.ubc.ca

### Programmers

NeXT Programmers SIG  
e-mail: next-prog-request@epoc.washington.edu

In October, some pointed criticism circulated regarding NeXT's decision to unbundle Common Lisp as an included development environment in NeXTstep 2.0. Comments like, "If Common Lisp loses support I have no reason to stay with a NeXT whatsoever," were frequently heard from disgruntled Lisp users. One person, however, did suggest an alternative: "For what it's worth, there is a very good public-domain implementation of Common Lisp available from archive sites on the Internet." Word of this discussion reached a NeXT employee, who told the newsgroup that Allegro Common Lisp will be bundled for all current users, but NeXT was still in the process of negotiating the agreement with Franz for new owners. The questions were answered when a Franz representative announced the company's decision: Allegro CL 3.1 is available from Franz for \$1500, but NeXT will distribute a free upgrade to current Release 1.0 customers. Franz will provide limited software support to all Allegro CL users.

Another point of concern was the new price of optical disks—a considerable increase from \$100 to \$150. It seems that the price difference is due to the fact that NeXT is no longer heavily discounting their optical disks; in the words of one Cube owner, "\$150 per disk is the fair, unsubsidized price for optical media." Of particular concern is that, as of this writing, over 100 companies have entered the magneto-optical disk market, and most are producing drives that use proprietary media formats. Eventually, then, with companies such as Sony (who recently announced a new synthetic plastic that can store 1000 times as much data as traditional optical disks) releasing new products, it's not hard to envision a world in dire need of optical disk standards. That, combined with the industry's increasing reliance on CD-ROM for inexpensive software distribution, makes the future of standardized optical media look dire indeed. It is ironic that original NeXT owners, who bought their computer from the very first company to include an erasable magneto-optical disk (now outdated) in their product line, will be among the first to be victimized by this growing lack of standardization.

In addition to the optical drive discussion, another topic emerged regarding Maxtor's introduction of a 535MB 3.5-inch hard drive that is even faster than the current 660MB 5.25-inch Maxtor available in the NeXTcube. Connors, too, has a very quick 510MB 3.5-inch drive with a

256KB cache and a 12-millisecond average seek time. The consensus seemed to be that both of these products would be a welcome addition to a NeXTstation.

Recently, much heated discussion has centered around Lotus's promotional offer involving Improv. This offer promised that Lotus will ship a copy of Improv (a \$695 value) to anyone who purchased a 68040-based NeXT computer or 68040 upgrade before the end of the year. In a message posted to the newsgroup, Richard Stallman, author of *Emacs* and the president of the League for Programming Freedom, stated, "Lotus is, of course, the company that has established a monopoly on the spreadsheet commands most users know. Now any independent spreadsheet is required to have new commands that nobody will know and that hardly anybody will want to learn, no matter how good they might be. And, beyond that, [this means] the loss of our freedom to write the programs the users want. These 'free' copies are actually very expensive. Using a Lotus product promotes Lotus, which aids them in denying your freedom. Even if you don't pay for these copies, using their product will encourage other people to buy it."

A rebuttal to Stallman's post came from a person employed by a large software publisher, maintaining that the creativity and effort employed in designing a user interface should be rewarded with a copyright or patent. Another stated: "Great! We get a product on the NeXT that should help to draw the business world to the machine, and we have people who want to drive them out! Improv should help NeXT sell lots of machines. I'd like to see this happen. More machines will mean more people who want to write software for the machine, and the effect will snowball, the way it did on the PC and the Mac." Another opinion came from a different software engineer, who claims that patents are legal monopolies granted by the government, and that these monopolies must serve the interests of the public. Since the resources invested by the users of a spreadsheet dwarf the resources invested by the developer, he argues that Lotus's monopoly does not serve the public and should not be protected in this fashion. ☐

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# NeXTworking

## Your First Time

by Daniel Miles Kehoe and Seth Ross

You won't tap a NeXT computer's full potential until you've tied together a NeXT network and put "interpersonal computing" to work in your organization. The tools for enterprise-wide computing are available on each NeXT computer, in the form of network-ready hardware, plus software that simplifies the task of network administration. This article will show you how you can pull your NeXT computers out of boxes in the morning and by 5 p.m. have a working network of interpersonal computers. You'll need to steer around a few sandbars, but the route is navigable, and this article will chart the course.

**Getting interpersonal.** A bunch of NeXT computers can be considered a networking kit, one that includes Ethernet connectors on every motherboard and a folder stocked with utility applications. All the tools are there, but users are well advised to note that "some assembly will be required." Imagine an instruction sheet that looks something like the top table on page 86. The first three steps lay the groundwork (planning ahead, cabling, setting up files), the middle steps actually establish the network, and the final steps (adding user accounts, setting up mail and printers) make the network useful.

Here's sandbar number one: If you don't read the NeXT documentation thoroughly, you'll quickly run aground. The *NeXT Network and System Administration* manual describes each step of setting up a simple network. NeXT's technical support will tell you that many people would have fewer problems if they spent more preparation time with the manual. Ironically, it's the jaunty UNIX wizards who most often founder in this trap.

Another necessary first step is planning. You'll need to develop a site plan that details what goes where. Map out a network organizational chart that shows which users will have access to what network resources. And while you're planning

ahead, make sure you can reach an expert. Ask for help, should you need it, from a local user group, a moonlighting university NeXT consultant, your local NeXT systems engineer, a retailer representative, or NeXT's technical support.

While you're planning, you might wonder what to do with the PCs, Macs, UNIX workstations, minicomputers, and mainframes that are already in use in your organization. Don't attempt to incorporate them into your plan if you've never set up a NeXT network before. Heterogeneous networks are difficult to set up, mostly because of the hodgepodge of add-on networking hardware and software required by the other platforms. Future issues of *NeXTWORLD* will untwist the knot of multivendor connectivity. For now, focus on the needs of a small workgroup of 2 to 15 coworkers and their NeXT computers. The departmental workgroup is the building block of any network, and you'll find it easiest to start with a simple NeXT network.

**Making a network.** The idea of a network is simple: Computers connected to each other. In practice, a network is woven together at many levels, some physical, some abstract. NeXT networking makes it possible to ignore most of these levels. All NeXT computers use the Ethernet standard, which allows the computers to communicate at the level of electrical signals, and TCP/IP (Transmission Control Protocol/Internet Protocol). TCP/IP conforms the electrical signals to a data standard that is common to each computer. It's sufficient to know that if hardware or software supports Ethernet or TCP/IP, it'll work with the NeXT.

From the vantage point of most system administrators, a network is composed of configuration files that reside on each computer and store information about the role of each computer and its relationship to others on the network. NeXT administers systems by a different method, controlled by the NetInfo utility, which exists in a database on a designated central computer, the "configuration server."

Every NeXT network requires three essential "servers": The configuration server controls the network, the Network File System (NFS) server

manages files, and a mail server manages electronic mail. For flexibility's sake, these three software machines can run on either different computers or a single computer. To keep things simple, use a single computer. Note that NeXT recommends that the configuration server have at least 12MB of RAM and a 330MB hard disk drive. For archiving files, this would be the best place for an optional optical disk drive.

While you are planning, don't forget people, the essential participants in the network. You need someone to be responsible for administering the network, and you must consider the security of your network, and you'll want to recognize that the way people work will change once the network is in place.

**Getting your hands dirty.** You can't avoid step 2, cabling. If you're only connecting a few computers in one contiguous location, do it yourself. That part really is as easy as plugging in a phone. If you're networking an entire office floor, hire an electrician who specializes in voice/data cabling to ensure that the work conforms to local building codes.

The hardware requirements for a basic network are summarized in the lower table on page 86. You have two choices for NeXT cabling: twisted-pair (which may be the telephone wire already installed in your office) or coaxial cable. In either case, all the hardware you need is available at electronics supply stores or from NeXT.

**Setting up the network files.** Don't expect that just because you've connected the cables to the computers the network is ready to work. There is more to a network than cables—and there are more sandbars ahead.

Before you get to step 3, setting up network files, take one simple, but undocumented, precaution. If any of your coworkers have already set up NeXT computers as stand-alone workstations, you must use the UserManager utility to make a list of the user IDs that are in use. Later, when you set up new network-wide user accounts, you'll check this list to be certain you don't use the same numbers.

Now set up the files. Put the LocalApps and LocalLibrary folders on the computer that will be the NFS server; these folders will store applications and literature that all users will share. You'll also need a folder named Users, and perhaps one named Projects for archiving collaborative work. The NeXT documentation does not suggest it, but you'll have an easier time if you set up these folders before you begin configuring your network.



## Creating a NeXT Network, Step by Step

Steps	Tools and Supplies	Time
1. Plan ahead	NeXT documentation Site plan Network organizational chart	1-2 days
2. Lay cable	Either coaxial or twisted-pair cable. (You may need a qualified electrician for building work.)	1-2 days
3. Set up network files on server	Workspace Manager application	<1 hour
4. Turn computer into configuration server	NetManager application	<1 hour
5. Add host computers	Terminators and T-connectors (if installing thin Ethernet) and NetManager application	1-3 hours
6. Export and mount files from Network File System server	NetInfoManager application, Edit	2-5 hours
7. Add network-wide user accounts	UserManager application	1-3 hours
8. Run mail and printer utilities	MailManager, Edit, PrintManager	<1 hour

## Hardware Requirements for Thin Ethernet and 10BaseT Networks

	Thin Ethernet	10BaseT Ethernet
<b>Cable specifications</b>	Coaxial RG58/U	Twisted-pair (many types acceptable)
<b>Topology</b>	Linear (computer to computer)	Star (wiring block at center)
<b>Maximum length of cable</b>	300m (total) without accessories; 1000m with repeaters	100m (computer to wiring block) without accessories; unlimited with repeaters or concentrators, but 185m between concentrators linked with thin Ethernet
<b>Additional hardware</b>	Two 50-ohm coaxial cable terminators (one at each end of network); one BNC T-connector for each computer	None

### Setting up the configuration server.

NeXT provides a suite of easy-to-use applications that unlock the system files that administer the network. The key software tools that set up a NeXT network are the "manager" applications that live in the NextAdmin folder. You'll use the NetManager application in step 4: It establishes the configuration server. Later you'll use NetInfoManager, MailManager, and PrintManager.

Before you proceed to step 4, consider saving important files and rebuilding the hard disk on the computer that will be the configuration server; it is not strictly necessary, but starting with a clean slate ensures that no preexisting disk glitches will hang you up later.

Figure 1 shows NetManager's main panel, as you'll see it when you follow the procedure described in the *NeXT Network and System Administration* manual. NetManager asks you to assign a name to the configuration server computer. The convention is to give it the name of your company or department (in Figure 1 the assigned name is "fortuity"). If you plan to connect to a global network such as the academic community's Internet, this name will form part of your e-mail address, so make it descriptive (future *NeXTWORLD* articles will explain how to join global networks). If, however, you are setting up a simple, self-contained NeXT network, you can just use NetManager's default settings.

One click of the OK button, and NetManager's magic turns your computer into a configuration server.

**Connecting the hosts.** Now proceed with step 5, connecting your coworkers' computers, called the "host" computers. You don't need to power off the computers to make the connections. Be sure you use 50-ohm (not 75-ohm) BNC terminators at each end of the network if you are using coaxial cable (thin Ethernet).

After your coworkers' computers are physically connected, you must restart the configuration server and again launch NetManager to enable "automatic host addition." This ensures that each computer on the network is automatically assigned an Internet address. If you are setting up a network from scratch, you can simply accept NetManager's defaults. There is a potential for conflict if any computer on the network has previously been used on a network where automatic host addition was disabled by a system administrator, but it's ordinarily clear sailing.

This is where you'll see NeXT networking at its easiest. To add a new computer to the network, you simply connect the computer and power it up! Every NeXT computer searches to see if it is connected to a network when it boots up. The first time it finds a network connection, it asks the user to assign a "hostname" that will identify the user's computer on the network. After that, it is forevermore a networked computer.

To appreciate the magic of the procedure you have just completed, consider that traditional UNIX networks require each computer on the network to be equipped with a full set of network-configuration system files. Every time the system changes, the network system administrator must log on to each computer and edit the system files. In contrast, NeXT networks store all the system configuration data in one spot: the configuration server in the NetInfo database, the true home of a NeXT network.

**Setting up the NFS server.** The purpose of a network is the sharing of files—also the purpose of step 6, in which you'll make files in the LocalApps, LocalLibrary, Projects, and Users folders accessible to everyone on the network.

These folders must be exported from the file server and mounted on each host computer by the NetInfo service. Under NeXTstep 2.0, the main tool for this job is NetInfoManager, which sets up the NFS server to do this job.

Before you break out NetInfoManager, use Edit to open the file `/etc/exports.example`. Add # to the existing lines to turn them into comments, and add these lines to the end:

```
/Users -anon=0
/Projects -anon=0
/LocalLibrary -anon=0
/LocalApps -anon=0
/usr/spool/mail -anon=0
```

(the resulting file should look like Figure 2). Type the lines carefully (don't overlook the hyphens), and save the file as `/etc/exports`. This file controls which folders are exported across the network.

After you have created an `/etc/exports` file, you are ready to use NetInfoManager to modify the NetInfo database. This is not a trivial task; follow the instructions in the *NeXT Network and System Administration* manual carefully. NetInfoManager is a can opener, not a Cuisinart. With NetInfoManager, a user can investigate every aspect of the underlying NetInfo database, and,

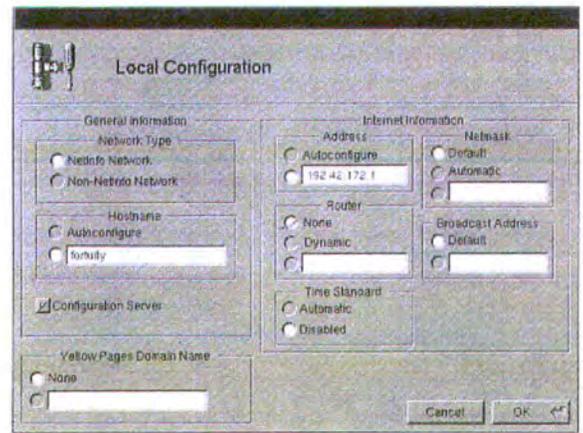


Figure 1. Checking the Configuration Server box on this panel allows other machines on the network to use this machine (the server) as a home base. Be careful: This step is very difficult to reverse.

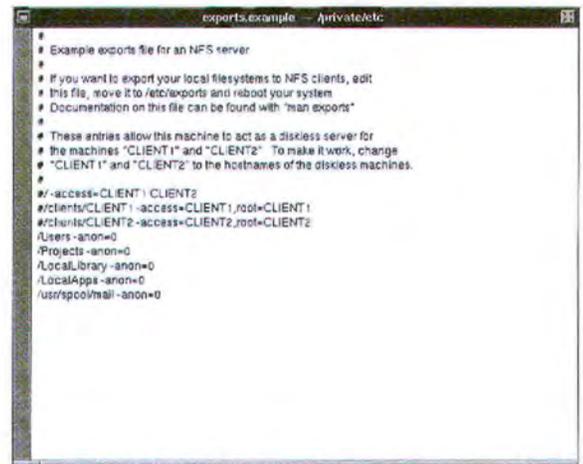


Figure 2. This simple ASCII file declares which directories or file systems will be exported (made available to others) at boot time. This file was made by modifying the `/etc/exports.example` file. Lines starting with # are treated as comments and are ignored.

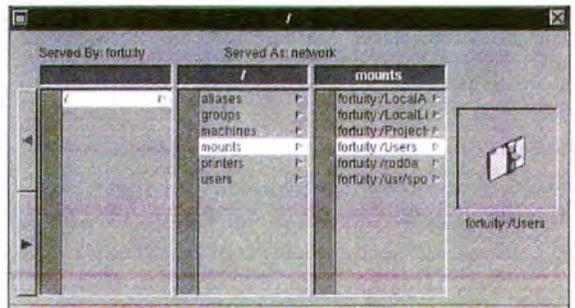


Figure 3. NetInfoManager provides access to all properties of a given domain, in this case the root domain. Everyone on the network has access to the files mounted in this domain.

given super-user privileges, change any attribute. But for all its power, NetInfoManager is no help when it comes to showing the novice how to set up a file server.

Getting a grip on some basic concepts will help you maintain balance despite the coming rapids. You should know that NetInfoManager manipulates logical categories that exist as network services, invisible to the user. A NetInfo database is built of "domains," purely conceptual contrivances that group information about users, machines, and resources. Domains are hierarchically organized like file directories. The top level, or parent, is the root domain, which could represent an entire organization, while child domains represent departments within the organization, down to the level of a workgroup or a single machine. For a simple network, you will need only the root domain.

Your first step is to use NetInfoManager to open the root domain (/). It looks like a folder with files, but it isn't. Within each domain, the NetInfo database is organized into "directories," which, however, are no relation to directories in the UNIX file system. Each directory contains "properties," which are associated with one or more "values." Follow the documentation to add new directories, create properties, add values, and change values. Do this for each folder you want to make available to the network. Be warned: The documentation shows only how to mount the Users folder. You must use the same procedure to mount LocalLibrary, LocalApps, Projects, and /usr/spool/mail.

#### **Adding network-wide user accounts.**

To continue to step 7, restart the configuration server, then all your coworkers' computers. You'll see the network appear—shared folders will appear in the Net folder of every computer.

Now you need to give each coworker a new account. UserManager will be a breeze after your hour with NetInfoManager. You'll run into problems only if users have already set up local accounts on stand-alone machines. If they have, they will have already used a few of UserManager's default user IDs.

To find out what numbers to avoid, check the list of IDs in the UserManager utility you made when you started. As an extra precaution, it's best to assign the network-wide user IDs in a new series—if the default is 21, change it to 41. Also, be sure to refuse the default that UserManager

suggests for a home directory. You must change this to the path for the NFS server's User folder, in the form /Net/servername/Users/acctname. UserManager will automatically create this home directory if you have not already done so. Have your coworkers copy any files they need into their new home directories.

**Electronic mail and printers.** The MailManager must be the simplest of all NeXT applications. There's one button to click after starting up the application on the configuration server; there's one button to click after starting up the application on each of the networked computers. Mail is then ready to fly, except for one problem: MailManager adds two lines to the /etc/exports file on the configuration server, which creates conflicts with the existing /LocalLibrary and /usr/spool/mail lines. Open up /etc/exports with Edit, and remove the new lines (the file should again look like Figure 2). You've just navigated past the last obstacle. As soon as you've exported printers, your network will start pulsing. And setting up your printer is easy. Use PrintManager in the NextApps folder. With a click of the mouse a local printer is made available for network use.

**Comparative networking.** With the NeXT system administration manuals and the tips we've given you, you should have no problem building a network, though you probably won't call it an easy job. How does it compare to building a network with Apple Macintoshes, with PCs, or with traditional UNIX workstations?

Look at the Mac first. A simple AppleShare network based on Apple LocalTalk communication is the prototype of plug-and-play networking. Printers plug in, and a Chooser application finds them. The same Chooser finds file servers and mounts them for file access. Networking software is set up with a simple Installer application. But with this ease of use comes inflexibility. For example, UNIX allows a single directory to contain files located on physically separate servers (for instance, the directory "Company Correspondence" may include files from a dozen computers). Apple's file system accommodates only physical devices such as hard drives, unlike UNIX, which allows symbolic links to be established between folders. The AppleShare approach is fine for simple networks but cannot be easily customized for enterprise-wide computing.

PC networks are harder to classify, since they come in so many flavors. All require batch files that configure each machine—and ensure the job

security of network administrators. The most popular, Novell's NetWare operating system, is widely used for small departmental networks, but it resists consolidation into hierarchical, enterprise-wide networks. Two networks cannot be joined without reconfiguring each.

Even among Novell partisans, UNIX is widely used for larger, enterprise-wide networks, particularly because unattended computer-to-computer communication is bundled in all UNIX systems. But traditional UNIX systems require full-time administrators who can "grep," "awk," and "sed" their way through system files on every host.

Sun workstations are the closest relatives of NeXT computers. The flexibility of Sun and NeXT networks is similar, and in fact, Sun's network management service is a direct ancestor of NeXT's NetInfo scheme. Like NetInfo, Sun's system relies on system files residing on one central computer, but unlike NetInfo, the Sun scheme offers no network management applications that a novice can touch. And unlike with NetInfo, systems built with the Sun tool cannot be dynamically and hierarchically stacked to build enterprise-wide networks.

Seen against this panoply of networking schemes, NeXT wins honors if not fanfare. NeXT networking is as powerful and flexible as other UNIX systems but vastly easier for the novice to manage. An "NFSManager" or "SharedFileManager" that replaces the cryptic NetInfoManager with a bullet-proof, prompted interface for exporting and mounting files would make NeXT networking truly plug-and-play.

If you are setting up a simple NeXT-only network, with cabling in place, you can be up and running in less than a day. The caveat is simple: The process requires many steps, and one false move will send you hurtling toward tech support. Don't let that stop you from trying, even if you have had no networking experience. It can be done, and the benefits of NeXT networking are worth the efforts. ☐

*Daniel Miles Kehoe and Seth Ross are authors of a book, New to NeXT, to be published this spring.*

# NeXT Question

Edited by Bruce Blumberg and Eric Larson

Welcome to NeXT Question. In this department we will provide answers to your questions about the NeXT and provide helpful hints and tips. We will cover NeXTstep, UNIX, and third-party products. Who are we? Well, the entire NeXT support organization will back this department, but in the lead are Eric Larson and Bruce Blumberg. Bruce Blumberg was the first employee the founders hired. He was involved in many of the fundamental design decisions regarding the machine and its software. Eric Larson is a member of NeXT's customer support group.

NeXT Question is divided into two sections: questions for the general user and questions for NeXT developers and administrators.

Since, for obvious reasons, we've had no reader questions so far, here are a few from our archives, from the NeXT publication NeXT Answers, and from asking around. We want future columns to represent NeXTWORLD readers' concerns. So please, direct any questions to NeXT Question, NeXTWORLD, 501 2nd Street, San Francisco, CA 94107, or [nextwrlld!dlavin@uunet.uu.net](mailto:nextwrlld!dlavin@uunet.uu.net).

## FOR USERS

**Q. Do I have to use NeXT-supplied cables with my computer?**

A. Yes. The MegaPixel Display cable carries keyboard, sound, and video information, as well as power. To keep the physical complexity in the monitor to a minimum, the signals to the monitor are timed specifically for this cable. The printer cable carries special signals to turn the printer on and off. Both cables are highly specialized; generic cables won't do the trick.

**Q. How do I keep the other people using my NeXT from browsing through my files?**

A. This question has to do with the issue of file ownership and permissions. There are three different types of access. Users with "read" permission can look at a file or directory, open directories, and copy files and directories. "Execute" permission is given to the "owners" of files, which allows users to run a program. Users with "write" access can write to a file or directory, or even wipe it out.

To examine or change the permissions on a file or directory in System 2.0 (which everyone should be running soon) choose the file or directory in the File Viewer, then choose Inspector from the Workspace Tools menu. The Attributes section of the Inspector panel includes a grid, labeled Per-

missions, with various boxes you can check, representing three types of users (owner, group, other), with three possible types of access (read, write, and execute). The owner (usually yourself) is also named in the panel. A group is made up of users with the same access privileges, as set up by the system administrator; one user can be a member of several groups. "Others" includes the rest of the world.

Permissions			
	Owner	Group	Other
Read	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Write	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Execute	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

A check mark means that a class of users has that access, an "x" means they don't. Click directly on the box in question to change a check mark to an x or vice-versa. Click OK to make the changes permanent. If you change the read permission for a group to an x, that group will not be able to browse your files. If you change the write permission to an x, that group will not be able to change the file.

**Q. Can I use third-party memory in my NeXT?**

A. In the NeXTcube and NeXTstation, Mac memory will work. Use an 8-data bit, no parity, 100 ns

memory or faster. (Be warned, however, that NeXT will not supply technical support for memory provided by a source other than NeXT.) Memory for the NeXTstation Color and NeXTdimension is available only from NeXT.

**Q. I need more space on the display. Can I make the dock go away?**

A. Grab the NeXT logo at the top of the screen and drag it down. You can make all but the NeXT logo disappear. To get the dock back, simply drag the logo back up. Double-clicking on the logo, by the way, makes the workspace active.

**Q. I've run out of space on the dock. I would like more slots because I use so many applications regularly.**

A. There is an excellent freeware program by Jayson Adams called AltDock. It creates a second dock elsewhere on your screen. Now in version 2.0, it is available from public access sites on the Internet and is probably available from your local user group. (See The NeXT World in this issue for a complete list of NeXT user groups.)

**Q. What SCSI hard drives can I use with my NeXT?**

A: NeXT provides a range of drives from 105MB to over 1GB in storage capacity. NeXT has carefully qualified these drives for connection to your computer. To use a third-party drive, the following must, in most cases, be true. First, you must be running System 2.0. Second, you must be using the proper cable (50-pin SCSI-type on the new machines). Third, your drive must support the SCSI commands Inquiry and Read Capacity. It must be running SCSI rev 12b or later, and it must support 10 bytes of Read/Write command blocks. Contact the drive manufacturer to find out whether a drive supports these specifications.

**Q. How do I eliminate that last header and footer line in WriteNow to jam more onto my page? I've tried everything.**

A. You haven't tried rewriting WriteNow from the source code. Unfortunately, these lines cannot be removed.

**Q. How do I keep a copy of the mail that I send?**

A. You have two options. You can put your own name in the send window under cc:. New in NeXTstep 2.0, however, is the option of archiving all your outgoing messages. Simply go to Preferences under Info . . . in the Mail menu and check archive.

## FOR DEVELOPERS AND ADMINISTRATORS

**Q: What are the standard cable, BNC connectors, and terminators for the NeXT's thin Ethernet?**

A: You need RG58A cable. It operates at 50 Ohms. Don't use RG59 (75 Ohms) or RG62 (90 Ohms) cable. The BNC connectors and terminators must also be 50 Ohms. Don't use the ones for cable television—they're at 75 Ohms. Note that each machine needs to be connected to the net with a T-connector, including the machines at the end of the Ethernet, and the machines at both ends have to be terminated. The '040 machines support twisted-pair, which we'll discuss later.

**Q: I have an optical disk that continually spins up and spins down. What can I do?**

A: Dust can contaminate an optical disk. For the long term, NeXT is shipping a retrofit kit with every hardware upgrade to solve this problem.

For the present, cleaning a dusty optical disk isn't difficult. You should use a soft lens-cleaning tissue (available at any photo supply store). Hold the gate open on the disk case and look at the shiny side of the optical disk. With the tissue, gently wipe the disk from the center outwards, toward the edge. Rotate the disk and repeat the process until you've cleaned off the entire disk.

**Q: I am interested in becoming a NeXT developer. Where do I go for information?**

A: Information can be obtained by calling our hotline in California at 800/848-NeXT and giving them your name and address.

**Q: I am interested in NeXT product information, but there is no local NeXT dealer or representative. Who should I talk to?**

A: See the previous answer. Use the same phone number.

**Q: Where can I learn more about object-oriented programming?**

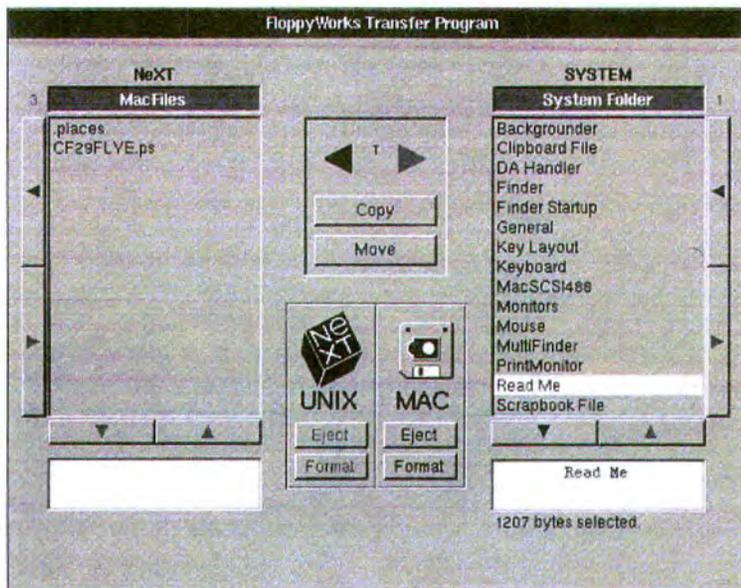
A: Here is a list of books, compiled by Edward J. Berard, of Berard Software Engineering:

Cox, B. J. *Object Oriented Programming: An Evolutionary Approach*. Reading, Mass.: Addison-Wesley, 1986.

Goldberg, A., and D. Robson, *Smalltalk-80: The Language and Its Implementation*. Reading, Mass.: Addison-Wesley, 1983.

Stroustrup, B. *The C++ Programming Language*. Reading, Mass.: Addison-Wesley, 1986. 

## Software for the NeXT™ That Links You to the Macintosh™ and Other Desktop Computers



### Introducing FloppyWorks™

*FloppyWorks™* is the only file transfer software for NeXT™ computers that can format, read, and write Macintosh™ (1.44 MB), NeXT, MS-DOS™, and OS/2™ (720 k, 1.44 MB, 2.88 MB) floppy disks and can be used with either of NeXT's software versions 1.0 or 2.0.

FloppyWorks software makes performing transfers quick and easy. The files on the hard disk and floppy disk are shown next to each other in two browsers. An intuitive user interface saves time by increasing the efficiency of the file transfer process, and file transfer filters provide a simple means of translating data among different word processing, spreadsheet, database, and graphic formats. FloppyWorks transfers a wide variety of files.

And, FloppyWorks can be used with the new NeXT 2.88 MB internal floppy drive, PLI's SuperFloppy 2.8™ and our newest external floppy drives, *CubeFloppy 2.9®* and *CubeFloppy Plus®*.

*CubeFloppy 2.9* is 100% compatible with the NeXT's new 2.88 MB internal drive and reads and writes 720 k, 1.44 MB, and 2.88 MB disks.

### Introducing CubeFloppy Plus

*CubeFloppy Plus* is our new SCSI floppy disk drive that will format, read, and write Macintosh 400 k, 800 k, and 1.44 MB floppy disks (does not support 2.88 MB disks) as well as MS-DOS and NeXT disks. This drive is designed specifically for NeXT users who need access to low density Macintosh disks such as those made by the Macintosh Plus.



Digital  
Instrumentation  
Technology, Inc.

901 18th St. #11000  
Los Alamos, NM 87544  
(505) 662-1459

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## Product Showcase

Turn here every issue for the latest-breaking, most interesting products in the NeXT marketplace. This is an exciting time for NeXT users. Development is exploding. The NeXTstep environment is proving to be a spawning ground for unique products. These ads keep you abreast of the best of what's out there. Showcase ads provide you with concise, easy-to-use information. Every one includes a picture, product information, and a handy reader service number. All this in 1,075 words (picture = 1,000 words + 75 text.) This is the first issue of NeXTWORLD and our first six showcases. Watch this space. It's gonna be fun.

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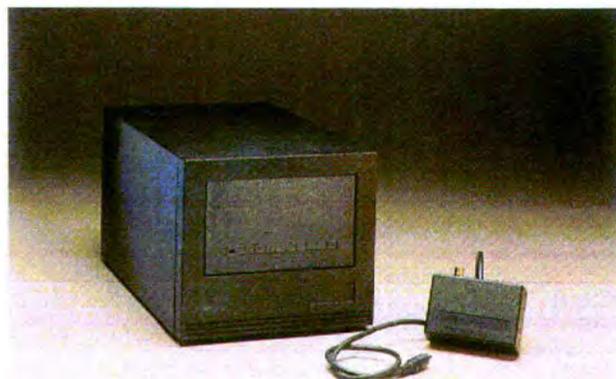


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## Accessories for those taking the cube route . . .



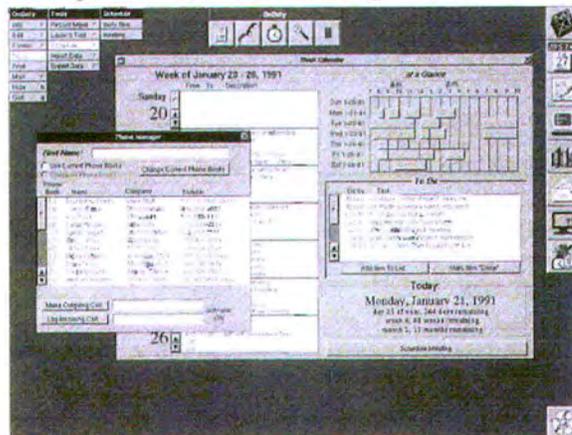
We are committed to providing high-quality, low-cost add-ons to the NeXT computer. All are fully guaranteed to work with your NeXT. Hard drives: Pre-formatted, pre-tested, plug-and-play Seagate Wren drives. Includes all cables, instructions, software, and unlimited 800# support. 660Meg \$1995/\$2195 1Gig \$3295/\$3495 (internal/external)  
Also: Inexpensive telecomm hardware to connect the NeXT to a phone line for voice mail, FAX, modem. Call for info.

**1-800-CUBE-RTE**

The Cube Route, Inc. /430 Broadway/Cambridge, MA 02138/(800) 282-3783

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## OnDuty™ is Your Office Organizer



Organize, prioritize, and categorize important information that comes across your desk. With OnDuty you can schedule time commitments with the Appointment Book. The Contact Manager lets you track leads, customers, and other contacts. Includes a Phone Manager for automatic dialing of your listed phone numbers. The Notepad lets you jot down and organize random ideas. Pocket, Financial, and Programmers Calculators provide full range of functions. Affordable price at \$295.00.

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## The NeXT Palettes



**MathPalette**  
Front End development tools for MATHEMATICA™



**SmartFields**  
Text field formatting and character validation



**Chooser**  
Mixed icon - text scrolling selection list

Call Objective Technologies today for more information about the most innovative palettes ever created for NeXT. Increase your development power. Save money by reducing your development time using objects created by the only commercial developers of custom palettes for NeXT's Interface Builder.

*Mathematica* is a trademark of Wolfram Research, Inc.

Objective Technologies, Inc./7 Dey St., #711/New York, NY 10007/(212) 227-6767

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- Stained Glass Software presents Calendroscope™ - time management software for individuals and groups.
- Features: Day, Week, Month and Year views. Easy propagation. Collective Calendar for group support. Sound/panel/email notification. Text and voice attachments. Low cost. Send blank optical or floppy disk for free sample.
- Stained Glass Software also provides consulting services for NeXT program design, implementation and porting.

Stained Glass Software/1173 Kent Ave./Sunnyvale, CA 94087/(408) 249-3337  
Fax (408) 249-5312

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## A/D64x A/D Converter



Hardware and software for high-quality sound recording and data capture on NeXT computers. Two-channel 16-bit delta-sigma conversion, 64 times oversampling, self-calibration, mic preamp with phantom power, balanced and unbalanced inputs. 32, 44.1, and 48 KHz (plus external) sampling rates. Multi-A/D64x synchronization. Digital (AES/EBU) input and output. NeXT software for recording, control, and editing. Stand-alone operation - replacement DAT recorder front-end, etc. Now shipping. \$1295.

Singular Solutions/959 East Colorado Blvd./Pasadena, CA 91106/(818) 792-9567  
Fax (818) 792-0903

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# Dock Soup

Dock Soup is a complete guide to third-party products available for the NeXT computer as of January 1991, according to the latest information available at press time.

The products reviewed in NeXTWORLD include the NeXTWORLD rating. For a description of the NeXTWORLD rating system, see Page 66 of this issue. For more information on any of the products listed here, call the manufacturer.

## Peripherals

### Abaton Scan 300/GS

An 8-bit flatbed scanner that scans at resolutions of up to 300 dots per inch for line art, halftones, and 256 levels of grayscale. Saves files in TIFF format and will print to NeXT, Macintosh, IBM PC, and PS/2 computers.

\$1598 for 300 GS engine, \$595 for interface kit. Abaton, 48431 Milmont Dr., Fremont, CA 94538. 800/444-5321, 415/683-2870 fax

### A/D64x

An analog/digital interface for high-quality sound recording and data capture. Offers two channels of 16-bit, delta-sigma conversion, a microphone preamp with phantom power, and independent digital AES/EBU input and output.

\$1295. Singular Solutions, 959 E. Colorado Blvd., Pasadena, CA 91106. 818/792-9567, 818/792-0903 fax

### Ariel QuintProcessor

A signal- and array-processing system that uses five digital signal processors to enhance the speed and versatility of the NeXT Music Kit. Can be used for array processing, music synthesis, speech recognition, and digital audio recording and mixing.

\$6995. Ariel Corporation, 433 River Rd., Highland Park, NJ 08904. 201/249-2900, 201/249-2123 fax

### Cube Floppy 2.9

An external SCSI 3.5-inch floppy disk drive that reads and writes to 3.5-inch disks used by computers with MS-DOS, Macintosh, and UNIX operating systems. \$250 for floppy works, \$520 for Cube floppy; \$680 for package with software. Digital Instrumentation Technology, 901 18th St., #11000, Las Alamos, NM 87544. 505/662-1459, 505/662-0099 fax

### DaynaFILE

An external floppy disk drive that enables NeXT computers to read and write to 5.25-inch, 1.2MB disks and 3.5-inch, 1.44MB disks. The DaynaDOS file transfer application permits NeXT, DOS, and Macintosh files to cohabit inside the NeXT file system and be opened and edited using various compatible NeXT applications.

Starts at \$750. Dayna Communications, 50 S. Main St. Fifth Floor, Salt Lake City, UT 84144. 801/531-0600

### Dazzl Model 16/12 Analog to Digital Converter

An analog-to-digital input board that acquires data on 16 single-ended or 8 differential channels. Reads data in ASCII or binary form and imports into a variety of applications, including medical monitoring, physiological potential recording, robotics, and analytical data acquisition. Sampling is done before, after, or around a trigger.

For price contact Dazzl, Dazzl, 1203 N. Bourland Ave., Peoria, IL 61606. 309/674-9317

### Digital Ears

A hardware/software package for entering, recording, and manipulating CD-quality sound and high-resolution laboratory data. Can be used for computer-based training, education, presentations, digital audio recording, voice therapy and diagnosis, speech and voice recognition, and acoustic research.

\$795. Metaresearch, 516 S.E. Morrison, Ste. M-1, Portland, OR 97214. 503/238-5728, 503/230-2627 fax

### Digital Eye

A hardware/software package for entering and recording still and moving NTSC video images from many sources, including laserdisc players, video and still-video cameras, and VCRs. Features variable image size and resolution selections and software controls for image enhancement.

\$975. Metaresearch, 516 S.E. Morrison, Ste. M-1, Portland, OR 97214. 503/238-5728, 503/230-2627 fax

### DM-N Ariel Digital Microphone

A microphone with preamps and two 16-bit analog-to-digital converters that are compatible with all existing software making use of the NeXT DSP port. Mini-phone input jacks accept external signals from audio sources like CD players and FM receivers, as well as other industrial-control instruments.

\$595. Ariel Corporation, 433 River Rd., Highland Park, NJ 08904. 201/249-2900, 201/249-2123 fax

### Epoch-1 InfiniteStorage Server

An application- and platform-independent network server that communicates with heterogeneous computer networks. Equipped with fast magnetic disks that serve as a virtual cache while data is "staged" on and off to optical disk. Performs automatic, unattended on-line and remote system backup across a network. \$82,900 to \$694,000. Epoch Systems, 8 Technology Dr., Westborough, MA 01581. 508/836-4711, 800/US-EPOCH, 508/836-3802 fax

### Extron Board

A board that allows NeXT computers to display video on a variety of compatible, large-screen data projectors or monitors. \$2500. Extron Electronics, 13554 Larwin Cir., Santa Fe Springs, CA 90670. 213/802-8804, 800/633-9876, 213/802-2741 fax

### Extron RGB 111

A computer-to-monitor interface that provides simultaneous local monitor viewing and an equally clear display on a compatible monitor or projector. \$370. Extron Electronics, 13554 Larwin Cir., Santa Fe Springs, CA 90670. 213/802-8804, 800/633-9876, 213/802-2741 fax

### IX-30F Image Scanner

An 8-bit flatbed scanner with a scanning resolution of up to 300 dots per inch and 4, 16, or 256 levels of grayscale. Saves images in EPS or TIFF formats with compression options. Has an automatic document feeder (ADF) option for OCR applications.

\$1545; \$595 for ADF. Canon U.S.A., One Canon Plaza, Lake Success, NY 11042. 800/848-4123

### JETSTREAM Tape Backup System

A backup program that uses standard 8mm removable and rewritable videotape cartridges. Archives up to 2.3 gigabytes of data per tape at speeds up to 14.4MB per minute. Error correction code ensures data integrity.

\$5995. Personal Computer Peripherals Corporation, 4710 Eisenhower Blvd., Bldg. A4, Tampa, FL 33634. 813/884-3092

### LaSTLock

A hardware security system for the NeXTcube. Protects the monitor, keyboard, mouse, and Cube from tampering and theft. Attaches to a NeXTcube without bolts, screws, or glue.

\$195. Prevail, 3490 The Alameda, Santa Clara, CA 95050. 408/296-6550

### OcéColor

A color thermal transfer printer capable of monochrome, 3-color, and 4-color printing using a wax-based ink ribbon. Outputs at 300 x 300 dots per inch. Comes with Pantone color simulations and 5MB RAM.

\$8990. OcéGraphics, 385 Ravensdale Dr., P.O. Box 7169, Mountain View, CA 94039. 415/964-7900, 800/545-5445, 415/961-6152 fax

### PLI SuperFloppy 2.8

A floppy disk drive that uses vertical recording to increase the capacity available in most disk drives from 1.44MB to 2.88MB. Compatible with 720KB and 1.44MB disk standards, allowing users to work with files from MS-DOS, OS/2, or UNIX-based systems.

\$499. Peripheral Land, 47421 Bayside Pkwy., Fremont, CA 94538. 415/657-2211, 800/288-8754, 415/683-9713 fax

### PM1.44

An external 3.5-inch SCSI floppy disk drive that reads compatible file formats from IBM, DOS, and Macintosh computers. Can be stacked on top of the Cube. \$849. Pacific Microelectronics, 201 San Antonio Cir., Ste. C250, Mountain View, CA 94040. 415/948-6200, 800/628-DISK, 415/948-6296 fax

### PMHDE

An external SCSI hard disk drive enclosure that accommodates 3.5-inch or 5.25-inch hard disks. Provides additional external disk storage of up to 7 gigabytes. Can be stacked on top of the Cube or mounted in a rack.

\$695. Pacific Microelectronics, 201 San Antonio Cir., Ste. C250, Mountain View, CA 94040. 415/948-6200, 800/628-DISK, 415/948-6296 fax

### Scan-X Professional

An 8-bit scanner that scans at resolutions of up to 1500 dots per inch for line art and 300 dots per inch for grayscale images. Saves in TIFF and EPS formats, recognizes 256 levels of grayscale, and scans legal-size documents. Optional 50-page sheet feeder and OCR software available.



geometric shapes and EPS or TIFF graphics.  
\$375. Stone Design Corporation, 2425 Teodoro N.W., Albuquerque, NM 87107. 505/345-4800, 505/345-3424 fax

#### The Font Company Type Library

A library of more than 1500 PostScript Type 1 typefaces. Buyers can purchase any number of fonts.  
Price varies with the number of typefaces purchased. The Font Company, 12629 N. Tatum Blvd., # 210, Phoenix, AZ 85032. 602/998-9711, 800/442-FONT, 602/998-7964 fax

#### TouchType

Accessory software for creating and controlling display type for book covers, titles, logos, and other projects. Simple to use and powerful.  
\$249. RightBrain Software, 20 Medway Rd., Woodside, CA 94062. 800/472-7246

#### WordPerfect

A word processor featuring columns, macros, merge, table of contents, indexing, spell checking, a thesaurus, footnotes and endnotes generation, graphics manipulation, and an automatic timed backup system.  
\$495. WordPerfect Corporation, 1555 N. Technology Way, Orem, UT 84057. 801/225-5000

### Connectivity/ Communications

#### AFS 3.0

A distributed file system for networks linking up to thousands of computers. Offers common file space for all users regardless of location. Equipped with a window for monitoring file server status, an on-line backup system, and various security features.  
Starts at \$7000; discount for educational institutions. Transarc Corporation, The Gulf Tower, 707 Grant St., Pittsburgh, PA 15219. 412/338-4400, 412/338-4404 fax

#### Communicate

Software that enables NeXT computers to communicate with DEC and IBM mainframes and minicomputers and other information services. Permits communication with many graphics and CAD mainframe and minicomputer applications.  
\$395. Active Ingredients, 222 Third St. #0234, Cambridge, MA 02142. 617/576-2000, 617/576-3609 fax

#### GatorBox

Hardware that links a Macintosh network to Ethernet, so that users on both

LocalTalk and Ethernet share laser printers, e-mail, and storage. Also provides TCP/IP services for terminal sessions from Macintosh computers to UNIX hosts.  
\$2795. Cayman Systems, 26 Lansdowne St., Cambridge, MA 02139. 617/494-1999, 617/494-9270 fax

#### GatorMail

A bridge between QuickMail or Microsoft Mail and any UNIX mail systems on SMTP networks, including Internet. Features mail exchange, aliasing, and data enclosures.  
\$995 (10 user package). Cayman Systems, 26 Lansdowne St., Cambridge, MA 02139. 617/494-1999, 617/494-9270 fax

#### MacLinkPlus/PC

A kit containing more than 100 translators that transfer and translate files between the NeXT and Macintosh environments. Some of these translators provide a databridge between WriteNow for NeXT and many Macintosh word processors (such as MacWrite, Microsoft Word, WordPerfect, and WriteNow). Also transfers and translates data from DOS files accessed through the Macintosh desktop.  
\$199. DataViz, 35 Corporate Dr., Trumbull, CT 06611. 203/268-0030, 203/268-4345 fax

#### 3270Vision

(beta)  
A powerful 3270 terminal emulator that allows IBM mainframe connectivity from the NeXTstep environment. 3279Coax is an adaptor box that connects the NeXT's SCSI port to an IBM 3174 or 3274 controller.  
\$695 for 3270Vision; \$2295 for 3270Coax. Conexions, 79 Wildwood Rd., #200, Andover, MA 01810. 508/475-5411

#### Worldtalk/400

An enterprise-wide messaging system that interconnects many existing messaging applications for computers with UNIX, OS/2, Netware, MS-DOS, and Macintosh operating systems. Compatible with other vendors' X.400-based messaging products and with European messaging standards.  
\$5000 for Worldtalk/400 core; \$3000 for Worldtalk/400 Gateway Engine. Touch Communications, 250 E. Hacienda Ave., Campbell, CA 95008. 408/374-2500, 408/374-1680 fax

### Databases

#### GatorShare

Software that resides in the GatorBox allowing file and data sharing between

Macintosh and NeXT computers, transforming the NeXT computer into a non-dedicated file server for the Macintosh.  
\$1995. Cayman Systems, 26 Lansdowne St., Cambridge, MA 02139. 617/494-1999, 617/494-9270 fax

#### INGRES Relational Database Management System

An application development environment providing 4GL, SQL, and visual programming methods. Created applications are instantly portable across multiple hardware platforms.  
Price varies. Ingres Corporation, 1080 Marina Village Pkwy., Alameda, CA 94501. 415/769-1400, 800/4INGRES, 415/748-2545 fax

#### MediaStation 1.2

A database for multimedia data acquisition and processing. Features include high-resolution image scanning, CD-quality audio recording, text processing, and frame-by-frame animation.  
\$2500. Imagine, 32 N. Washington #14, Ypsilanti, MI 48197. 313/487-7117, 313/487-1323 fax

#### Objective DB Toolkit

An object library that bridges the gap between the Sybase database engine and developer applications. Provides extensive templating for TextFields and mapping of palette objects to database data types. Accumulates text, image, and sound data and supports text, buttons, and slider arrays.  
\$995. Professional Software, 599 North Ave., Wakefield, MA 01880. 617/246-2425, 617/246-2443 fax

#### ORACLE Relational Database Management System

An RDBMS that simplifies application development and operation by implementing fourth-generation capabilities. Runs on more than 80 different computer platforms. Oracle applications and data move easily from one platform to another without modification.  
For price, contact Oracle Corporation, Oracle Corporation, 20 Davis Dr., Belmont, CA 94002. 800/345-3267

#### SYBASE SQL Server

Server software based on Sybase's SQL RDBMS. Features include client-server architecture to separate front-end and back-end functions, distributed data management, and the DB-Library SQL Server Interface to connect applications with the SQL Server.  
For price, contact Sybase, Sybase, 6475 Christie Ave., Emeryville, CA 94608. 415/596-3500, 800/879-2273, 415/596-4508 fax

### Scientific

#### Airfoil Design Kit

An engineering tool for computing the aerodynamic characteristics of two-dimensional airfoils. Analyzes existing airfoils in the Airfoil Library, predicts the effects of modifications, or makes new designs.  
For price, contact Alva Computer, Alva Computer, 163 Alaric Dr., Hampton, VA 23664. 804/851-6830, 804/851-1826 fax

#### DAN, The Data Analyzer 1.0

An engineering and scientific data analysis system. Capabilities range from input and output of several data file formats to table generation, mathematical manipulation of data tables in memory, and complete X-Y coordinate-plotting support. Any number of overlaid plots are available with distinguishing styles, plot symbols, and grayscales.  
\$795. Triakis, 560 Bryce Ave., Los Alamos, NM 87544. 505/672-3180

#### Mathematica

An application for both interactive calculation and high-level programming. Performs almost any numerical, symbolic, or graphical mathematical manipulation. Displays 2D and 3D plots of functions and data and 3D object modeling.  
For price, contact Wolfram Research, Wolfram Research, 100 Trade Center Dr., Champaign, IL 61820. 217/398-0700

#### Spring

A program for exploring the second-order differential equation that models the motion of a mass on a spring. Features graphs and real-time animations of the solution and the parts of the solution. Useful for teaching and studying university-level mathematics.  
\$295. Halchin and Fleming, 2122 Reynolds Dr., Charleston, IL 61920. 217/348-0917

#### Math++ 2.0

A C-language math library of 100 functions designed to support numerical analysis in applications. Includes over 1.5MB of source code and a 470-page user's guide with numerous program examples.  
\$295. Triakis, 560 Bryce Ave., Los Alamos, NM 87544. 505/672-3180

#### Taylor

An interface to Mathematica that allows users to investigate Taylor polynomials. Users specify the function to be approximated, the degree of the Taylor polynomial desired, and the center point of the expansion. Taylor then graphs the function and its approximating polynomial on the same axes.

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**Product Showcase Information**

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**Product Showcase Information**

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  - 23) MacUser
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  - 25) Macworld
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  - 32) Unix World
  - 33) Wall Street Journal

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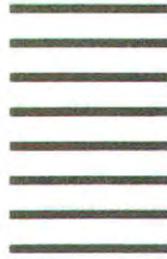
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  - 11) Macintosh
  - 12) NeXT
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\$2195. HSD U.S., 1350 Pear Ave., Ste. C, Mountain View, CA 94043. 415/964-1400, 415/964-1538 fax

#### SCSI488/N

An IEEE 488 interface plus a software driver that gives the NeXT computer control of up to 14 IEEE instruments. Uses familiar Hewlett-Packard-style IEEE commands while providing transfer rates as high as 900KB per second. Attaches to the SCSI port, leaving an expansion slot open.

\$1495. Iotech, 25971 Cannon Rd., Cleveland, OH 44146. 216/439-4091, 216/439-4093 fax

#### VISUS Digital Document Scanners

The Personal Page Scanner (with optional auto-feeder) scans any document up to legal size. For high-volume workload and larger documents, the Departmental Scanner (11 x 17 inches) and the Large Format Scanner (24 x 60 inches) scan at resolutions up to 400 dots per inch. The Industrial Scanner scans at resolutions up to 2000 dots per inch with an absolute gauging accuracy of .002 inch over a distance of 24 inches.

\$1395 for Personal Page Scanner; \$2295 for auto-feeder; \$17,995 for Departmental Scanner. Visual Understanding Systems, 3400 Forbes Ave., Pittsburgh, PA 15213. 412/687-3800, 412/687-7065 fax

#### VISUS Fax Modems

A pocket-size, battery-powered, Group III device that sends, receives, and automatically files faxes. Designed for high-volume applications and supports Professional PaperSight workgroups over a NeXT network.

\$995. Visual Understanding Systems, 3400 Forbes Ave., Pittsburgh, PA 15213. 412/687-3800, 412/687-7065 fax

### Business

#### Calendoscope

An appointment calendar program for individuals or organizations. Appointments are listed by day, week, month, or year. Agendas and notes can be attached as documents. Appointment notification options include sound, pop-up windows, and e-mail.

\$95. Stained Glass Software, 1173 Kent Ave., Sunnyvale, CA 94087. 408/249-3337

#### Lotus Improv 1.0

📊📊📊 (beta)

With a revolutionary model custom-made for data analysis, Improv is an essential spreadsheet for anyone doing financial modeling. Its first release, however, lacks such basic important features as an undo

command and a macro language.

\$695. Lotus Development Corporation, 55 Cambridge Pkwy., Cambridge, MA 02142. 617/577-8500

#### OMEN III

A stock-quotations system incorporating client management, technical analysis, real-time news retrieval, and on-line order entry functions. Live connections to spreadsheets and analytical programs update linked charts, reports, and tickers. Provides voice and visual alerts when any security, currency, commodity, or index limits are reached.

For price, contact Microstat Development Corporation. Microstat Development Corporation, 2150 Western Pkwy., Vancouver, BC V6T 1V6, Canada. 604/228-1612, 604/228-9793 fax

#### PaperSight Light

A digital file cabinet that can be used on a stand-alone system or integrated network. Accepts and refiles documents from a variety of input sources. Text and voice annotations and markup overlays can be added.

\$695. Visual Understanding Systems, 3400 Forbes Ave., Pittsburgh, PA 15213. 412/687-3800, 412/687-7065 fax

#### PowerStep

📊📊 (beta)

A capable spreadsheet, equipped with most of the power features pioneered by leading PC and Mac spreadsheets, marred by an Interface-Builder-gone-wild design. Price to be announced. Ashton-Tate Corporation, 21010 Hamilton Ave., Torrance, CA 90509. 800/437-4329, ext. 3717

#### Who's Calling? 1.0

A client-management system that imitates many routine office functions by combining relational database technology with simple file interfaces. Voice messages remind users to make phone calls and to announce appointments, while a message board sends text, voice, and images to others on a network.

\$495. Adamation, 1435 Center St., Oakland, CA 94607. 415/452-5252

#### Wingz 1.1

📊📊📊

A powerful, English-like programming language and stunning 3D graphics put this spreadsheet out front for users who care about those things. However, rudimentary file links and 2D files that make modeling difficult, and a clunky interface, make this a less than stellar entry.

\$699. Informix Software, 16011 College Blvd., Lenexa, KS 66219. 913/599-7100, 913/599-7350 fax

### Groupware

#### Professional PaperSight

An image-management program for scanning, viewing, organizing, filing, searching, and archiving documents, and sending and receiving faxes. Overlays can be used for multiple layers of corrections, annotations, and written or recorded messages. Optional intelligent character recognition available.

\$1695; \$1795 for character recognition. Visual Understanding Systems, 3400 Forbes Ave., Pittsburgh, PA 15213. 412/687-3800, 412/687-7065 fax

#### Redmark

A paperless review program that allows multiple reviewers to proof and critique documents by marking up a transparent overlay on the original. Annotation options include standard proofreading symbols, drawing tools, text, voice recordings, and imported graphics.

\$345; \$995 for four copies. Epitome, 11015 Sonja Dr., Knoxville, TN 37922. 615/675-0910, 615/966-2558 fax

### Graphics

#### Adobe Illustrator

A graphic design and illustration program that uses Display PostScript, and includes freehand, auto trace, geometric shapes, pen, and blend tools. Compatible with versions of Adobe Illustrator on other computer systems.

\$595. Adobe Systems, 1585 Charleston Rd., Mountain View, CA 94039. 800/344-8335, 415/961-3769 fax

#### ClickArt for NeXT

A collection of nearly 400 illustrations in EPS format. The Business Art segment includes images of office equipment and symbols for occupations, communications, and transportation. Other illustrations show people, animals, maps, sports, and food.

\$295. T/Maker, 1390 Villa St., Mountain View, CA 94041. 415/962-0195

#### Create!

📊📊📊 (beta)

A full-featured Color PostScript drawing and paint environment for manipulating and adding special effects to graphic objects and text.

\$495; low-cost upgrade for TextArt owners. Stone Design Corporation, 2425 Teodoro N.W., Albuquerque, NM 87107. 505/345-4800

### Diagram!

📊📊📊 (beta)

A "digital whiteboard" that creates everything from organizational charts to annotated illustrations.

\$399. Lighthouse Design, 6516 Western Ave., Chevy Chase, MD 20815-3212. 301/907-4621, 800/366-2279

#### MundoCart/Optical

A map database that produces maps of all parts of the world at different scales and levels of detail. Cartographers combine the maps they create with standard NeXT desktop publishing tools. Includes custom drawing tools and projection and ellipsoid panels.

\$14,800. Chadwyck Healey, 1101 King St. #380, Alexandria, VA 22314. 800/752-0515

#### TopDraw v. 1.0

An object-oriented drawing package that integrates graphics, text, and raster images. Accepts EPS, MIF, TIFF, and RTF formats. Drawing objects include a spectrum of geometric shapes, with many object-fill properties. Text can be edited after applying graphic manipulations. Also features user-definable color palettes and spot color separations.

\$595. Media Logic, 2501 Colorado Ave. #350, Santa Monica, CA 90404. 213/453-7744, 213/453-9695 fax

### Text Processing/DTP

#### Adobe Plus Pack

A collection of 26 additional fonts to supplement the 13 standard fonts on NeXT computers. Typefaces include Palatino, ITC Bookman, ITC Zaph Chancery, ITC Zaph Dinghats, ITC Avant Garde Gothic, ITC New Century Schoolbook, and Helvetica Narrow and Condensed.

\$495. Adobe Systems, 1585 Charleston Rd., Mountain View, CA 94039. 800/344-8335, 415/961-3769 fax

#### FrameMaker 2.0

A publishing environment that integrates word processing, graphics, page layout, equation-editing, and book-building tools.

\$995; academic price \$495. Frame Technology Corporation, 1010 Rincon Cir., San Jose, CA 95131. 408/433-3311, 408/433-1928 fax

#### TextArt 1.0

A combination drawing package and PostScript generation tool that skews text, places it in a straight line, around a circle, or in an arc or rose, and adds shadows. Controls letter placement with track, sector, and pair kerning. Basic drawing functions combine images with

\$20, site license \$80. *Holchin and Fleming*, 2122 Reynolds Dr., Charleston, IL 61920 217/348-0917

## Vertical Market

### SimuLEARN

A desktop toolkit for producing interactive computer-based instructional materials. Uses graphics, sound, video, and a linking and branching facility to guide the learner through simulations at his or her own pace. Allows student to attach electronic comments addressing the author of the projects, modules, or lessons.

For price, contact Knowledge Transfer International. Knowledge Transfer International, 5080 Spectrum Dr. #912W, Dallas, TX 75248. 214/233-7693, 214/233-3319 fax

### VTLS InfoStation 1.0

A hypermedia information-access system for library automation. Provides on-line catalog search and retrieval of audio, textual, and graphic data. The audio-visual help system gives users digitized voice instructions, line drawings, and text explaining how to use the program.

\$995; contact VTLS for network prices. VTLS, Virginia Tech Corporate Research Center, 1800 Kraft Dr. #200, Blacksburg, VA 24060. 703/231-3605, 703/231-3648 fax

## Developer's Tools

### Absoft Object-Oriented FORTRAN 77 (v. 2.1)

A full implementation of the ANSI X3.9-1978 and MIL-STD 1753 FORTRAN language definitions designed for scientific and engineering users who want to port and develop programs from mainframe, mini, and workstation environments.

\$995, academic price \$750. Absoft Corporation, 2781 Bond St., Rochester Hills, MI 48309 313/853-0050, 313/853-0108 fax

### ACUCOBOL-85

System software that produces machine-independent object code. Offers a multiple-version source control system, a split-screen interactive source code debugger for viewing, and interlanguage communication flexibility. Supports most features of Data General COBOL.

\$2995. Acucobol, 7950 Silverton Ave. #201, San Diego, CA 92126. 619/271-7097, 619/566-3071 fax

### AKGH

System software that utilizes NeXT multimedia capabilities to create user-friendly application instructions, procedural guidelines, and personalized internal help.

Hypertext-style links can be set up to combine text, sound, and graphics. Uses NeXT SQL Server to store multimedia information.

\$385 without optical disk, \$485 with optical disk. Information & Communications, 5601 La Jolla Blvd., La Jolla, CA 92037. 619/454-9160, 800/776-9966, 619/454-9766 fax

### Allegro CL

A full-featured Lisp programming environment that is compatible with Objective-C, Interface Builder, and the Application Kit. A foreign function interface allows programmers to call FORTRAN and C routines. Also offers debugging options and generation-scavenging garbage collection.

For price, contact Franz. Franz, 1995 University Ave., Berkeley, CA 94704. 415/548-3600

### Displaytalk 1.0

An integrated development environment for Display PostScript programming. Useful for creating and testing pswraps during program development, and for designing and developing full-screen PostScript animation.

\$995. Adobe Systems, 1585 Charleston Rd., Mountain View, CA 94039. 415/961-4400, 415/961-3769 fax

### Flexible License Manager v. 2.0

A network-wide, multiaccess package that allows software to be licensed on a concurrent-usage basis. Features include software that runs on any network node, enforced software expiration dates, demonstration software that can be licensed over the phone, and a log file that records all license transactions.

\$12,000 one-time binary license fee. Highland Software, 940 E. Meadow Dr., Palo Alto, CA 94303. 415/493-8567, 415/493-4506 fax

### Macro Cross Assembler

A program that translates one or more source fields containing DSP instruction mnemonics, operands, and assembler directives into object modules that are relocated and linked by the DSP96000 Linker. Features functions for data conversion, error checking, and transcendental math.

For price, contact Motorola. Motorola, Digital Signal Processors, MD: OE314, 6501 William Cannon Dr., West Austin, TX 78735. 512/891-2030, 512/891-2947 fax

### NeuExpert

A knowledge representation tool that combines expert system and neural network capabilities. Supports statistical rule analysis, uncertainty, graphic knowledge representations, backward chaining, and system learning. Limited object-oriented knowledge structures can be defined by the user.

\$25,000. Pacific Microelectronics, 201 San Antonio Cir., Ste. C250, Mountain View, CA 94040. 415/948-6200, 800/628-DISK, 415/948-6296 fax

### NextBus Development Kit

Hardware and documentation for designing a NextBus board. Includes documentation for the NextBus and the NextBus Interface Chip (NBIC), preliminary information on writing loadable kernel drivers, two NBIC chips, a prototype board, and a disk containing related software tools and examples.

\$350. NeXT Computer, 900 Chesapeake Dr., Redwood City, CA 94063. 800/848-6398, 415/780-2801 fax

### [OT Palettes: 1.0]

A family of custom object palettes for use with the Interface Builder application. Each palette combines objects of similar form and function, such as SmartFields, Chooser, and Math.

Prices vary according to object. Objective Technologies, 7 Day St. #711, New York, NY 10007. 212/227-6767

### Oasys Compiler Family

A group of language compilers based on the Green Hills integrated family of compilers (C, FORTRAN, and Pascal). All the languages are inter-language callable. Offers procedural inlining, register caching, common sub-expression elimination, strength reduction, and loop unrolling. Provides full 68881, 68882, and IEEE floating-point support.

\$1500 per language. Oasys, 230 Second Ave., Waltham, MA 02154. 617/890-7889, 617/890-4644 fax

### PaperSight Developer's Toolkit

More than 70 code and data modules to aid the VAR or turnkey developer in image management. Includes modules for scanning, fax input and output, image compression and decompression, image transformation and character recognition, text and voice annotation, annotation-based indexing, and voice help.

\$40,000. Visual Understanding Systems, 4300 Forbes Ave., Pittsburgh, PA 15213. 412/687-3800, 412/687-7065 fax

### Simulator Programs

Two software programs to aid in the development of programs and algorithms running on the Motorola DSP56000 and DSP96000. The SIM56000 program emulates all of the functions of the DSP56000/1. The SIM96000 provides identical functions for the DSP96000 family.

For price, contact Motorola. Motorola, Digital Signal Processors, MD: OE314, 6501 William Cannon Dr., West Austin, TX 78735. 512/891-2030, 512/891-2947 fax

### UNIX MUMPS v. 3.1

A computer database and programming language specially suited for the interactive manipulation and storage of large volumes of medical and business data. Unlike conventional MUMPS (Massachusetts General Hospital Utility Multi-Programming System) implementations, UNIX MUMPS can be integrated into the UNIX environment and supports transparent, distributed, and heterogeneous networks.

\$595 for single user; \$5500 for multi-user (one to four seats). Toltec Human Services, 5005 N. Pennsylvania Ave. #301, Oklahoma City, OK 73112. 405/840-4254, 405/840-3041 fax

## Other Products

### LINK-IT v. 1.0

A hypertext system for linking information and documents. A built-in macro language facility is available for advanced users to create input and sort templates.

\$245, \$195 through February 1991. Icarus Software, 17 Arlington St., Boston, MA 02116. 617/247-1350, 617/247-1527 fax

### The First Compilation Disk

A collection of 400MB of the most popular software publicly available for NeXT computers. Includes utilities, programming languages, games, and information files. Also comes with one year of NeXT-specific Usenet network news and hundreds of old-fashioned UNIX programs.

\$249. Lighthouse Design, 6516 Western Ave., Chevy Chase, MD 20815-3212. 301/907-4621, 800/366-2279

### TheLibrary

An on-line information system for application developers and information publishers designed to work like the public library. "books" are found through a card catalog and located on "bookshelves." Features interactive on-line versions of books.

For price, contact We Design. We Design, 4286 Redwood Hwy #237, San Rafael, CA 94903. 415/479-1105, 415/449-0967 fax

# Classified

NeXTWORLD magazine Classifieds is a bimonthly feature. Rates effective January/February issue, 1991. Per-line rates \$40.00. Thirty-six characters equal one line (count each letter, space and punctuation mark as a character). Four-line minimum, seven lines per inch. For column inch rates, please call or write for complete rate card information. Check or money order for certified check must accompany copy and be received six days prior to close date. All ads accepted at the discretion of the publisher. NeXTWORLD magazine 501 Second St., San Francisco, CA 94107 415/978-3182.

## USER GROUPS



The NeXT experience is meant to be shared. Connect yourself to the NeXT community through the Bay Area NeXT-user Group. For more information, contact BANG at: bang\_request@meta-x.stanford.edu or P.O. Box 8858, Stanford, CA 94309 or fax 415/957-0512.

## DESIGN SERVICES

The look of Good Design sells products in the 1990s. This is Design. John Van Hamersveld, Electronic

Designer, 28247 Via Acero, Malibu, CA 90265 213/457-1747 Fax 457-5485.

Eye-catching icons and logos at affordable prices. In need of icons or logos for your NeXT application? Call Knox Design. In addition to designing icons and logos for top-selling software products, Knox has also produced a clip art library containing over 400 illustrations. Our diverse styles will give any software application a crisp professional look and feel while conveying their intended message. Knox Design, 300 Broadway, #29, San Francisco, CA 94133 415/398-0136.

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grated Media, Inc. 501 Second Street San Francisco, CA 94107 Fax 415 442-1891.

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Proven consulting and development services on the NeXT platform from Adamation. In just over a year and a half, Adamation's NeXT credits include: ported INGRES, a relational data base program, to the NeXT platform; Developed two commercial applications, Who's Calling?, a client management system, and Live Wire, a product for sharing multimedia information; Created over 30 font and back-end application development tools and objects; Provided various clients, including the William Morris Agency (a talent agency with a large network of NeXT computers) with consulting, design and custom software development services.

Adamation offers you a single resource through which to maximize the potential of the extraordinary NeXT technology. Call us and put our depth of NeXT experience to work for you. Adamation 1435 Center St., Oakland, CA 94607 415/452-5252

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Therein lies the first misunderstanding. Multimedia must be as media-independent as possible, and at the root of this kind of computing must be the ability to transcode information from one medium to another. A simple example would be moving text from the visual to the audio domain. Doing the reverse is slightly more difficult but still feasible.

A more fanciful aspiration would be to ask your computer to make a movie for you from a knowledge representation. Although this example may be beyond our reach for a long time, the point is not. We, as a community of researchers, must recognize the extraordinary need to decouple the explicative channel from the knowledge representation. As long as we think of multimedia as a quiltwork of presentational means, our aspirations for multimedia will be stunted. Instead, we must treat knowledge in a media-independent fashion in order to use the presentational channel to say the same thing in different ways.

2. The next misunderstanding is about mismatched impedance. By this I mean the degree to which researchers and manufacturers of multimedia systems have focused on the richness of output, the *son et lumiere* of data display, the power of storytelling. Contrast the quality of multimedia presentations with the back channel, or means by which the user can interact with the presentation. The wonderful ways through which the computer can communicate are mismatched with parsimonious devices and stingy input techniques. We give the user a mouse! This has to be the greatest I/O impedance in the history of computing.

A more appropriate view (and implementation) of multimedia publishing is derived from face-to-face, human-to-human communication, emulating the conversation, not the monologue. Gestural and speech input are examples of what is needed.

3. The third misunderstanding concerns video, of which HDTV (high-definition television) is the tip of an iceberg of confusion. Both resolution and bandwidth are at issue. (Fully digital video is assumed.)

The misunderstanding about video resolution stems from the built-in, almost subconscious, assumption that the source of a picture has a fixed number of scan lines. Whether the resolution is 525, 625, 1125, or 1250, we assume a video sig-

nal to be a given number of lines, no matter how large or small the picture (that is, the receiver) may be. In the "old days" this made sense, because as the screen became bigger and bigger, we assumed that the user would sit further and further away from it, ultimately reaching the canonical distance for a couch potato.

Today, this situation has changed. Our distance from the screen of a workstation does not change as a function of the screen's size. Our thinking about computer screens is more print-like, wherein the number of pixels per square inch becomes the meaningful and operative measure. Unlike Hollywood, we have no predispositions to always fill up the screen; we are a windows culture. For these reasons, and others, the signal itself should be scalable. By scalable I mean there should be variable resolutions and resolution independence (as well as frame-rate independence and aspect-ratio independence). In this way, we can deploy a full range of images, from postage-stamp-size movie icons to wall-size displays, derived from the same representation. In an entertainment example, you could expect the cost of pay TV to vary as a function of the resolution you want (pay-per-view-per-bit). The concept of scalable video may be the single most important idea of the coming decade; it will make video international and useful on all screens, including those yet to be invented.

The bandwidth rut in which we find ourselves has as much to do with stubbornness and smallness of thinking as it does with bandwidth as such. The technical worlds of 64Kb video, 1.5Mb video, and digital TV (studio quality: normal and HDTV) are like three lanes of a highway, each separated by an insurmountable median strip. Each group is optimizing at the expense of a continuum. A wiser approach is to consider that each additional bit per second could provide a nominal or not-so-nominal increase in resolution. In this regard, the International Standards Organization's Motion Picture Experts Group (MPEG) is poised to do a major disservice to the industry by ignoring scalable video and squeezing every last ounce of picture quality out of 1.5Mb per second.

4. The fourth misunderstanding may be the greatest. This confusion is over the difference between symmetrical and asymmetrical coding schemes for video compression—the difference between coding real-time video (as required in teleconferencing) and non-real-time video (movies and multimedia publications). Some scientists

would have you believe that there is none. This is because they have misunderstood the difference. The difference is look-ahead (multiple passes) and recomputation (post-compression).

Look-ahead, by which I mean seconds and minutes, not milliseconds, is the ability to view a video sequence as an average bandwidth versus worrying about instantaneous peaks. In coding a movie, one assumes a single encoding process and millions of decodings. This assumption is correct, but it misleads researchers because it is not the main point about asymmetry. The main, or even only, point is that you can make multiple passes at the data, stuffing the bandwidth peaks into the bandwidth troughs. In this way, any bandwidth can be accommodated for a given movie (yes, each movie is different) with sufficient memory in the receiver. Clearly, the memory skyrockets below a certain bandwidth, but the 1.2Mb per second or T1 (in the U.S. or Europe) is well above that point for video as we know it.

A clear reason to opt for off-line compression is that recomputation becomes possible, where more and more passes at the image stream allow for additional compression. In the future, this will include understanding image content to compress data still further. But even limiting our horizon to pushing pixels, more and more sweeps at the data (with look-ahead) will unquestionably allow better compression (for example, by reordering the sequences).

However, what happened in the industry and, hence, in the minds of many, is that Digital Video Interactive (DVI), first at RCA and now at Intel, proposed and marketed an excellent asymmetrical scheme. But potential buyers were expected to send their movies to a DVI "movie factory" to be compressed. This distasteful idea did a disservice to desktop asymmetrical compression in general and steered most people away from such techniques, even if they were deployable on the desktop. In fact, this may have cost DVI the opportunity to become a serious standard. If asymmetrical coding had been explained in the following way, no one would dispute its value: You can leave your computer on all night, and the next morning your video files will be half the size, double the resolution, and in a format compatible with symmetrical coding.

5. The final misunderstanding about multimedia is that we are misreading the markets. Multimedia has brought a great many computer-aided instruction types from the sixties and seventies,

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along with their ideas for "drill and practice," out of the closet (where they should have stayed). The major marketing thrust is in education, from early learning to adult training. If you are in the education multimedia market, you are a pioneer and are probably ahead of the market. As an educator, I cannot argue against the importance of this market, but exactly how big it is and whom it comprises may not be what is expected. For example, when considering the K-12 market, there is a simple problem: Who is the customer? The child, the teacher, or the school system? Each is distinctly different.

Also, in education, many people regard multimedia today in the same manner as they viewed an advanced human interface ten years ago. Namely, they speak of it as a luxury, not a necessity. In the case of multimedia "courseware" (a word that gives me the willies), people talk about competing with Nintendo or Bill Cosby for a child's attention. That is a very suspect motivation, even though Nintendo is a wonderful example of "I/O compatible" multimedia and, perhaps, the biggest educational force in our nation.

The education market is certain to become better defined and to develop into a large business. But in the meantime, why are people so blind to the bigger market that will evolve from telecommunications deregulation? The huge multimedia market that surely will burst open is electronic Yellow Pages. It will happen not *if* but *when* the divested telephone companies are allowed to enter the information services business. I am convinced that a groundswell of consumer demand will make this happen sooner rather than later.

When it does occur, the Yellow Pages, as a literal example and as a metaphor for personalized direct mail, will be a perfect application for multimedia publishing. It is an example consisting of two consenting adults, so to speak, a buyer and a seller. The seller has a self-interest in making the material. The buyer has a goal and a need. The combination will need little help to evolve into an enormous market for multimedia computing. Just look at what the French Minitel System was able to do with only the White Pages. Imagine what we could do with the Yellow Pages.

Such dreams for multimedia computing in the home are dampened by the threat of Compact Disc Interactive (CD-I) making it to the market. This imminent commercial venture is, so far, a closed system and a television peripheral, designed with the belief that computers, as such,

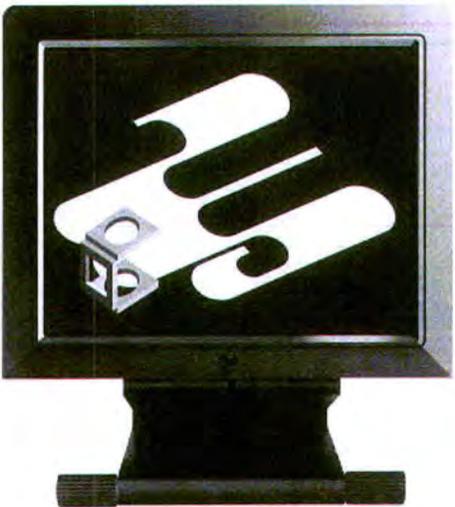
are the anathema of the proverbial man in the street. The 2.5 million Nintendos in the U.S. today suggest that this is not true. In fact, the very market that CD-I is targeting, and which I hail as being the big one, is a market well imbued with computing engines. What we need instead of CD-I is an open architecture for multimedia, wherein a cottage industry can grow in parallel with the emergence of professional materials.

I am constantly reminded that new media are set into motion by "hits." Charlie Chaplin drove movies. Caruso made the 33 rpm record. And, in a real sense, spreadsheets launched PCs. It is also the case that new media start out by mimicking their predecessors and gain their own character much later in time.

Multimedia is not likely to follow these patterns, as it is not an extrapolation but a synthesis

of means, calling equally on the right and the left brain, begging for plural thinking. It is not the evolution of one means of expression into another; it is the combination of ways that are highly concurrent and redundant. The misunderstandings result from incremental thinking about multimedia and will be corrected only with fresh imagination and orthogonal conceptions. If we can think more clearly and invent cleverly, we'll see a rich world of home information and entertainment products and services. In that world, our TV set and computer will be one and the same, and talking to them will be like talking to another person. ☐

Nicholas Negroponio is director of MIT's Media Lab in Cambridge, Massachusetts.



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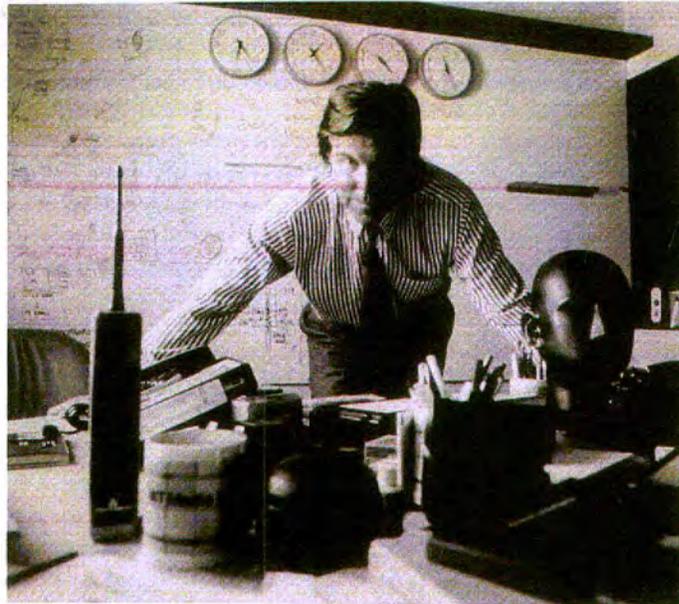
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## Vanishing Point/Nicholas Negroponte

Multimedia publishing—rarely have so many people been so interested in the same thing at the same time. However, in spite of such concentrated attention and major corporate commitments, the topic is plagued by a handful of misunderstandings. The following remarks are my interpretation of the most serious points of confusion.

Before I enumerate these, it is important to recognize that we are in a curious period, one on which historians will look back with some puzzlement. We are experiencing two common, but totally separate, technological evolutions. On one hand, we have manufacturers of television receivers putting more and more computing into their TVs. On the other hand, we have computer makers putting more and more video into their computers. Looking back on this period, historians from the next millennium will wonder why these two business and engineering groups did not talk to each other, and why computer manufacturers were so reluctant to recognize that their biggest market was going to be in home information

and entertainment appliances and services.

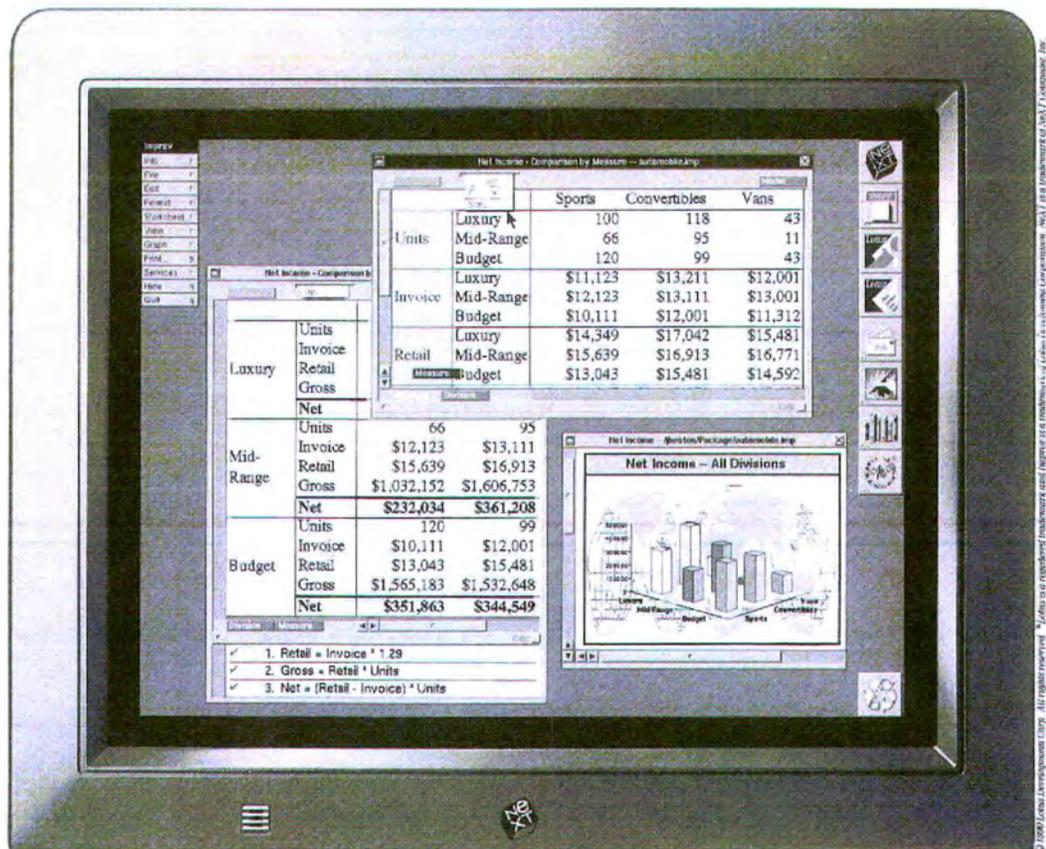
To the degree that one can regard these approaches—TV + computing and computer + video—as being in a race, I predict with great confidence that computer + video will win the race and become the defacto TV of the future. Broadcast television as we know it will slowly, or not so slowly, die (except for sports and election results). Multimedia computing won't be known by that name necessarily, but will emerge as the television of tomorrow, as interactive movies, as electronic games, books, magazines, newspapers, Yellow Pages, and the like.

Now for the multimedia misunderstandings, of which five come to mind.

1. The commonly held definition of multimedia is this: a synchronized meeting of text, sound (music and voice), still images, animation, and video *at the screen*. Today's challenge is twofold: (a) to put all the data types in correct digital form and (b) to provide tools that will choreograph their progress in space and time (call this authoring, if you will). These two challenges carry the assumption that these streams of data are concurrent but separate. They meet only at the screen.

*Continued on page 98*

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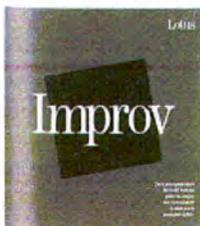
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