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FEATURES

16
Business Calls: The Story of Adamation
The Adams brothers and Who's Calling?
Roger Dubin

22
A Sound Thesis
Research into the roots of computer music at Stanford University's CCRMA
Laura Fredrickson and Henry Cowles

26
Special Report: The New NeXT

28 The Slab
High-performance, low-cost grayscale or 16-bit color: the NeXTstation. Nicholas Bowman

33 True Color
Professional, 32-bit color and real-time video: the NeXTdimension. Rick Reynolds

37 NeXTstep 2.0
Refining the interface. Charles L. Perkins

59 Key Software
Revolutionary third-party applications in key categories. Bruce Webster

COLUMNS

7
Black Box/Michael Miley
Why the world needs a new computer—and a new computer magazine.

9
Living Technology/Hazel Kahan
The computer is more than a machine: It's a metaphor.

11
NeXT ink/Dan Lavin
In order to change the world, NeXT needs to rethink its sales channels.

100
Vanishing Point/Nicholas Negroponte
Multimedia publishing machines will be the TV of the future.
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REVIEW

67
Spreadsheets: The NeXT Generation
Wingz, PowerStep, and Lotus Improv define different
niches in the spreadsheet market. Robert Lawson

73
3270Vision
Connections provides 3270/NeXT connectivity.
Daniel Powers

74
TouchType and Create!
Special-purpose programs deliver sophisticated
PostScript effects. Rick Reynolds

75
Diagram!
Instant charts from Lighthouse Design. Rick Reynolds

DEPARTMENTS

81
In Context
Cyberspace: the shock of entry

82
The NeXT World
The word from the NeXT community

85
Ne(X)TWorking
Setting up your first NeXT network.
Daniel Milks Kehoe and Soft Ross

89
NeXT Question
NeXT's technical support team answers your
questions.

93
Dock Soup
A potpourri of products for the NeXT
NeXTWORLD

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NeXTWORLD

President and Publisher Gordon Haight
Associate Publisher Jeanne Barmand
Editor-in-Chief Michael Miley

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Managing Editor: Darcy DiNucci
Editor, Technology: Dan Levin
Editor, Features: Laura Friedrickson
Copy Editors: Genevieve Anderson, Caroline Arakelian
Contributing Editors: Joe Hutsol, Hazel Kahani, Daniel Miles Kahoe, Charles L. Perkins, Richard M. Reynolds, Seth Ross, Bruce Webster

ART AND DESIGN

Art Director, San Francisco, California
Creative Director: Charles Routhier
Art Direction and Design
Samantha Tripodi

PRODUCTION

Director of Manufacturing: Joanne Bower
Production Coordinator: Vincent Giuliano, Hilal Selo

ADVERTISING SALES

Account Representative: Jacqueline Caldwell

ADMINISTRATION

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Director of Information Services: Kevin Greene
Corporate Services Manager: Cynthia J. Meade

MARKETING

Director of Marketing: Jeff Erickson
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CIRCULATION

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Promotion Coordinator: Joana Niewboer

IDG CORPORATE ADMINISTRATION

Director of Finance: Vicki Peilen
Accounting Manager: Pat Murphy

HOW TO CONTACT NeXTWORLD

General Address
To reach NeXTWORLD by mail or courier, use the address NeXTWORLD, 501 Second Street, San Francisco, CA 94107. You can also contact NeXTWORLD via the Internet at nextworld@diginews.com, via MC Mail at NEXTWORLD or via Compuserve at 76207,1326.

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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 NeXT WORLD, 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 ITSELF, 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. NeXT WORLD 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 two 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. 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: 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,
This (minus my naming conventions) was Steve Jobs' message that day. It was a message meant to remind me of my microcomputer roots, a kind of lesson in evolution. From Jobs' 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 rote 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 ITs 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 smoggendorf. 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 prart it out and look it over. Looks like only one thing remains: 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 discussions, 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 intelligence? 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 using our sense of morality, justice, and humor; our life's emotions and insights. The idea that a human mind could be reduced to a set of procedures and rules seems preposterous to some—yet there are those whose brilliant reasoning would take it that far. That's the point.

Computers seduce us into such hyperbole and dangle 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 intelligence, if you're an AI cynic), virtual reality, hyper space, time-shifting—sources of both wonder and revenue to media analysts, and of consternation to pursers 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 embraced into, entering a special world for the mind.

And each time we enter that world, we are changed. We prove 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, in a manner 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, our 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.

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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 dilemma now hanges 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 worked out the kinks. Now it's time to close the hood, make the interface seamless, and move unto 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 year 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 sell 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...
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, flexible 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 PC). 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.

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NeXT Ink will focus a sharp eye on NeXT and its impact on the microcomputer market. Dan Lovin is technology editor of NeXTWORLD. He is always interested in talking about these and other NeXT issues. He can be reached at 415/978-3166, or e-mail nextworld@sunet.uu.net.

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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" coprocessor. 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.
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.
Who they are  Stephan and William Adams
Company  Astromation, 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 Stephen 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." —Stephen 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 forfeit 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 it 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 applica-

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." —Stephen 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, Stephen 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
pooled their resources. William 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 Adamses. 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 Adamaton. 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 Adamaton'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 Adamaton 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 Adamaton. 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

Respecting 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 Adamaton's future. The relationship with Catalyst Productions also produced key results. Impressed with the custom programming Adamaton 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 Adamaton out of William's apartment and put it on the map. Now the brothers were ready for NeXT. And NeXT 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 adopting programs from other platforms. They also figured, judging from their past interests, that the type of product they would want to create for Adamaton 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 $5000 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 Adamaton 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?, Adamaton'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 Adamaton can approach the corporate community. Who's Calling?, now in release 2.0, has been the
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.

Mastering a Different World

"My brother is a mastermind," Stephan Adams says recently. 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 guesses. "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. When we 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 code 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 says. 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
Researchers at Stanford study synthetic sounds to create the NeXT generation of computer music.

by Laura Freidickson 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 with 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 F6ty 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 Chee, 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, Parry 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," Cook 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
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 another 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. Glendan 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 Notation. The name is a pun of sorts, incorporating the ideas of notation, mutation, and newness. Basically, Notation is an object-oriented visual programming language with which composers can write musical scores in a hierarchical, or layered, fashion.

By developing Notation, 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 Notation, the composer can layer the elements, or objects, or 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.

Notation 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 Foculy/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 note 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, he says, it "would take an hour and a half." The Lisp 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," Schottstaedt 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 scoring 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 features editor at NETWORLD.

Thomas Castro is creative director of CCS, 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 IIfx 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, inter-application 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 Bass 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 NeXTstation and NeXTstation Color provide NeXT power in a sleek and affordable new package.

by Nicholas Baron

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 these 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 2 1/2 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, the block-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 25 MHz 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's 80486-based workstations running at the same clock speed.

In practice, the NeXTstation's performance for 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 test 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 fans 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 test 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 2.8MB 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 $200 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 ommissions 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 new 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. Port 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 Motorola 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 256KB 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 interface. 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 Cubes 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 than 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 NeXTanimation. 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 Baron is the editor and publisher of Baron’s Tech Letter, a newsletter covering NeXT Computers.
True Color

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

by Rick Reynolds

Predictions 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, microphone, headphone jack 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 snapzy 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 other displays operate 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 CLSS0 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 32MB 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, 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 flimsy 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 and 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 massaged 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.

Rich 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 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 and 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 ironed 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
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.

Applications

NeXTstep Workspace Manager, Interface Builder, Application Kit, Window Server

Operating System (Mach, UNIX)

Hardware (68040)

NeXTstep provides a spinning PostScript display. 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 to something that 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 "*.tif." 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 raw 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 computer’s 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.

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
- NeXTinfoManager
- NetManager
- PrinterManager
- UserManager
- Installer

**Release 2.0 Extended**

includes these additional programs:

**End-User Applications**
- Oxford Dictionary of Quotations
- William Shakespeare, The Complete Works
- TgX 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)
- Mocha Debugger
- AppInspector
- PostScript Tools
- Application Kit
- Music Kit
- Sound Kit
- Online 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, CYMK, 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 Wellesley, Massachusetts.
“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.

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

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 a revolutionary 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.

To make this happen, we'd like to take you next 13 pages to see the many extraordinary things it can do.

You'll see how the NeXTstation chip is a strategic tool that raises productivity in a way as revolutionary as the spreadsheet.

Even first-time users could sit down and use it right away, without knowing anything we've used before.

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.

...
new way of work and education, company task. We called and we filled its ranks with many veterans of the actions. the only logical long hard look. al computer, we already stretched, not at all opti-ve terans of the Jtions .

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 extraordinary 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 revolutionize the way an organization works. Whether that organization operates 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 spreadsheet, and eliminate the compromises 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.
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 with your formulas read! Instead of seeing “=B2*BD3,” you Value = Tons * 5.75.” And Improv lists formulas in one place, hiding them in indi-So when you revisit a spreadsheet months to make sense. Like looking at a spreadsheets been designed by si
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.

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, 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.
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 programs that are more sophisticated, and even easier to use.

We also wanted to be compatible 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 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 simultaneously without freezing up or virtual memory swapping.

The NeXT Laser Printer offers the most resolution at the same time as it cuts printing and paste.
You Get.

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).

Not only does NeXT technology allow programs to work together, it helps people work together. Writers, editors, illustrators 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 publishing have already released software packages that fully exploit NeXT technology.

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

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

**PERSONAL COMPUTING BECOMES INTERPERSONAL COMPUTING.**

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

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 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

the NeXTeub server. By linking any one company, any one company can communicate with another – whether in the same world.

In fact, when networks are tied to NeXTmail, different companies become ingless in the same interpersonality.

NeXTmail can virtually instan
eXTmail lets communicate with any person, or a group of people, with a single click of the mouse. With eXTmail, differences in time zones become almost meaningless in the scope of a project. NeXTmail can be delivered virtually instantly, even if a 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.

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

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

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

You can 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 your own customized applications - which is much easier to software with the power of Windows that will ultimately use.

And the interface which may have taken your time previously less than 5% - a step that could put a serious dent in your backlog of projects.

Most importantly, you create are much simpler applications - they're real, industrial applications - every one of which is thoroughly tested and ready for the shelf, and even complete.
Perfect software. NeXTstep environment. Renteed world. Special, making to work with than T computer.“ The most extraor- dinary NeXTstep is 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—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.

Applications you develop with NeXTstep are modular, too, so you can reuse portions whenever you see fit. And they’re 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 NeXT Cube, and is available for the asking with the NeXTvector.
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 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.

If that work involves running TCP/IP and you want to connect to a network of NeXT machines, the NeXT computers can read and write 1.4 and 2.8 megabyte disks in IBM format; EtherTalk 1.4MB or 2MB. So exchanging files between NeXT and IBM computers is no trouble at all.

IBM PS/2 with or without 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 2MB). 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 overshadowed computers many times bigger.
If that work should require IBM® PC file compatibility, so be it. NeXT computers can read and write floppy disks in DOS and OS/2 formats (144 MB or 720 K), 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 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 reproducing machines (such as the Linotype® LPL, LIP and L30) via the Ethernet or RS232 port. All PostScript output devices are fair game, from slide makers to QMS® color printers.
WHAT MAKES A NeXT COMPUTER
A NeXT COMPUTER.

You'll never search for another switch again.
With 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 (when enabled on the keyboard).

If you're a lefty, mouse button functions can easily be reversed.

Only NeXT makes a Digital Signal Processor chip, part of the NeXT computer architecture.

This chip is designed to crunch huge arrays of numbers, making CD-quality sound possible.

It also helps in compressing data and sound files so they can be more easily sent via NeXTmail.

Though significantly slower, 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 4 gigabytes of hard disk storage, up to 64 megabytes of RAM and three NeXTcube™ disks for worlds of new power.
The NEXTstation starts out with a generous eight megabytes of RAM — more than enough for all but the most demanding uses. And it can be expanded all the way to 32 megabytes.

Small world. Using VLSI (Very Large Scale Integration) technology, our engineers have built more than one million transistors 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 5.25-inch hard disk — onto which we’ve already installed an impressive bundle of software (including WriteNow®, Digital Writer, 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. Its storage potential is tremendous: a single 3.5-inch floppy disk can store a colossal 1.88 megabytes of data — an industry first.

The NEXTstation’s internal components are housed in tight stacked modules, all you hear is silence.

It takes an extraordinary effort to build an extraordinary computer. Unlatched by human hands, NEXT machines are produced by an unassuming team of robots in Fremont, California (supported, of course, by a terrific team of carbon-based workers).

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

Our machines can read and write data not only on NEXT formats, but in DGS and OCS formats as well (H.444R and TDF).

So, for example, moving data between Lotus Impression on a NEXT computer and Lotus 1-2-3 on an IBM machine can be perfectly painless.

SIMSON00000516
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. The same offer is being extended to current NeXT owners who opt for our 040 upgrade board. We couldn't even guess where you could make a comparable purchase. Fortunately, we can tell you exactly where to make this one. Just call us at 1-800-848-NeXT.

RIGHT NOW, YOU CAN GET TWO BREAKTHROUGHS FOR THE PRICE OF ONE: $4995.

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

by Bruce R. 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.
WordPerfect Corporation has leapt in to fill that void with WordPerfect for the NeXT. The company hopes WordPerfect will be to the NeXT what it is to DOS computing—the dominant word processor—only more so. On the PC, WordPerfect has achieved only a 70 percent market share; on the NeXT, it’ll probably garner 90 percent. Why? Well, first, because it’s there before everyone else. Beyond that, the product appears to be fast, clean, and complete. NeXT owners used to slogging through WriteNow on an ‘030 machine stored open-mouthed at the near-instantaneous page reforms during the "Spreadsheets: The NeXT Generation" in this issue.) Ashton-Tate, the company that brought you dBase,
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, WHOLESALE PRICE, RETAIL PRICE, EXPENSES, GROSS SALES, and NET PROFITS. In the formula panel, you would enter the following formulas:

"EXPENSES = UNITS BOUGHT * WHOLESALE PRICE"
"RETAIL PRICE = 1.4 * WHOLESALE 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-
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 develop­
ment 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: DataFile from Stone
Design Corporation. This is a flat-file database system that should prove suf­
cient for most simple needs but is insufficient for business and corporate data­
base 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 ver­
sion 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 col­
lections of clip art (ClickArt from T/Maker and Klip It from Adamotion), 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 pro­
mote interpersonal computing. If you drag connectivity and communications un­
der that blanket term, then you can discuss some existing and planned products.
However, true groupware—applications specifically designed for multiple simulta­
neous users—remains more elusive. The new NeXT systems have a high de­
gree 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 capa-
bilities. 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 Atlantic’s Access software, which ties to-
gether UNIX, DOS, and minicomputer networks, represents a firmer commit-
tment. Two firms, Avatar Corporation and Conexions, are offering that
ubiquitous tool of mainframe connectivity, the 3270 terminal emulator. Commu-
nicate, a communications program with extensive DEC terminal emulation capa-
bilities, has been out for a while but is less than overwhelming in interface
design and functionality. Software Ventures Corporation has announced Micro-
Phone 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 run-
ning 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 pro-
gram 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 Manage-
ment System (BDMS), which will allow over-the-network searching, checking-
out, and updating of documents of all types. Built into BDMS is a project man-
agement 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 docu-
ments, 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.
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 here.
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.
NeXTWORLD's Reviews Policy

Products 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.
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 resume 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
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 graphics 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 graphs, with a variety of fonts and colors, tree-Boating 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 SuperCalc 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 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, 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 spreadsheets. 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 common 3D graph shows Wings's graphics superiority. Wings (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.

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

**Wings 1.1.** Informix claims that Wings offers the most advanced graphics, presentation, and programming tools of any spreadsheet, yet it 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 Wings 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 Wings that is unique to the NeXT, though—it's nearly identical to versions of Wings for PCs, Macs, and Sun and HP/Convex workstations. It's an advantage to be able to share Wings files with users on other platforms, and Wings 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: Wings's klunky interface, lousy online help, and sketchy documentation make it relatively hard to use.

Wings has one of the most awkward interfaces available on the NeXT. For instance, there's no contextual 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 Wings 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 Wings's manuals into the Librarian for easy reference.

Except for the klunky interface, Wings'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 Wings'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.

Wings's other strong suit is its programming language, HyperScript. A learn mode lets you quickly whip out a basic program of Wings 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 Wings'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 rescale all linked sheets to be sure the data is up-to-date. This severely limits the links' usefulness.

As a general-purpose spreadsheet, Wings 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, Wings 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

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**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.
Robert Laubman is a self-employed computer consultant who has written extensively about spreadsheet software. He is the author of "Improving Your Spreadsheet Skills" (Wiley). He can be reached at 215-546-6900.

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Despite the flaws of this manual release, Improv's Improv-380 is a useful tool for spreadsheet users who need to work with complex financial models or spreadsheets that contain financial data. The manual is well-written and provides a good introduction to the software's features. However, it could be improved by including more detailed instructions and examples. Overall, the Improv-380 is a well-designed tool that meets the needs of many spreadsheet users.
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**

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**3270-terminal (Display PostScript)**

[Image of a keyboard interface]
TouchType and Create!

by Rick Reynolds

PostScript, 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 2.828K, 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 slidebar, 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 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 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!'s not 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 an associated Macintosh user group service bureau in San Francisco.
Diagram!

by Rick Reynolds

Diagram! 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 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.

$399 (shipped on floppy)

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GRAPhICS

Diagram!

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

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THIS DRAWING TOOL TELLS ALL.

LIGHTHOUSE DESIGN

A graphics tool for people who think and draw...at the same time. Here's a drawing program intelligent enough to really put your ideas across. Diagram! is a true digital whiteboard on which you can create compelling combinations of diagrams, drawings, and data. And its innovative file-linking feature lets you include data from other NeXT applications. That's right, you can drop a spreadsheet file, for example, right into your drawing. Setting links is easy, too. Just drag a file icon over a drawing object and drop it in.

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 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.

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Our product is covered by the next step warranty. The product must be delivered to us within 30 days of the original purchase. Pickup and delivery services are available to all areas. Delivery service is provided by UPS Ground. We will not accept returns for products that have been used or damaged in any way, or for products that do not perform to the specifications listed in the product catalog. Returns are subject to a 15% restocking fee. The cost of the return will be charged to the customer. We will not accept returns for non-defective products. Returns must be processed through our return department within 30 days of the original purchase date. All returns must be pre-authorized by us. Returns are subject to inspection and approval. Returns must be returned to us within 30 days of the original purchase date. Returns must be original packaging and in original condition. Returns must include all components and documentation. Refunds will be issued for defective products. Refunds will be processed within 30 days of the original purchase date. Refunds will be issued for defective products. Refunds will be processed within 30 days of the original purchase date. Refunds will be issued for defective products.
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, 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 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. Shenando Zuberh, 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, buta new concept of work is.

As early as 1953, the computer made its appearance, a machine that was capable of performing tasks that once required human intervention. The technology promised to revolutionize the way we live and work. Yet, as I witnessed during my interviews, the impact of this new technology was not always positive. The clerks and managers I spoke to were often concerned about the changes it brought about. They feared that the computer would replace them, taking away their jobs and leaving them feeling obsolete.

However, the computer also had the power to transform the world. It allowed people to communicate with each other in ways that were previously impossible. It enabled them to access vast amounts of information, and it provided them with tools to solve problems they had never before been able to tackle. The computer was a tool that could be used for good.

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The computer is the latest episode in this scientific infatuation with mechanistic metaphors borrowed from smart machines. Once again, as 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.


As far back as four years ago, the group of scientists about Dr. Rosenbluth and myself had already become aware of the essential unity of the set of problems centering around 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.


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 interaction 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 nextworld@msn.com.
The NeXT World

Edited by Dan Levin and Declan McCullough

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 Nielsen, BaNG has hosted some of the most exciting meetings to be found. Where else can you ask a question about NeXT mail 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 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 usergroups@next.com or call 800/648-NEXT.

UNITED STATES

Alaska
Arctic Circle NUG
Aarne Monne
P.O. Box 900-641
University of Alaska
Fairbanks, AK 99775
907/459-2247
e-mail: aarne@alaska.bitnet

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

SCaN (Southern California NeXT Group)
Michael Mahaney
Dept. of Computer Science and Engineering
California State University, Long Beach
Long Beach, CA 90840
213/985-1350
e-mail: Mahaney@vgradios.csulb.edu

SNUG (San Diego NUG)
Nicholas MacConnell
1155 Stanford Ct.
Del Mar, CA 92014
619/481-7335 or 619/565-9738
e-mail: NeXT@next.com

Sierra (Rocky Mountain NeXT Users Group)
Dave Hubs
4521 Wellington Rd.
Boulder, CO 80301
303/530-2560
e-mail: DaveHubs@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: po@8next.com

Georgia
BuzzSNUG (Georgia Tech NUG)
Erica Leibman
1150 Coller Road NW Apt L-12
Atlanta, GA 30318
404/352-5551
e-mail: ericakl@gtat.edu

newsletters editor: Erica Leibman

NeXT World
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 machineries were shipping immediately after their introduction date, whereas NeXTs are shipping months after the September announcement. However, the SPARCstation 2's rather poor price/MIPS rating ($335 versus the NeXTstation's price/MIPS of $113) 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 were considering purchasing a NeXTstation abandoned their plans in favor of a Cube at Businessland's discount prices.

Illinois
Chicago NUG
Bill Pavol
Northwestern University
427 Dartmouth Place
Evanston, IL 60208
708/491-5368
e-mail: parola@basis.acns.nwu.edu

Massachusetts
Boston Computer Society (BCS) NeXT SIG
Dan Levin
BCS NeXT Group
One Center Plaza
Boston, MA 02109
617/969-6355
newsletter editor: Michael Bruness

Minnesota
Minnesota NUG
Mike Tie
Math and CS Department
Carleton College
One North College Street
Northfield, MN 55057
507/222-4087
e-mail: mrt@carleton.edu

New Mexico
Los Alamos NeXT Users Group
Dwight Burns
Group C-6, MS-8727
Los Alamos National Laboratory
P.O. Box 1663
Los Alamos, NM 87545
505/667-8870
e-mail: db@lanl.gov

New York
GUN (Greater Users of NeXT)
Tim Reed
Objective Technologies
7 Day St. #711
New York, NY 10007
212/227-5677
e-mail: treed@object.com
Group e-mail: gunt@object.com

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

Texas
Austin NUG
Lorne Wilson
930 Capitol of Texas Highway N. #300
Austin, TX 78709
512/343-1111
e-mail: pen@xenon.cs.utexas.edu

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

Washington
University of Washington NUG
Corey Sutton
University of Washington
3500 Academic Computer Center, HG-45
5737 Brooklyn Avenue, NE
Seattle, WA 98105
206/543-5411
e-mail: corey@voicewashington.edu

INTERNATIONAL

Australia
Cug NeXT (Australian NUG)
Paul Davis
P.O. Box 55
School of Business
Bond University
Queensland 4229 Australia
07/552-291. 953-3220 Fax
e-mail: paul@therapie.bond. su.au

Canada
Vancouver NeXT Group
Lionel Talon
Computing Services
Simon Fraser University
Vancouver, B.C.
Canada V6A 1S6
604/955-6702
e-mail: lionel_talon@cs.sfu.ca

NeXThotW, quarterly newsletter
Tom Poiker and Shirley Chan, editors
Department of Geography
Simon Fraser University
Burnaby, B.C.
Canada V5A 1S6
604/291-4515
e-mail: waertson@cs.sfu.ca or
poiker@whiter.t sterile.sfu.ca

Too, monthly newsletter
Robert Lin, editor
Objective Software
1701 W 64th Ave.
Vancouver, B.C.
Canada V6P 2P9
604/261-3168
e-mail: rlin@cs.ubc.ca

Montreal NeXT Section of Club Macintosh
Robert Paulius
2250 Guy Street, Room 303
Montréal, Québec
Canada H2B1P2
514/939-0392
e-mail: poulis@calvin.ca.mcgill.ca

Ottawa NUG
Hugo Defoer
19 du Maguer
Hull, Québec
Canada K1A 9C7
613/736-3605 (NeXT office)
e-mail: phume@host.com
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, makes the future of standardized optical media look dire indeed. It’s 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 3.5MB 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 knows 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.

Dave Levin is technology editor of NeXTWORLD.
Declan McCollough is a student at Rutgers and a frequent contributor to comp.sys.next.
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 sandbox 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 a 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 administrators 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 12 MB of RAM and a 330 MB 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, 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

<table>
<thead>
<tr>
<th></th>
<th>Thin Ethernet</th>
<th>10BaseT Ethernet</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cable specifications</strong></td>
<td>Coaxial RG58/U</td>
<td>Twisted-pair (many types acceptable)</td>
</tr>
<tr>
<td><strong>Topology</strong></td>
<td>Linear (computer to computer)</td>
<td>Star (wiring block at center)</td>
</tr>
<tr>
<td><strong>Maximum length of cable</strong></td>
<td>300m (total) without accessories; 1000m with repeaters</td>
<td>100m (computer to wiring block) without accessories, unlimited with repeaters or concentrators, but 185m between concentrators linked with thin Ethernet</td>
</tr>
<tr>
<td><strong>Additional hardware</strong></td>
<td>Two 50-ohm coaxial cable terminators (one at each end of network); one BNC T-connector for each computer</td>
<td>None</td>
</tr>
</tbody>
</table>

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
/lost+found -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...
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 rapid. 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. Figure 3 shows an opened NetInfo root domain (4). 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 bout 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 /NetServerName/Users/username. 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/export file on the configuration server, which creates conflicts with the existing /etc/export and /etc/spool/mail lines. Open up /etc/export 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 networking 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 Kahoe 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 system 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 nextworld@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 Finder, then open the File menu. The Attributes section of the Inspector panel includes a grid, labeled Permissions, with various boxes you can check, representing three types of users (owner, group, other), with three possible types of access (read, write, 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.

Q. Can I use third-party memory in my NeXT?
A. In the NeXT cube 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 repeatedly.
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 1.2 or later, and it must support 8 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:


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**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.

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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.
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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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**

*Abalon Scan 300/GS*

An 8-bit flatbed scanner that scans at resolutions of up to 300 dots per inch for line art, halftone, and 256 levels of grayscale. Sources in TIFF format and will print to NeXT, Macintosh, IBM, and PS/2 computers. $1799 for 300 GS engine. $2195 for interface kit. Abalon, 48431 Melmont Dr., Fremont, CA 94538. 506/444-5721, 415/663-2807 fax.

*A/Dtk*

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. $1293. Singular Solutions, 920 E. Colorado Blvd., Pasadena, CA 91106. 818/792-9557, 818/920-0003 fax.

*Ariel QuintProcessor*—A small-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 processing. $6895. Ariel Corporation, 433 River Rd., Highland Park, NJ 07202. 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. $230. For floppy-only drives, $250. For Cube floppy drives. $680 for package with software. Digital Instrumentation Technology, 901 18th St., Sunnyvale, CA 94086. 415/571-0100, Los Alamitos, CA 90720. 505/662-1499, 605/662-0099 fax.

*DaynoFile*

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 DaynoFile drive transfer application permits NeXT, DOS, and Macintosh files to coexist inside the NeXT file system and be opened and edited using various compatible NeXT applications. Starts at $750. Dayno Communications, 50 S. Main St., Falls, NY 14404. 615/531-0000.

*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 format and imports into a variety of applications, including medical monitoring, physiological recording, robotics, and analytical data acquisition. Sampling is done before, after, or around a trigger. For price contact Dazzl. Dazzl, 1203 N. Bould Av., Peoria, IL 61604. 309/674-9317.

*Digital Ears*—A hardware/software package for recording, hearing, 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 diagnostics, speech and voice recognition, and acoustic research. $795. MetraAudio, 516 S.E. Morrison, Ste. M-1, Portland, OR 97214. 503/228-5728, 503/230-2627 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. IXscan, 4599 E. Flora St., West Jordan, UT 84081. 801/632-9976, 801/202-2741 fax.

*Jetstream Tape Backup System*—A backup program that uses standard Samba removable and rewritable videotape cartridges. Archives up to 1.3 gigabytes of data per tape at speeds up to 14.4 MB per minute. Error correction code ensures data integrity. $975. MetraAudio, 516 S.E. Morrison, Ste. M-1, Portland, OR 97214. 503/228-5728, 503/230-2627 fax.

*DNA-Arid 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. Miniphone input jack accepts external signals from audio sources like CD players and FM receivers, as well as all industrial-control instruments. $955. Ariel Corporation, 433 River Rd., Highland Park, NJ 07202. 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 $945,000. Epoch Systems, 2 Technology Dr., Westborough, MA 01581. 508/836-4711, 800/826-3802.

*Extron Board*—A board that allows NeXT computers to display video on a variety of platforms. Offers large-screen projectors or monitors. $1950. Extron Electronics, 13554 Linvin Cir., Santa Fe Springs, CA 90670. 213/802-8804, 800/635-9876, 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. $570. Extron Electronics, 13554 Linvin Cir., Santa Fe Springs, CA 90670. 213/802-8804, 800/635-9876, 213/802-2741 fax.


*PMHIDE*—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, 800/629-0040, 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-sized documents. Optional 50-page sheet feeder and OCR software available.
geometric shapes and EPS or TIFF graphics.

DOS, work with Hardware (beta links at)

Type Connectivity

connectivity

WordPerfect

Wordprocessor featuring columns, margins, merge, table of contents, indexes, spell checking, a thesaurus, footnotes and endnotes generation, graphics manipulation, and an automatic timed backup system.

MacPlus/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 database 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.

MacTools

A tool kit containing the NeXT's Object Library for creating and controlling display type for book covers, titles, logos, and other projects. Simple to use and powerful.

Connectivity/Communications

AFS 3.0

A distributed file system for 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.

Communications

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 mainframes and minicomputer applications.

GatorBox

Hardware that links a Macintosh network to Ethernet, so that users on both networks can access files and share laser printers, e-mail, and storage. Also provides TCP/IP services for Unix systems via Ethernet.

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.

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.

DAN, the Data Analyst 1.0

An engineering and scientific data analysis system. Capabilities range from input and output of data file formats to whole generation, mathematical manipulation of data tables in memory, and complete XY coordinate-plotting support.

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.

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 parameters of the solution.

Mathews 2.0

A C-language math library of 100 functions designed to support numerical analysis in applications. Includes over 1,500 source code and a 470-page user's guide with numerous program examples.

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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- Unix workstation

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C. Publication you read regularly (please check all that apply):
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Innovia Improv 1.0
(beta)
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PowerStep

(beta)
A capable spreadsheet, equipped with most of the power features pioneered by leading PC and Mac spreadsheets, marketed by an Interface Builder-gone-wild design. Price to be announced. Ashton Tate Corporation, 21010 Hamilton Ave., Tarrytown, CA 90009. 800/437-4349, ext. 3917.

Who’s Calling? 1.0
A client management system that organizes 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; Adsection, 1453 Center St., Oakland, CA 94607. 415/452-5252.

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A powerful, English-like programming language and running 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 clumsy interface, make this a less than stellar entry. $499; Infomix Software, 1691 College Blvd., Nixa, MO 65619. 913/399-7100, 913/399-7230 fax.

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A "digital whiteboard" that creates everything from organizational charts to annotated illustrations. $390; Lighthouse Design, 6516 Western Ave., Chevy Chase, MD 20815-3212. 301/907-4637, 800/363-2379.

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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 presentation means, our aspirations for multimedia will be stunted. Instead, we must treat knowledge in a media-independent fashion in order to use the presentation channel to say the same thing in different ways.

2. The next misunderstanding is about mismatched impedence. 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 top 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 signal 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 farther and farther 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, whereas the number of pixels per square inch becomes the meaningful and operative measure. Unlike Hollywood, we have no predispositions to always put the screen in a window. 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 postagelumiere 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 cut 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 64 kb video, 1.5 Mb video, and digital TV (audio 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 non-cost 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 1.5 Mb 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 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 2 Mb 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 stream allow for additional compression. In the future, this will include understanding image content to compress data still further. But even with our horizon on pushing pixels, more and more swells 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. If it was portable, that is, if you could send your movie from diskette to DVI, you might change the market. 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 type forms from the sixties and seventies.
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 educa-
tion multimedia market, you are a pioneer and are
probably ahead of the market. As an educator, I
cannot argue against the importance of this mar-
tet, but exactly how big it is and whom it com-
promises may not be what is expected. For example,
when considering the K-12 market, there is a sim-
ple problem: Who is the customer? The child, the
teacher, or the school system? Each is distinctly
different.

Also, in education, many people regard mul-
timedia 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 neces-
sity. 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 motiva-
tion, even though Nintendo is a wonderful ex-
ample of "DO 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 busi-
ness. But in the meantime, why are people so blind to
the bigger market that will evolve from telecommu-
nications deregulation? The huge multimedia
market is bound to burst open is electric
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 li-
teral example and as a metaphor for personalized
direct mail, will be a perfect application for multi-
media 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 this is not true. In fact, the very mar-
tet 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 pat-
terns, 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 misunder-
standings 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 enter-
tainment 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 Negroponte is director of MIT's Media Lab in
Cambridge, Massachusetts.

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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 de facto 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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