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MCDONALD'S
WILL IT ESCAPE
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DOES IT
DISCRIMINATE
AGAINST
WOMEN?

**CELL
PHONES**
A GUIDE TO
THE NEXT
GENERATION



THE **LINUX** UPRISING

How a ragtag band of software geeks is threatening Microsoft and Sun—and turning the computer world upside down



How a ragtag band of software geeks is threatening Sun and Microsoft—and turning the computer world upside down

Met Nicholas Walker, digital nomad. Like blues musicians who once wandered the South singing for their supper, this 18-year-old high school dropout lives out of a suitcase—sometimes trading his software programming skills for a place to crash or some spending money. His travels have taken him far and wide, from a programmers' confab in Istanbul to Massachusetts Institute of Technology's famed Artificial Intelligence Laboratory. Walker's fresh, earnest face tells all: He's an idealist. He believes in sharing his software innovations with others. "I'm not comfortable with selling the things I do and making money from them," Walker says during a stopover at his parents' home in New Hampshire.

Three hundred miles to the south, on the 12th floor of a Manhattan office tower, Walker has an unlikely soul mate. Jeffrey M. Birnbaum, 37, is managing director for computing at brokerage giant Morgan Stanley's Institutional Securities Div. He's so buttoned-down that he wears a suit on Casual Friday. You would think this cog in the capitalist machine would have nothing in common with young Walker. But Birnbaum is betting Morgan Stanley's technology future on the kinds of software projects, called "open source," that Walker participates in.



the way software is made. At the heart of what they do is Linux, an operating system flexible enough to run everything from an IBM supercomputer to a Motorola cell phone. Because it's open source, Linux can be downloaded off the Web for free—though it's typically bought by corporations as part of a package that includes service.

The computer realm may never be the same. Imagine the havoc in the energy business if some newcomer started giving away gasoline. Linux is bringing on a convulsion of that magnitude in tech. Practically every tech company is being forced to figure out how to take advantage of Linux—or to avoid being swept aside by it. And don't be fooled by Linux' harmless-looking penguin mascot, Tux: This stuff is shaking up the balance of power in the computer industry. It poses the biggest threat to Microsoft's hegemony since the Netscape browser in 1995.

Backed by technology titans such as Intel, IBM, Hewlett-Packard, and Dell, Linux is just now going mainstream. From DaimlerChrysler to Tommy Hilfinger—not to mention just about every major brokerage on Wall Street—Linux is gaining ground. Coming from near zero three years ago, it has grabbed 13.7% of the \$50.9 billion market for server computers. That figure is expected to jump to 25.2% in 2006, putting Linux in the No.2 position, according to market researcher IDC. And get this: Starting this year, No.1 Microsoft's 59.9% share in the server market will reverse its long climb and slowly slide backwards,

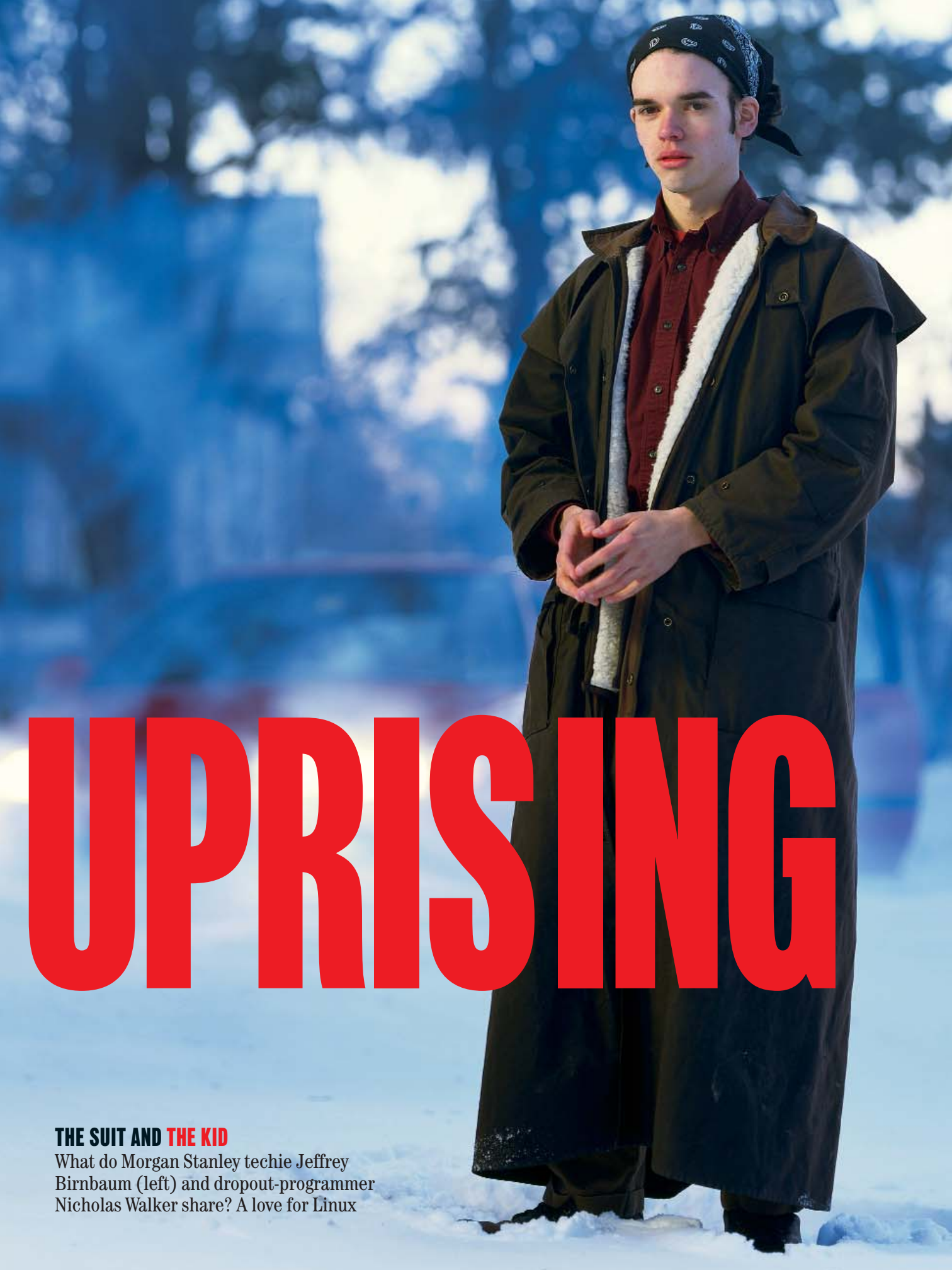
THE LINUX

Birnbaum has fallen hard for Linux, a penny-pinching open-source alternative to computer operating systems such as Microsoft Corp.'s Windows and Sun Microsystems Inc.'s Solaris. He's busy replacing 4,000 high-powered servers running traditional software with much cheaper machines running Linux. Projected five-year savings: up to \$100 million. Does it bother him that counterculture kids like Walker have a hand in Linux? Not a bit. "We see their work, and it's good," he says.

Just when it seemed the technology world had lost its fizz, a powerful movement is on the rise. A ragtag band of open-source programming volunteers scattered around the globe—and hooked up via the Internet—is revolutionizing

predicts IDC. Meanwhile, Linux is finding its way into countless consumer-electronics gizmos, including Sony PlayStation video-game consoles and TiVo TV-program recorders. "Has Linux come of age? The answer is absolutely, positively, unequivocally yes," says Steven A. Mills, group executive for IBM Software.

No one could have seen this one coming, not even Linus Torvalds, the young Finnish programmer who wrote Linux as a cut-down version of Unix for the PC in 1991. Torvalds figured it would be a free plaything for computer hobbyists who weren't satisfied by what big tech companies like Microsoft and IBM produced. "If someone had told me 12 years ago what



UPRISING

THE SUIT AND THE KID

What do Morgan Stanley techie Jeffrey Birnbaum (left) and dropout-programmer Nicholas Walker share? A love for Linux

LINUX EVERYWHERE *The operating system is finding its way into a wide variety of devices and uses*

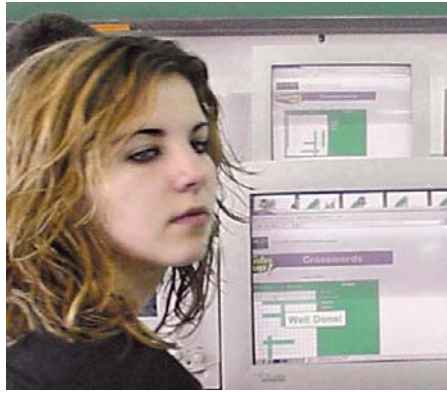


CORPORATE COMPUTING

Linux is gaining ground in corporate data centers, where buyers use it for running everything from Web sites to stock-trading systems. It held a 13.7% market share in servers last year.

DESKTOP COMPUTING

Linux has 2% of the market, but it's making converts. Wal-Mart sells \$200 Linux-based PCs. In Spain, the region of Extremadura is giving away 10,000-plus Linux-based PCs to residents.



SIMULATION

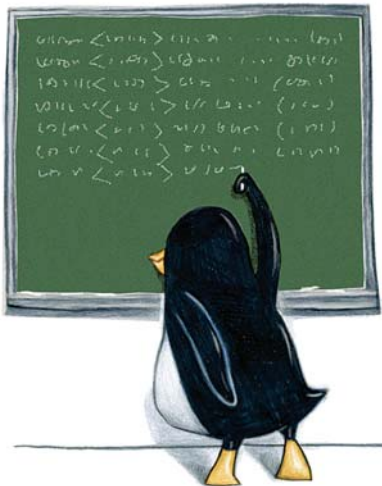
DaimlerChrysler is using Linux machines to simulate car crashes. With Linux, it can do the simulations 20% faster and 40% cheaper than on more traditional computing systems.

would happen, I'd have been flabbergasted," says Torvalds.

How did Linux make the jump into the mainstream? A trio of powerful forces converged. First, credit the rotten economy. Corporations under intense pressure to reduce their computing bills began casting about for low-cost alternatives. Second, Intel Corp., the dominant maker of processors for PCs, loosened its tight links with Microsoft and started making chips for Linux. This made it possible for corporations to get all the computing power they wanted at a fraction of the price. The third ingredient was widespread resentment of Microsoft and fear that the company was on the verge of gaining a stranglehold on corporate customers. "I always want to have the right competitive dynamics. That's why we focus on Linux. Riding that wave will give us choices going forward," says John A. McKinley Jr., executive vice-president for global technology and services at Merrill Lynch & Co., which runs some key securities trading applications on Linux.

Microsoft takes the threat seriously. While it is holding on to its monopoly in desktop systems, Linux' march into servers threatens a key growth area—one that controls much of the Internet. Microsoft Chairman William H. Gates III and CEO Steven A. Ballmer decline to answer questions on the subject. But James Allchin, the group vice-president who runs the Windows business, calls Linux "the No.1 competitor for this company," ahead of even IBM and Sun. Because it's free, Linux is undercutting Microsoft much the way Microsoft has gutted its rivals with lower prices for the past two decades. But Microsoft insists that Windows is more capable than Linux and argues that innovations—such as its Tablet PC technology—will keep coming from commercial software outfits.

Frustrations, though, run high. One Microsoft executive, chief strategist Craig Mundie, even calls Linux unhealthy for the technology industry. "It ultimately is a question about whether societies are going to value intellectual property or not," he says.



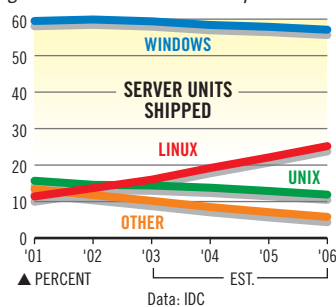
He has a point. The computer industry has been built on a simple premise: Companies invest to create software, sell it, and pour a good part of the proceeds into building more. Now, with the open-source philosophy, that stream of revenue is threatened. And it's not just because the Linux operating system is free. Before using open-source software, tech companies must sign a license in which they promise to give away innovations they build on top of it. "The business doesn't go away," says Eric von Hippel, a professor at MIT's Sloan School of Management. "But it changes forms. Instead of making money from the operating system, you are going to have to make it elsewhere."

For tech companies to thrive in this new world, they'll have to operate differently. This could mean building businesses around selling services, as IBM does, or creating software that runs on top of Linux, like Oracle Corp.'s database. Dell Computer Corp. benefits from Linux and sidesteps its dangers by staying out of the software business altogether.

Longer term, the open-source movement threatens vast sectors of the software industry. True, since the volunteer programmers often lack specialized knowledge, complex business applications are probably beyond their range. But basic open-source databases and e-mail are already available. What happens if corporate customers begin gobbling them up? While no one knows how far open source will go, it could deflate profits.

LINUX MOMENTUM

While Linux' share in desktop operating systems is only 2%, it's fast gaining ground in the market for computer servers



DIGITAL ANIMATION

Pixar Animation Studios, creator of hit films *Monsters Inc.* and *Toy Story*, is switching from Sun servers to Linux for the painstaking rendering of digital characters.

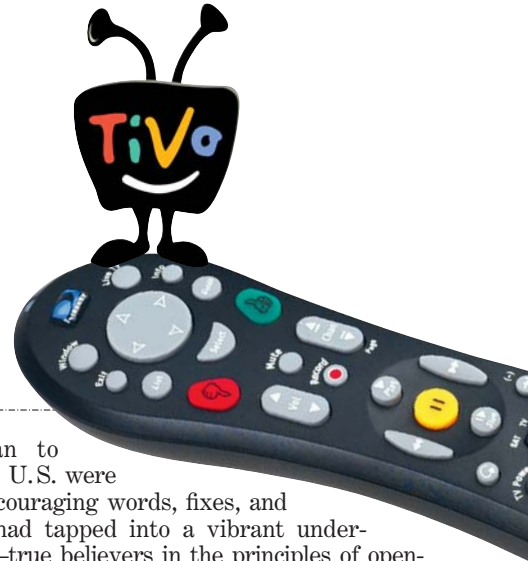


NUMBER-CRUNCHING

Oil explorer Amerada Hess is using a Linux-based supercomputer to help it find pockets of oil and gas.

CONSUMER ELECTRONICS

Linux is the digital brains inside TiVo television-recording devices. Consumer-electronics companies are using Linux to build everything from game consoles to TVs with Internet connections.



Like all big shifts, the Linux phenomenon will produce winners and losers. Likely winners include IBM, which specializes in high-performance computing and is selling twice as many Linux servers as any other computer company. Processor maker Intel is riding Linux' coattails into the world of high-powered computing. And Dell is pumping out low-priced Linux servers and selling them directly to companies via the Net.

While Microsoft stands to lose from Linux, the movement is inflicting far greater damage on Sun. Some of Sun's customers are migrating to Linux machines, which perform similar tasks at a fraction of the price. Online stock trading site E*Trade Group Inc., for example, replaced 60 \$250,000 computers that run on Sun's Sparc chip with 80 Intel-based Linux machines costing just \$4,000 a pop.

What could derail Linux? The biggest risks are intellectual-property issues. SCO Group, holder of the original patents for Unix software upon which Linux is based, has announced plans to form a licensing division and hire superlawyer David Boies to press its claims against sellers of Linux. Another potential problem: There are a handful of commercial versions of Linux. If they evolve into substantially different programs, software companies that sell applications might have to create a separate version for each type of Linux.

None of this, though, looks likely to halt Linux' advance any time soon. So far, the threat of patent claims is not deterring customers. And sellers of Linux vow to keep their versions compatible with one another. A recent survey by Goldman, Sachs & Co. shows that 39% of large corporations now use Linux. While many companies haven't tried it yet, analysts expect an improved version coming out this year to tempt a new wave of corporate tech buyers.

The Linux phenomenon spreads like water—finding its way into all sorts of surprising nooks and crannies. And that's by design. When Torvalds started writing the operating system on a \$3,500 computer while a graduate student in Finland, he made it both compact and flexible, so it could be used in a host of ways. He also decided to share the technology freely with others. The idea: Take it, build something, share what you make. Within weeks of the now-auspicious Aug. 25, 1991, date, when Torvalds first posted the bare bones of his little program on the Internet, dozens, then hundreds, of

people from Japan to New Zealand to the U.S. were responding with encouraging words, fixes, and new features. He had tapped into a vibrant under-ground community—true believers in the principles of open-source software—that would help him build Linux into a global phenomenon.

Torvalds, now 33, still orchestrates this digital quilting bee. He has final say on everything that goes into the updates of his operating system—and doesn't mind being called the "benevolent dictator" of Linuxland. These days, Torvalds' day job is programming for startup chipmaker Transmeta Corp. in Santa Clara, Calif. He speaks at Linux conferences from time to time. But for the most part he prefers to stay in the background, writing code, exchanging e-mails with his comrades-in-arms, and spending his free time with his wife, Tove, the six-time women's karate champion of Finland, and their two daughters.

Torvalds appears unspoiled by success. While he makes no money directly from Linux, he cashed in on the boom modestly by selling some stock he was given before the 1999 initial public offering of Linux seller Red Hat Inc. After that, he traded in his old Pontiac for a sporty BMW Z3. Mainly, he says, he just wants to have fun, which he considers a prerequisite for good programming. "People need to be able to goof off," he says.

The open-source movement's roots are decidedly more radical than Torvalds'. In this software revolution, Richard Stallman, a former programmer at MIT's Artificial Intelligence Lab, plays the role of Karl Marx. The 49-year-old Stallman, with his flower-child hair, has long believed in free software, uncontrolled by copyrights. Back in 1984, when he set out to build such a system, it seemed downright utopian. But Stallman persevered. With a small group of programmers, he started building free software programs. Stallman also created the licensing system on which Torvalds would eventually base Linux.

Open-source software programmers say they're different from Stallman in one major way: They don't have a problem with people making money off their work—or making money

Special Report

themselves. Miguel de Icaza, the Mexican programmer who created GNOME, software that makes Linux easier to use, in 1999 co-founded Ximian Inc., a private Boston company that sells software for making Linux easier to install and update.

Still, de Icaza says it's passion for the work and not the prospect of riches that drives

Special Report

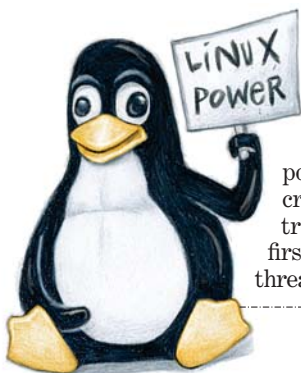
him. "I can't tell if I have worked all my life or if I have never worked a single day of my life," he says.

But if Linux' surge continues, it will be due in large part to the Goliaths of the tech industry. Companies including IBM, Intel, Oracle, and Dell have thrown their weight behind it—and have given the technology credibility with corporate tech buyers. Intel, for instance, interested in expanding its role in the corporate server market, convened a meeting of Wall Street heavy hitters to consider Linux on Dec. 6, 2001, at the Michelangelo Hotel in midtown Manhattan. Gradually, Intel and the Wall Streeters persuaded software makers such as storage specialist VERITAS Software and financial-information suppliers such as Reuters Group to up their commitment to Linux. "Intel's muscle on this was incredible," says Bridget E. O'Connor, chief technology officer at Lehman Brothers Inc.

As it happens, Linux fits comfortably with the strategic imperatives of many of the industry's behemoths. Take IBM. For a change, it's on the cutting edge of a technology shift. That's because in late 1999, Samuel J. Palmisano, then head of IBM's server group and now the company's CEO, asked his staff what the next big trend would be in servers. Their answer: Linux. Within a matter of weeks, intensifying during what became known as the "Christmas meetings," IBM decided to make Linux a pillar of its strategy. During the next year, it earmarked \$1 billion to retool its software and computers to run on Linux and devoted 250 engineers to working with the open-source community. With Linux, IBM was able to put tremendous resources behind the trend toward lower-cost Intel chips without becoming ever more dependent on Microsoft, its archrival in corporate computing.

Today, Linux and IBM are as inseparable as Las Vegas animal tamers Siegfried and Roy. Big Blue has more than 4,600 Linux customers. About 15% of the IBM mainframe capacity shipped in the first half of 2002 ran Linux. And in the fourth quarter, IBM sold \$160 million worth of Linux servers, equal to the combined tally of its nearest competitors, Hewlett-Packard and Dell, according to market researcher Gartner Inc.

Get caught on the wrong side of Linux, though, and you take a pounding. Scott G. McNealy's Sun Microsystems, for example, is losing contracts to rivals who embraced Linux first. "Clearly, Linux poses the greatest threat, at least in the short term, to Sun,"



SURPRISED CREATOR Torvalds saw Linux as a free plaything for hobbyists and hackers

says Thomas P. Berquist, of Goldman Sachs.

McNealy is using a two-track strategy to grapple with Linux. For the top of the market, Sun is racing to keep its own Solaris software a step ahead of Linux. At the same time, it's selling basic machines running Linux for simple tasks such as serving up Web pages. "We have a very deliberate plan here. We're going to stay focused. We're not going to do what IBM or HP are doing—abandoning a 20-year investment in mission-critical Unix operating systems. They're marooning customers," he says.

While McNealy donned a penguin suit during an analyst's conference on Feb. 6, 2002, to show his love for the operating system, the penguin has yet to return the love. Sun just started selling Linux servers last fall. In the fourth quarter it racked up just \$1.3 million in Linux server sales in the U.S., compared with \$675 million in sales of its Unix-based servers, according to Gartner.

Contrary to just about every other tech company and sage, Sun insists that the biggest impact from Linux will come on the desktop. It's tooling up to begin selling desktop computers loaded with Linux and its own Linux-based StarOffice suite of word processor, spreadsheet, and database programs. Yet analysts say Microsoft's Office software, with better than a 95% share of the market, is so entrenched

LINUX CUTS BOTH WAYS

THE WINNERS

IBM Big Blue is selling twice as many Linux servers as any other company and is well-liked by Linux developers

INTEL The processor giant is riding Linux into the world of high-powered computing in corporate data centers

DELL The thriftiness of Linux appeals to Dell, which can sell Linux servers cheaper than other major computer companies

RED HAT The leading seller of Linux has lined up distribution deals with just about every big computer company

THE LOSERS

SUN MICROSYSTEMS Customers are abandoning its Solaris software for Linux, which performs similar tasks

MICROSOFT Linux wins the price war and is luring corporate customers leery of getting locked into Microsoft

LINUX STARTUPS Other than Red Hat, there's not much room for these small fry

LINUX PURISTS Linux developers who don't like the idea of working with capitalists had better get used to it

that it will be hard to supplant. Faced with the costly prospect of converting vast terabytes of Word and Excel documents, desktop users will likely stick with Microsoft, predicts analyst Al Gillen of IDC. "Microsoft won the desktop battle a long time ago," he says.

Special Report

Still, large companies are jumping on the Linux bandwagon for servers. And with so many bruisers aboard, there's scant room for startups. Among them, only Red Hat is a bona fide success. Like a half dozen other upstarts, it sells packages including Linux software for desktop computers and servers. But because of the ban on selling Linux itself, Red Hat is essentially selling related software, ongoing technical support, and maintenance for corporations. Three years after going public, the company made its first-ever profit in its third quarter ended Nov. 30—a scant \$305,000, on \$24.3 million in revenues. It seems to have staying power; though, thanks to distribution deals with the likes of IBM, HP, and Dell. And it got certification on Feb. 11 to sell to the Defense Dept.

While a host of Linux-oriented startups were launched in the late 1990s, most of them were geared to selling to dot-coms—many of which have since gone out of business. A dozen Linux companies failed in the past two years, including Loki, a gaming company, and Eazel, which was making Linux easier to use. VA Software Corp., formerly VA Linux Systems, a maker of Linux-based computers, is just hanging on as a seller of software-development tools—this only three years after it broke all IPO records with a share price that soared 698% on the first day of trading.

A handful of industry giants can make the market grow faster than an army of startups ever could. That's especially true internationally, where the big companies can afford to operate sales forces in all the major countries and many minor ones. IBM, for instance, sold Linux computers to China's

postal service for 3,200 post offices in a single province. Last June, Germany's Interior Ministry and IBM signed a contract to enable the public sector in Germany to buy Linux.

It's no surprise that industry giants such as IBM, Intel, HP, and Dell dominated the LinuxWorld conference at New York's Jacob K. Javits Convention Center in January. Their huge booths crowded out the more modest digs of Red Hat and Ximian on the show floor. During a ride down the escalator on the way out of the building, three Gen Y guys dressed in black and sporting multiple facial piercings seemed to represent a passing era. One of them, talking on a cell phone to a friend, called the gathering "boring." Down-escalator, a young woman dressed in a camouflage shirt and pants and a pink babushka heartily agreed. "It's all Big Business now. Linux has been taken over by the suits," she sneered.

Her name was oh-so avant-garde: Scirocco Six. Yet it turned out she was working for none other than Microsoft.

These days, even the titans of industry are hurrying to act like rebels. But as the Linux movement continues to push its freeware into the world, a delicate balance is forming. Its success hinges on keeping the peace between two extremes: the volunteer programmers like Nick Walker, who pull all-nighters writing code to change the world, and the commercial types like Morgan Stanley's Jeffrey Birnbaum, who use the software to save money. It's a weird twist on capitalism. But it just might work.

By Jim Kerstetter in San Mateo, Calif., with Steve Hamm and Spencer E. Ante in New York and Jay Greene in Seattle

BusinessWeek online

For a Q&A with Sun's McNealy, go to the Mar. 3 issue online at www.businessweek.com.