A BARNRAISING IN CYBERSPACE: Linux And The Free Software Movement

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Introduction

As the 1990s came to a close, the fabled "Y2K bug" and the media hype propelling it caused many to consider the quality of their software. As alarm about the bug spread, Free-Source (also called Free or Open-Source) software[1] gained momentum, built around a tongue-in-cheek "devotion to an ideal that Linus Torvalds [the inventor of Linux]and Eric Raymond [a self-professed "Open-Source evangelist"] call 'software that doesn't suck.' "[2] As a result of this movement, a new software development methodology is currently gaining popularity. In the final months of 1999, there was much discussion in Silicon Valley and on Wall Street about the Linux-based operating system (OS). Linux is unique because, unlike any other operating system in the history of software, it was developed by thousands of global volunteer programmers working collectively and without a profit motive under the guidance of Torvalds.

Linux, like all operating systems, is a collection of computer programs that work together to instruct the computer on how it should operate. The operating system is the first program that must run on the computer; without it the computer is useless. The most popular operating system for personal computers is currently Microsoft Windows; other examples include the Apple Macintosh OS, BeOS, and UNIX. Linux, which is a modern adaptation of UNIX, differs from other operating systems in another important way—it is the first major operating system whose distribution is not limited by copyright laws surrounding the idea of "intellectual property." As Free software, Linux's source code (the series of commands created and readable by programmers) is freely available to anyone who wants to study it. This openness is in contrast to proprietary software, wherein source codes to programs are closely guarded trade secrets, viewable only by certain programmers employed by the company. Free software, unlike proprietary software, is subject to global peer review. As projects like Linux demonstrate, such openness turns out to be a tactical advantage that greatly improves the stability, functionality, and reliability of the software. It allows any competent programmer, whether an employee of the software developing company or not, to modify the program. It also allows companies or individuals to hire independent programmers to fix bugs or customize their Free software. This mode of operation has a decentralizing effect on the software industry as a whole since, among other things, it is not necessary to wait for the original authors of the program to fix bugs or implement desired features.

In one sense, this desire for control caused the Free software movement, which grew out of frustrated software developers wanting to reclaim control over their software. Since its inception in 1983, Free software programmers have created at least twenty-five million lines of code, resulting in thousands of useful computer programs that are freely available for anyone to use, inspect, de-bug, customize, or modify.[3] With such a huge infrastructure of Free software in place, it is no longer necessary to purchase expensive proprietary software to run a computer. Additionally, the Linux operating system generally runs more efficiently on modern hardware due to, among other things, its inherent multitasking capabilities.[4] Linux, like UNIX before it, is simply a more stable environment for a user to connect to the Internet while running browsers, e-mail programs, word processors, and spreadsheets, and listening to music played by a CD player or an MP3 player all at the same time. To top it off, Free software is not proprietary and is readily available for a nominal cost.

The Free software movement raises several intriguing questions: How will the Open-Source development methodology affect the quality and rate of software evolution? How will the liberation of software affect the relationship between humans and technology? How can companies specializing in Free software remain profitable if their products are given away? Will the Free software movement affect power relations within the software industry? Before exploring possible answers to some of these questions, this paper will first trace the history of the Free software movement in enough depth to enable the reader to understand some of what is at stake. I will then argue that the Open-Source methodological paradigm shift is just the beginning of the next phase of the Information Revolution; the Free software movement has initiated an embryonic sociological revolution of profound significance. The continuing evolution of Free software can be seen as a computer-simulated socioeconomic experiment of unprecedented scale, showing that not only are large numbers of people willing to cooperate for the benefit of all humanity rather than for personal profit but also, more importantly, that global communities of people working together in this manner wield more political and economic power than even the largest, most profitable corporations.

History Of The Free Software Movement

> Free Software is about giving software users the freedoms that are necessary to treat each other as friends and form a community. This means that you must have the freedom to change a piece of software to do what you want or need it to do. You must also be free to redistribute that software so that you can help your neighbor. It follows from there that you must be free to publish an improved version of that software, so that you can share your improvements with other people who can also benefit from it and build on it further.[5]

The Free software movement was born out of the hacker[6] culture on 23 September 1983, when Richard Stallman of the Artificial Intelligence Lab at MIT announced the creation of the GNU project. This project was designed to provide "a sufficient body of Free software" so that people ethically opposed to proprietary software "will be able to get along without any software that is not free."[7] "GNU" is a recursive acronym for "GNU is Not UNIX"—a playful way to define the project in terms of itself. UNIX is a powerful—and expensive—operating system designed to run on large computers usually found in laboratories and universities. Since a computer cannot run without an operating system, it was clear that a fully functional, Free software operating system should be a high priority of the GNU project. Therefore, the first goal of the project was to "write a complete UNIX-compatible system . . . and to give it away free to everybody who can use it."[8] To re-create a system as large as UNIX would not be possible single-handedly; Stallman realized from the beginning that he would need help. Additionally, he was looking to create a community wherein individuals could freely share software, scrutinize the source code, and learn from one another. Stallman also envisioned working with people not motivated by profit: "I may be able to hire a few people full or part time. The salary won't be high, but I'm looking for people for whom knowing they are helping humanity is as important as money."[9] In 1985, Stallman and other GNU programmers created the Free Software Foundation, designed as "a tax-exempt charity for Free software development."[10]

One of the first and most important contributions of the GNU project was not a computer program, it was a new philosophy about freedom, copyright law, and the empowerment of software users. Stallman realized early on that if he were to continue to be employed by MIT, conflict over who "owned" the GNU software could arise; MIT could conceivably claim his work as its property. To prevent such a conflict, Stallman resigned from MIT. Moreover, in order to clearly define Free software for the community, while at the same time preserving the freedom of Free software, the GNU project created a new kind of licensing agreement in 1985 called the "GNU General Public License" (GPL). This license had (and continues to have) a profound influence on the Free software community. The GPL was carefully written to function within the framework of existing copyright law, but reversed it to remove restrictions imposed by "intellectual property." Under the GPL (amusingly referred to as "copyleft—all rights reversed" in the Free software community), the creator of the software still holds the copyright but allows anyone to use the software for any purpose, provided that any new versions of the software remain free to everyone else. As a result, anyone can take any GNU program (or any program released under the GPL) and modify it, customize it, and re-release the derived program themselves, provided that the derived version also offers the same freedoms to other users as the original program. This license prohibits a company from appropriating Free software, privatizing it, and preventing others from seeing any improvements that are made. With the GPL and the Free Software Foundation in place, Stallman became a devoted advocate of Free software in general and of the GNU project in particular.

Over the next several years, the GNU project became more complete as volunteer programmers replaced components of the UNIX system with GNU versions. By 1992, all essential components of a complete Free software operating system had been written except for the kernel, the core of the operating system itself. At this same time, Torvalds, then a graduate student at the University of Helsinki, was working on a functional UNIX kernel of his own called Linux (a synthesis of UNIX and his first name). It is important to note that the work Torvalds was doing would not have been possible without the tools (editors, compilers, debuggers, etc.) developed by the GNU project. When Linux became functional, it merged with the rest of the GNU software, creating a fully functional Free software operating system most accurately known as GNU/Linux. This new system was made available on the Internet, which was also in its early stages and growing rapidly. GNU/Linux spread like wildfire among online programmers, who began using and modifying it, allowing it to grow with unprecedented speed and function:

> From nearly the beginning, it was rather casually hacked on by huge numbers of volunteers coordinating only through the Internet. Quality was maintained not by rigid standards or autocracy but by the naively simple strategy of releasing every week and getting feedback from hundreds of users within days, creating a sort of rapid Darwinian selection to the mutations introduced by developers. To the amazement of almost everyone, this worked quite well.[11]

Because GNU/Linux was modeled after UNIX, in its embryonic form it did not represent a technological breakthrough. Its innovation "was not technical, but sociological."[12] Allowing an open, global, peer-review community of programmers to cooperatively build Linux resulted in an operating system that quickly became very stable and reliable for critical applications, thus representing a viable alternative to expensive proprietary operating systems.

Due to its stability, reliability, and nominal cost, Linux first became dominant in the Internet server market. A server is simply a large computer designed to allow other computers to connect to it. Every Internet service provider (ISP), for example, is essentially a large-scale server. Linux became very popular on Web servers running another Free software program called Apache, which was designed to host websites. This combination of Free software applications quickly became an obvious choice for young ISPs with limited budgets:

> The advantage of the Apache choice is very strong. Just how strong, we may judge from the monthly Netcraft survey, which has shown Apache steadily gaining market share against all proprietary webservers since its inception. As of June 1999, Apache and its derivatives have 61% market share—with no legal owner, no promotion, and no contracted service organization behind them at all.[13]

This trend is likely to continue as the Internet expands into parts of the world less affluent than the West. "A need for low-cost, high-performance Web servers is emerging as regions like India, China, Eastern Europe, and other countries . . . begin to get 'wired' to the Internet. Linux is proving to be an optimal solution in this environment."[14]

These advances in the Free software movement did not go unnoticed by the industry. In 1998, Netscape decided to release the source code to Communicator, their extremely popular Web-browsing software. Netscape admitted to being profoundly influenced by Raymond's *The Cathedral and the Bazaar*, one of the first socioeconomic analyses of the pragmatic and technical benefits of Free software's developmental methodology.[15] Netscape represented the first major software company to convert one of their already existing commercial software packages over to Free software ideology. This move legitimized the Free software movement as something more than a fringe experiment; it had real potential to affect the software industry. As Raymond put it, "for the first time in the history of the hacker culture, a Fortune 500 darling of Wall Street had bet its future on the belief that *our way was right*."[16] Many within the Free software community realized that Netscape's announcement provided "a precious window of time within which we might finally be able to get the corporate world to listen to what we have to teach about the superiority of an open development process."[17]

As a result of Netscape's decision, Free software community members convened for a strategy session to develop a plan to maximize this window of opportunity. At this meeting in February 1998, "the real conceptual breakthrough . . . was admitting to ourselves that what we needed to mount was in effect a *marketing campaign*—and that it would require marketing techniques (spin, image-building, and re-branding) to make it work."[18] In the past, the idea of Free software had not been met with enthusiasm in the corporate world. The word "free" conjures images of giving away the very income-generating product itself, working against the inclinations of the profit-oriented culture of the business world. At the meeting, the committee concluded that

> the term "Free software" had done our movement tremendous damage over the years. Part of this stemmed from the well-known "free-speech/free-beer" ambiguity. Most of it came from something worse—the strong association of the term "Free software" with hostility to intellectual property rights, communism, and other ideas hardly likely to endear themselves to an MIS [Management Information Systems] manager.[19]

The goal of this marketing campaign was to convince the business world that the Free software development methodology provided benefits too strong to ignore. It was at this meeting that these Free software community members decided to distance themselves from the Free software label and mount an aggressive marketing campaign to re-brand Free software as Open-Source software, a move that has divided the Free-Source community into two camps: Free software advocates who believe that freedom is of primary importance, and Open-Source advocates who place primary importance on adoption by industry.

Since the Open-Source marketing campaign began in February 1998, Free-Source software has developed rapidly. After Netscape's endorsement, major computer companies such as IBM, Corel, Dell, Compaq, Sun Microsystems, Hewlett Packard, Apple, and many others have embraced the Free-Source development paradigm at some level. The August 1998 issue of *Forbes* featured a cover story on Open-Source with Linus Torvalds. Then, in November 1998, as the Microsoft antitrust trial was underway, some internal Microsoft documents outlining the threat of Free-Source to their business and some possible strategies to subdue it were leaked to the press. These were termed the "Halloween documents" because they were leaked on 31 October 1998. The Halloween documents, which have been confirmed as genuine by Microsoft,[20] "were a ringing testimonial to the strengths of Open-Source development from the company with the most to lose from Linux's success."[21] More importantly, the press descended on this story with remarkable zeal, particularly since the antitrust trial was not going well for Microsoft. Free-Source software was, for the first time, in the international spotlight.

The latest chapter in the Free-Source movement (as of this writing in January 2000) is Wall Street's embrace of new companies committed to Free-Source software ideology. Two companies, Red Hat Linux (makers of the most popular Linux "distribution" or brand) and VA Linux Systems (makers of high-end computers customized for Linux) have both had record-setting Initial Public Offerings (IPOs), with their stock prices starting in the teens and soaring to well over two hundred dollars per share by the end of the first day of trading.[22] These two companies have raised millions of dollars in capital; both companies are now worth billions of dollars on paper.[23] As I write this, both Red Hat and VA Linux are pouring their new capital into projects designed to take Free-Source software development to unprecedented levels of scale and sophistication. For example, VA Linux recently set up "SourceForge.net," a website designed to provide an infrastructure for efficient Free-Source software development. This service, available free of charge to the Free-Source software community, allows anyone to house their Free-Source projects on a fast, reliable, consistent website for others to inspect, use, and improve. That a Free-Source company would set up such a large-scale site and give its services away is not so surprising; these companies depend on a healthy Free-Source software community for survival. Thus, it is in their best interest to ensure the prosperity of this community as a whole. This new service is significant because up until these successful IPOs took place a few highly skilled programmers volunteering in their spare time largely propelled the Free-Source software movement. With significant money behind the project, the rate of Free-Source software development should continue to accelerate.

The next frontier for Free-Source in general and Linux in particular is average "desktop" computer users. These users, who need only to surf the web, check their e-mail, and use basic office software, can gain tremendous benefits from Linux and Free-Source software. I myself have been experimenting with Linux and have found it to be much more stable than Windows. There is an impressive number of very usable Free-Source programs, but most are still in their infancy. One benefit of Free-Source software, however, is that it matures quickly; these programs should be no exception. Once these projects mature, there will be fewer and fewer reasons to pay large software companies to use less stable software that cannot be improved by the Free-Source community. This is the first paper I have written under the Linux platform; although the software is not yet as polished as the commercial software I am used to, it is quite usable. And the computer hasn't crashed once, which is a new experience for me. In the next few years, users will increasingly be confronted with a question whose answer will become more and more obvious: should I continue to use expensive, unstable proprietary software or switch to rapidly evolving, inexpensive, more stable Free-Source software that has similar and growing capabilities?

I predict that proprietary software for the masses will not exist as we know it within a few years.[24] It has been interesting to write this paper in mid-January 2000, as it seems there is another major announcement in favor of Free-Source software on almost a daily basis. To illustrate my point, here are some news items from the past few days alone: On 4 January 2000, VA Linux officially launched the aforementioned "SourceForge.net."[25] On 5 January, Intel announced a new line of Internet appliances that would run Linux, despite Intel's long relationship with Microsoft Windows.[26] On 7 January, China announced that Linux was outselling both Microsoft Windows98 and WindowsNT.[27] January 10 was a very eventful day, with IBM announcing a "major expansion of Linux efforts," making all of their products Linux compatible,[28] and Caldera, another Linux software vendor, applying for a $57.5 million Initial Public Offering.[29] Clearly, the market is demanding Linux. As Sam Palmisano, senior vice president of IBM explains, "Customers say they want choice . . . a flexible, open environment. They find this a very attractive alternative."[30] Free-Source software, with Linux as its current foundation and champion, is poised to offer this choice.

Big Business And Beyond

> The great irony here is that this utopia was not built like an empire, or by people who were, in Walt Whitman's words, "consumed with the mania of owning things." It was built like an Amish barn by hackers who made it because they needed it, and it sure wasn't going to come from the old software industry. The result was a second world—one made with code rather than matter—that embodied and expressed the long-overlooked virtues of the first: no one owns it; everyone can use it; anyone can improve it. These principles are so basic, they undermine all efforts to deny them.[31]

With the success of Free-Source, one of the most common questions in the business world is "how can companies make money when they give away the product?" Before addressing this question, I must point out that it misses the fundamental point of Free-Source software. Unlike proprietary software, which would never have been written in the first place without a profit motive, Free-Source software exists outside of the commercial environment and, therefore, cannot be controlled by commerce. Free-Source does not depend on industry; conversely, if present trends continue, industry will depend on Free-Source. In other words, industry is bootstrapping itself to the already thriving Free-Source movement.

With this process in mind, we return to the profitability question: the answer is that *the Free-Source software itself is not the product*. Rather, successful Free-Source companies are building a service industry around ubiquitous Free-Source software. As a result, the software industry itself is beginning to shift from a manufacturing industry to a service industry. Because customers can get Free-Source software easily and inexpensively from a number of different places, in many cases at no cost, a company depending only on the sale of their software would fail. As Free-Source software becomes more and more common, proprietary software companies who don't empower their users could make themselves obsolete because it is now possible to operate a computer without using any proprietary software at all. Most users familiar with the level of freedom and control provided by Free-Source software will not willingly return to a situation in which they have no freedom or control. Therefore, many in the proprietary software industry are now realizing that they had better figure out a way to make money in the Free-Source environment.

As a result, many viable business options have come out of the Free-Source movement. All successful business plans in Free-Source have a common understanding of the change underway in the software industry. Since Free-Source software cannot be exclusive intellectual property, a successful Free-Source business must turn to another source of profit. In short, the Free-Source software movement is changing the rules of the software industry game, which will ultimately remove power and control over software from large software corporations and return it to individual users.

One approach to the new software industry game, used by Red Hat Linux, is to position themselves as the premier brand of operating systems available to consumers. That is, Red Hat does *not* distribute Linux. Red Hat distributes *Red Hat Linux*. This is not contradictory, despite the fact that Red Hat Linux is very similar to and compatible with all other flavors of Linux. Bob Young, CEO of Red Hat, draws an interesting analogy in describing Red Hat's strategy:

> Ketchup is nothing more than flavored tomato paste. Something that looks and tastes a lot like Heinz ketchup can be made in your kitchen sink without so much as bending a copyright rule. It is effectively all freely-redistributable objects: tomatoes, vinegar, salt, and spices. So why don't we, as consumers, make ketchup in the kitchen sink, and how does Heinz have 80% of the ketchup market? . . . Heinz has 80% of the ketchup market because they have been able to define the taste of ketchup in the mind of ketchup consumers. Now the Heinz Ketchup brand is so effective that as consumers we think that ketchup that will not come out of the bottle is somehow better than ketchup that pours easily![32]

In the same way that Heinz has become identifiable as "superior ketchup," Red Hat is endeavoring to become identified as a "superior computer operating system." They may or may not succeed, but this is a valid goal to pursue. If Red Hat is even marginally successful, they will certainly be profitable.

Brand positioning is only part of the story, however. A fully functional Linux-based operating system can be purchased for around thirty dollars (note the difference in price between a Free-Source system and a proprietary system. To give a comparison, Microsoft Windows2000 Professional and Microsoft Office2000 Premium Edition together have a list price of $819, more than twenty-seven times the cost of a complete Linux system).[33] This Linux package will contain one or more Linux CD-ROMs, a manual, and most likely some sort of technical installation support from the manufacturer. The CD-ROMs will contain all the programs most users ever need: the operating system itself, word processors, Web browsers, e-mail clients, image manipulation programs, spreadsheets, databases, Webservers, MP3 players, games, and hundreds of other programs. These same packages can also be downloaded from the Internet at no charge. Additionally, third-party vendors often sell legal CD-ROM copies of the complete download versions for as little as $1.99.[34] Many people then ask, "why would anyone pay thirty dollars for something they can get for free or for $1.99?" Again, this question makes the mistake of assuming that the software itself is the product. The fact that millions of Linux distributions have been sold shows that people are willing to pay thirty dollars for the "official" package for the benefits not found in the free versions.[35] First, users will pay for the convenience of not having to download huge files from the Internet on today's slow modem connections, which takes many hours and a reliable Internet link. Second, users will pay for the knowledge contained in a well-written, up-to-date instruction manual. Third, users will pay for the peace of mind of knowing they have someone to call if they run into problems installing the software. Free-Source companies understand that they are not selling software; they are selling convenience, knowledge, and peace of mind, delivered in the vehicle of very high quality, peer-reviewed software. As such, Free-Source software vendors are service vendors.

Another company with a successful Free-Source business model is VA Linux. Building on business plans from other national computer retailers such as Dell and Gateway 2000, VA Linux sells high-end computers designed to run Linux. VA Linux has put quite a bit of time, energy, and resources into furthering the development of Free-Source software, and they expect no direct return on this investment. Their investment return will come indirectly through new users. In the meantime, VA Linux has endeavored to position itself, with substantial success, as the leading maker of high-end Linux computers. These are only two of many successful business models in this very young industry. Undoubtedly, many more Free-Source businesses will come and go, enjoying varying degrees of success.

Despite the early success of Free-Source companies on Wall Street and in the business world, there is much more at stake than these companies' profit margins. Similarly, despite Microsoft being a popular target of acrimony in the Free-Source movement, there is more at stake here than monopolistic tendencies. This is a much bigger issue, involving more than one company or even one industry. The Free-Source software movement represents empirical proof that thousands of individuals can and will work together to produce technological innovation for reasons other than profit. This circumstance has only recently become evident because the instantaneous communication provided by the Internet has only recently made it possible for so many people to communicate and work together so efficiently. It is no accident that the Free-Source movement's exponential growth exactly coincided with the similar growth of the Internet. This latent benefit of the Information Revolution gives us a glimpse at how our ideas about commerce will be revolutionized, just as the Industrial Revolution changed commerce in a previous epoch.

This phase of the Information Revolution is shattering the monopolistic grip the commercial software industry has held on technological innovation in software. In the past, innovation in the software industry was only a means to a profitable end, whereas with Free-Source, innovation is the end in itself. This change has interesting effects: in the proprietary software world, limited competition becomes a factor. If Microsoft Word (for example) isn't adapted to my needs as well as Corel WordPerfect, then I should use WordPerfect as the lesser of two evils. Instead, Free-Source allows for the following scenarios: AbiWord (for example) wasn't perfectly meeting my needs because of a bug in line 3,477 of its code, which was reported to me by an independent programmer I hired to repair the bug. I have submitted this patch to AbiSource to include in future versions of their product, improving the state of AbiWord and any other processor with the same bug. Short of ludicrous, oppressive legislation outlawing Free-Source, it will continue to grow rapidly through its accelerated mutation and selection process. The cat is out of the bag.

In general, people who enjoy freedom of any kind are not usually willing to return to situations of restriction. Consequently, the software industry will be transformed from an oppressive situation in which profit is the motivating factor to one in which empowering customers to use high-quality software however they wish is most important. This new software industry will, by its very nature, prevent single companies from creating and maintaining monopolies. Even new, successful companies such as Red Hat and VA Linux will never gain hegemony for these reasons. Since the last word of power and control over software rests with software users, the Free-Source movement will always find a way to circumvent monopolistic abuses.

If the Free-Source phase of the Information Revolution extends beyond the software industry, then we will no doubt need to reevaluate our present notions of "ownership" and "property." Traditional notions of "intellectual property" as presently applied to information technology equate to unwelcome control over many people's actions. More importantly, notions of intellectual property presuppose that the profit of a small number of individuals (landlords of the intellectual property) is more important than the advancement of the human race and its technology. Free-Source is reversing this presupposition. Despite software monopolies, there is no scarcity inherent in software; software as digitized bits of information can effortlessly be redistributed. Such control over information and the ability to freely manipulate it is, indeed, the whole point of computers. In a similar way, it has been suggested, for example, that "scarcity is not the cause of hunger" in the world, and that this problem's "solution can only be found by addressing the issue of power."[36] As food-production technology continues to improve, making food more abundant, humanity can learn a lesson from the Free-Source movement by making food ubiquitous through even distribution unhindered by economic power relationships that bring profit to a few and oppression to the vast majority.

As it currently exists, the Free-Source movement represents a test drive in a post-scarcity environment. Similarly, it can be seen as a socioeconomic experiment of global scale and with global repercussions. This experiment, as the next phase in the Information Revolution, will require us to ask new questions: How should economies be structured? Is it acceptable to put private profit ahead of public well-being? Is cooperative technical innovation scalable to areas outside of software development? The Free-Source social experiment will make answers to these questions clearer, provided we are wise enough to use the data we gather from this phase of the Information Revolution to decide how to invent our future.

NOTES

1. A note on terminology: "Free software," "Open-Source software," and "Free-Source software" are very similar terms, but they are not quite interchangeable.

The term "Free software" was created in 1983 to refer to software that gives users the following freedoms: the freedom to run the program, for any purpose; the freedom to study how the program works and adapt it

to specific needs; the freedom to redistribute copies so that neighbors can help each other; and the freedom to improve the program and release improvements to the pubic so that the whole community benefits. For the full definition of Free software, see the GNU project's "What is Free Software?"
http://www.gnu.org/philosophy/free-sw.html

The term "Open-Source software" was created in 1998 as a marketing campaign for Free software. Broadly speaking, Open-Source proponents place attractiveness to business at a higher priority than the freedom of users. For the official "Open-Source Definition," see the following website:
http://www.opensource.org/osd.html

Although the difference between these two terms is subtle, it is important. There is a surprisingly wide chasm of philosophical difference between the two camps, despite the fact that both terms refer to nearly the same set of software. "Free-Source software" is a newer term that broadly refers to both camps within the movement as a whole.

In this article, I will use whichever term is historically appropriate. If I am referring to events prior to 1998, I will use "Free software" because it was the only term in existence at the time. If I am referring to events since 1998, I will use "Free software" if I am referring specifically to the Free software camp, "Open-Source software" if I am referring specifically to the Open-Source camp, and "Free-Source" if I am referring to the broad movement as a whole.

[2] Doc Searls, "Review of *Open Sources: Voices from the Open Source Revolution*," *Linux Journal*, no. 63 (July 1999): 24.

[3] See Rishab Aiyer Ghosh and Vipul Ved Prakash, "The Orbiten Free Software Survey" (7 May 2000).
http://orbiten.org/ofss/01.html

[4] See John Goerzen, "Reasons to Use Linux" (23 October 1999).
http://www.aclug.org/ACLUG/info/linuxreasons.html

[5] Adam Goodman, Matt Welsh, and Lee Gomes, "Saint Richard: Free Software Will Save Your Soul," *Linux Magazine* 1, no. 3 (July 1999): 32.

[6] "Hacker" is a much-misunderstood term. It does not traditionally mean "someone who breaks into computers"; this is actually a "cracker." To use Stallman's words, "the use of 'hacker' to mean 'security breaker' is a confusion on the part of the mass media. We hackers refuse to recognize that meaning and continue using the word to mean 'someone who loves to program and enjoys being clever about it.' " (*Open Sources: Voices from the Open Source Revolution*, ed. Chris DiBonna, Sam Ockman, and Mark Stone [Sebastopol, Calif.: O'Reilly & Associates, 1999], 53).

[7] Richard Stallman, "New UNIX Implementation," *Newsgroup net.usoft.Usenet* (22 July 1999 [27 September 1983]).
http://www.caip.rutgers.edu/~davem/gnu_origin.html

[8] *Ibid.*

[9] *Ibid.*

[10] Richard Stallman, "The GNU Operating System and the Free Software Movement," in *Open Sources*, 60.

[11] Eric S. Raymond, "A Brief History of Hackerdom," in *Open Sources*, 28.

12. *Ibid.*, 27.
13. Eric S. Raymond, "The Magic Cauldron" (10 January 2000). http://www.com/catalog/cb/chapter/magic-cauldron.html
14. Alex Daly, "Linux in the Post-PC World," *Linux Magazine* 1, no. 3 (July 1999): 16.
15. See Eric S. Raymond, *The Cathedral and the Bazaar* (Sebastopol, Calif.: O'Reilly Press, 1999). First available online, where it was widely circulated in the Free software community.
16. Eric S. Raymond, "The Revenge of the Hackers," in *Open Sources*, 210.
17. Eric S. Raymond, "History of the Open Source Movement" (22 July 1999).
http://www.opensource.org/history.html
18. Raymond, "Revenge," 211.
19. *Ibid.*, 212.
20. Microsoft Corporation, "Microsoft Responds to the Open Source Memo Regarding the Open Source Model and Linux" (11 January 2000).
http://www.microsoft.com/ntserver/nts/news/mwarv/linuxresp.asp
21. Raymond, "Revenge," 216.
22. "Andover, VA Score Big on IPOs," *Linux Magazine* 2, no. 2 (February 2000): 13.
23. Doc Searls, "Cannon Fodder," *Linux Journal* no. 71 (March 2000): 70.
24. Though I made this prediction in January 2000, a recent report by Forrester Research reaches a similar conclusion, predicting that "Open-source standards will completely reshape the software industry by 2004." The report also notes the profound impact Free-Source software, not limited to Linux itself, will have on the software industry: "All the hype that surrounded Linux in the last year or two missed the important part of the story. It's not about Linux—it's about a fundamental change in how all software will be developed, distributed, and used." Additionally, the report predicts a gloomy fate for Microsoft, the leading proprietary software company in the world: "Eventually," the report forecasts, "MS will become little more than a 'legacy vendor,' offering support for its antiquated products." See Michelle Dello, "It'll Be an Open-Source World," *Wired News* (15 August 2000).
http://www.wired.com/news/print/0,1294,38240,00.html
25. VA Linux Systems, Inc., "SourceForge Frequently Asked Questions" (10 January 2000).
http://sourceforge.net/docs/site/faq.php
26. Reuters Limited, "Intel Unveils Plans for Web Appliances" (11 January 2000).
http://biz.yahoo.com/rf/000105/bbm.html
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33. For more information on Microsoft pricing, see http://shop.microsoft.com/
34. There are numerous places to purchase Linux products. For an online example, see http://www.linuxmall.com/, where most official Linux distributions are available starting at $29.99. In addition, LinuxMall's own "Penguin Power" line of unofficial CDs are available for $1.99 each. The "Penguin Power" CDs (the official mascot of Linux is a cartoonish penguin) are exact duplicates of official Linux CDs, sold without manuals. Available CDs include Red Hat Linux, Linux Mandrake, Slackware, SuSE Linux, Caldera OpenLinux, Storm Linux 2000, TurboLinux, Corel Linux, and Debian GNU/Linux. These are the nine most popular Linux distributions as of this writing.
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