Establishing A Culture of Open Development: The Open Source Movement

Do Platform as a Service Providers Align with the Established Principles of the Open Source Movement?

A Research Paper submitted to the Department of Engineering and Society

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Spring 2024

On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

In 1998, Netscape made software history by releasing the source code to their flagship Communicator web browser and began accepting code contributions from anyone over the internet. This fundamentally different way of developing software would come to be known as the open source model, born out of a synthesis of radical philosophy of intellectual property and computer user rights with proven development efficiency benefits. Today, open source software is widely popular with projects including the Linux operating system and the Firefox web browser. Advances in technology since the founding of the movement like the explosion in cloud computing have led to recent controversy in the open source community about the role of cloud providers and if they cannibalize traditional income streams for open source developers. Reflecting on early disagreements in the open source movement should reveal the core philosophy of the movement, applicable to current discussion about which participants are truly "doubling down on open".

Literature Review

Much of the sociotechnical research examining open source software was published in the early 2000s, a few years after the widely publicized transition to open source by Netscape, establishing Mozilla (Netscape, 1998). This period also saw the founding of the Open Source Initiative and the definition and general adoption of the term *open source* (OSI, 2006). The highly cited book *The Success of Open Source* by Steven Weber, published in 2004, was pivotal in examining the open source movement through an economic lens. Weber argues that the open

source movement is not an exception to economic principles, instead that the unique circumstances of software engineering make open innovation economically rational. Weber also describes a business strategy for a firm to earn a profit while publishing open source software, a model still used by businesses like Red Hat today. Open source development has also been analyzed through alternative economic lenses including as a gift economy, which is particularly applicable to highly distributed projects worked on by many individual developers (Zeitlyn, 2003).

Arguably the most influential work on open source development is the 1997 essay and later book *The Cathedral and the Bazaar* by software engineer and open source pioneer Eric S. Raymond. Raymond was motivated to write the essay after the successful development and release of the free operating system Linux, managed by Linus Torvalds, and his own development of the email client Popclient, later Fetchmail (Raymond, 1999). Linux was developed out in the open, releasing new versions rapidly, even after only minor changes. Torvalds accepted contributions from the growing community of Linux users and developed a project management system for accepting and applying those changes. Raymond notes that "Linus's cleverest and most consequential hack was not the construction of the Linux kernel itself, but rather his invention of the Linux development model". The Linux developmental model, which Raymond calls the *bazaar*, would set the groundwork for future large scale, community developed projects.

Raymond contrasts the transparent bazaar approach to the development strategy of GNU tools and other early free software that were developed by individuals or small teams with long periods between releases. The prevailing idea was that large software like the Emacs text editor, or the Linux kernel had to be developed along a centralized plan to streamline the development

process and avoid writing bugs. Teams were usually kept small because adding additional developers to a project often only increased delays, an observation known as Brook's law. This development philosophy, which Raymond likens to cathedral building, is motivated by a strong distinction between developers and users and a desire to keep bugs out of the sight of users. The bazaar approach challenges both assumptions. In contrast to the older cathedral approach, in the bazaar approach, users are treated as co-developers rather than solely end-users. Because of this perspective change, users discovering bugs becomes a positive because they have access to the source code and are empowered to suggest fixes or submit higher quality bug reports. In this way, the bazaar approach solves the issue of extended debugging delaying releases that Raymond notes as endemic to the cathedral approach. Although taking on potentially hundreds or thousands of developers for a complex project seem disastrous when considering Brook's law, Raymond observed that the efficiency penalty implied by Brooks law only applied only to groups of developers working on the same issue. Since Linux is a very large and multifaceted repository, most individual features do not rely on each other, meaning that development could be effectively parallelized to be much faster while avoiding efficiency losses from Brook's law. Raymond synthesized these ideas into Linus's law, summarized as "Given enough eyeballs, all bugs are shallow".

Although *The Cathedral and Bazaar* was written before open source was a corporate model and was focused on individual developer motivation as motivating development first, its release was highly influential in changing perspectives about how software could be built. Explaining how Linus's law could lead to massive efficiency gains with the successful examples of Linux and Raymond's own software Fetchmail made the bazaar approach more appealing to software firms. Most notably, the essay influenced Netscape to establish Mozilla and release

their Communicator web browser as open source software, quoting Raymond and Torvalds in their press release (Netscape, 1998). Raymond quotes CTO of Netscape Eric Hahn "On behalf of everyone at Netscape, I want to thank you for helping us get to this point in the first place. Your thinking and writings were fundamental inspirations to our decision" in an epilogue appended to later releases of *The Cathedral and Bazaar* (Raymond, 1999). Although open source was not "magic pixie dust", the Mozilla project was an eventual success, establishing them as a key participant in the open source space. Mozilla was also influential as an early open source success story that started as a corporate project.

More recently, the move by some large software firms like Microsoft to open source some of their products prompted a case study by Kochhar et al. (2019) examining how these transitions worked to benefit the open sourcing company and the software community. They find that transitioning software to open source has numerous practical benefits to the development process, mostly from the massively increased number of developers working on these projects. This study also notes that firms like Microsoft have a strong interest in promoting an "open source culture" even though this does not have a direct impact on the development process.

Overview of Participants

Free Software Foundation

Among participants in the open source community, the Free Software Foundation (FSF) is notable for its history and ideological bend. Founded in 1985 by Richard Stallman, the FSF was an early advocate for software sharing, inspired by Stallman's experiences in the software sharing community of MIT researchers and what he saw as the growing encroachment of proprietary software (Stallman, 1999b). The FSF is responsible for maintaining the GNU project, a set of free programs usually bundled with the Linux kernel as the operating system GNU/Linux

(FSF, n.d.-a). Critical to the FSF's mission is advocating for Stallman's personal philosophy of computing freedom, summarized in his four essential freedoms: "The freedom to run the program as you wish, for any purpose", "The freedom to study how the program works, and change it so it does your computing as you wish", "The freedom to redistribute copies so you can help others", and "The freedom to distribute copies of your modified versions to others…" (FSF, n.d-b).

The copyleft provision of the GNU General Public License (GPL) issued by the FSF exemplifies the distinction between free software and open source software. The GNU GPL is less permissive than other open source licenses, requiring all derivative works to also use the same or equivalent license, ensuring that free software will not be used to build proprietary software (FSF, 2022). This reflects the ideological focus on the expansion of free software rather than being as permissive as possible. Although Stallman notes that programs released under permissive, non-copyleft open source licenses are still free software, he calls them a weak contribution to the free software community because they can be used to produce exclusionary proprietary software (Stallman, 2003). This contradicts with the open source perspective, which may prefer a program to be released as open source but takes no issue with a proprietary program using open source tools. In Stallman's view, the software world is divided between free software and proprietary software and copyleft puts up walls using copyright, preventing proprietary code profiting from free software (Stallman, 1999a).

In an early essay titled *Why Software Should Not Have Owners*, Stallman advocates for software sharing and against proprietary software (Stallman, 1994). Core to his argument is in the misalignment between the copyright system for physical books and applying the same system to software and other digital information that can be easily copied and distributed by individuals

for free. The distinction between individuals are corporations is important in Stallman's logic. He argues that the copyright system as originally established only enforced against copying by mass producers of printed material, not against individuals who were discouraged by the arduous task of copying books by hand. Stallman asserts that the copyright system being applied to software treats all users like the former large scale printers, in his view inappropriately. To Stallman, digital information is fundamentally different to physical goods by its ability to by trivially copied. Therefore, in his view, any system to regulate it must not impede the free spread of information. Stallman also argues that *piracy* is a smear word and that it and *intellectual property* are used to suggest an illegitimate connection between digital and physical goods. In the conclusion of the essay, Stallman emphasizes that free software is a philosophical project that developers should take part in even if it is not economically rational.

Stallman and the FSF take considerable care to distance themselves from the open source movement. Stallman is quick to correct any mention of himself being a leader or associated with the movement, including responding to an article in *Dr. Dobb's Journal* to clarify "I am not a supporter of the open source movement, and never have been." (Stallman, 2001). In a later essay titled *Why "Open Source" Misses the Point of Free Software*, Stallman explains his focus on distinguishing the free software movement even though almost all open source software is free software and vice versa (Stallman, 2021). Stallman's project with the FSF is the promotion his philosophy of computer user freedom, which the open source movement is silent on. In this way, Stallman considers labeling his work as part of the open source movement as ignoring his mission, focusing too much on source availability as a central issue. Stallman's insistence on this distinction is indicative of his resentment being included in the open source tent without a choice. He also rejects Bruce Perens's notion that open source is a marketing campaign for free

software, arguing that the marketing fails to advocate for user rights. There is a fundamental difference of opinion between the open source side trying to sway the business mainstream with practical benefits and the free software side intentionally in opposition to the proprietary software mainstream.

Stallman has a focus on precision of language that can be seen in his constant distinction between *open source* and *free software*. This applies to his personal writings as well, where he includes a glossary of word substitutions that align with his generally progressive political philosophy (Stallman, n.d.-b). Included are *antisocialist* replacing *libertarian*, *climate mayhem* replacing *climate change*, *thug department* replacing *police department,* and twelve alternatives for *Donald Trump* like *the wrecker*, *the troll,* and *the insurrectionist*. In similar fashion, an "anti-glossary" of terms Stallman refuses to use is also included (Stallman, n.d.-a). This anti-glossary often takes issue with terms Stallman considers euphemistic or propagandistic like *healthcare*, *pro-choice* or *pro-life*, [national] *defense*, *custody*, or *officer-involved shooting*. Stallman's anti-glossary also includes an entry on *centrist democrats*, which he says misrepresent themselves as the political center, instead preferring to refer to them as *plutocrats*.

Stallman more broadly explains his political vision in a March 2021 blog post titled *Necessary Changes in Society*. In the post, Stallman lists all his political goals including "replace plutocracy and tyranny with democracy", "stop global heating and ocean acidification, "end pollution: toxic, plastic, and antibiotic", "establish abortion and contraception rights", "deconcentrate industry", "provide gratis [free] medical care for all", "end prejudice (racism, sexism, antisemitism, caste prejudice, and others)", "lift everyone out of poverty", "end nonfree software", and "establish freedom to share all published works". This post is evident of how

Stallman views the free software movement as part of a greater goal of making the world a more equal, open, and just place.

The GNU project site includes a post titled *Stallman's Law*, with the following observation: "Now that corporations dominate society and write the laws, each advance or change in technology is an opening for them to further restrict or mistreat its users." (Stallman, 2012). This is critical to understanding Stallman's philosophy. Corporations and proprietary software act as encroaching evils, needing to be protected against with the free software movement and through democratic government. In a post titled *Why we need a state*, Stallman explains the unique functions of a state and its necessity even in an ideal society, refuting the anarchist position (Stallman, 2013). In Stallman's view, the state is an essential tool to protect its citizens and execute their will, although he concedes that the current US government has been captured by plutocrats. Stallman also sees the government as an agent to promote free software and establish it as the norm, arguing that it has the duty to do so (Stallman, 2017).

Open Source Initiative

The Open Source Initiative (OSI) was founded in 1998 at a conference of developers including Eric S. Raymond and Bruce Perens in favor of software sharing after notable developments in the field (OSI, 2006). For profit companies like SUSE had shown that publishing free software with paid enterprise support was a viable business strategy (SUSE, n.d.), and Netscape had just made history by releasing the full source code of their web browser to the public before the term *open source* had been coined (Netscape 1998). The founding members felt that a single label was needed to define the practice of software sharing, and that it must emphasize the business benefits of software sharing and community development. The decided on term of *open source* reflects this. According to OSI cofounder Bruce Perens, it is

intentionally distinguished from the more political “free software” despite them being essentially the same, though this similarity is disputed by Stallman (Perens, 2007).

The role of the OSI is to maintain the open source definition and to determine which licenses fall under the open source umbrella (OSI, 2023). Having a central authority on this definition is intended to maintain its philosophy and permissively. The OSI notably rejected the new server side public license submitted by MongoDB as not open source and issued a press release decrying Elastic NV for deceptively abandoning open source when they switched to the SSPL (OSI Board of Directors, 2021). The OSI is widely supported by large tech firms including Amazon, Google, and Microsoft (OSI, n.d.).

Eric S. Raymond became involved in open source software when he took over development of the open source email client Fetchmail in 1996. As discussed above, his essay and later book *The Cathedral and Bazaar* was highly influential in spreading the bazaar development style and directly led to the formation of Mozilla and the release of their browser source code. Netscape’s direct acknowledgment of Raymond and his essay established him as a leader of the developing open source community. Raymond also published an expanded edition of *The Jargon File* as *The New Hacker’s Dictionary*, reflective of his prominent position in the hacker subculture (Raymond, 2009). Raymond cofounded the OSI and served as its president until stepping down in 2007 (OSI, 2007).

Philosophically, Raymond is a member of the Libertarian party (Raymond, 2003) and describes himself as an “anarcho-capitalist” (Raymond, 2019a). A post on Raymond’s blog titled *A libertarian rethinks immigration* is illustrative of Raymond’s ideal society (Raymond, 2019a). In the post, Raymond describes how immigration control is not contradictory to libertarian or even anarchist philosophy, tacking against the mainstream view. In Raymond’s “Libertopia”, the

traditional role of the state is easily supplanted by insurance corporations and law replaced by a vague social contract or societal norms. In discussing why border security need not be carried out by the state, Raymond writes "'Libertopia enforces the law' would cash out to 'insurance companies pay security agencies to do it because the alternative is profiting less on those crime-insurance premiums'.".

Raymond's philosophy about open source follows from his political beliefs. To Raymond, the open source development model is an efficient way to organize large projects and individuals or corporations using it increases the quality of software as a whole by contributing to a common software toolbox. The open source project is apolitical in that it does not challenge liberal capitalism and it's participants, especially corporate ones, do so out of their own self-interest, rather than a political vision.

Raymond was a part of the group that coined the term *open source* to replace to the earlier term *free software* (Raymond, 1998). In a blog post titled *Goodbye, "free software"; hello, "open source"* Raymond argues for switching to using *open source* as an unambiguous and apolitical term to "take the desktop and engage the corporate mainstream". In a column for the news site *Linux Today*, Raymond responds to Stallman distancing free software from open source by asserting that open source is a big tent that takes no position of the political vision of free software (Raymond, 1999). According to Raymond, the Free Software Foundation's rhetoric is ineffective at convincing those outside the hacker community and that in contrast, the pitch for open source software has succeeded at converting the mainstream.

Outside of software advocacy, Raymond holds other right wing views. His most pressing political issue is gun rights, including supporting the controversial Defense Distributed, which produced files for 3D-printed firearms (Raymond, 2012b). Raymond views gun ownership as not

just a right, but a responsibility of citizens, and considers every person having access to the power to kill as a logical extension of personal liberty (Raymond, 2020a). He is adamantly against attempts to shift language for insensitive terms in computing like *master* and *slave*, likening advocates of these changes to Big Brother of *1984* (Raymond, 2018). Raymond has alleged that "women in tech" advocacy groups are "collecting scalps" of leaders in the open source movement through false sexual assault and harassment allegations, naming Linus Torvalds as a target specifically (Raymond, 2015). Raymond has also accused LGBTQ people covertly supporting pedophilia in a blog post admonishing conservatives for focusing too much on Jeffery Epstein rather than "the real monsters" (Raymond, 2019b). In the blog post about border security discussed above, Raymond advocates for restricting immigration and deciding who to let immigrate with an IQ test and profiling based on age, religion, and country of origin (Raymond, 2019a). Raymond also endorsed an opinion piece by John Derbyshire (Raymond, 2012b) that was so racist and objectionable that Derbyshire was fired from his position at the National Review, a conservative editorial magazine (Sorkin, 2012). Raymond was banned from OSI mailing lists for messages that violated the organizations code of conduct in 2020 (Raymond, 2020).

Bruce Perens became involved with the free software community by joining the Debian GNU/Linux project after setting out to produce a distribution of Linux with free tools for HAM radio (Fernández-Sanguino et al., 2023). Perens took over as leader of the Debian project after the departure of its founder Ian Murdock in 1996. While leading the Debian project, Perens wanted to make clear the position of the project as a part of the emerging free software movement, drafting a *Debian Social Contract* (Perens 1997). This document confirmed Debian as free software and expressed the commitment of the project members to the greater free

software movement. Included in the document is a list of 10 points titled *The Debian Free Software Guidelines*, which made clear the criteria for software to be considered free. These points would later be rewritten to be more widely applicable by Perens as the OSI Open Source Definition.

Although Perens cofounded the OSI with Raymond in 1998 and wrote the Open Source Definition, he left the foundation after only a year in 1999, explaining his departure a blogpost titled *It's Time to Talk About Free Software Again* (Perens, 1999). In the post, Perens reflects on the success of open source outside of the hacker community. Perens argues that the dominance of open source has overshadowed Stallman's original free software movement, leading to its principles about user freedom being ignored, specifically mentioning Raymond's leadership as a contributor. The post also shows Perens's regret in contributing to the open source / free software schism and his want to bridge the two movements.

Perens endorsed the 2016 Sanders presidential campaign in 2016, citing his experience in the open source community as motivation (Perens, 2016). In the blog post, Perens states that open source software has been a great boon to industry, highlighting the development strategy's efficiency while implying that its benefits may not have been fairly distributed. In Perens's view, the proven effectiveness of collaboration and knowledge sharing is applicable outside software or engineering and motivates his left-wing perspective.

Perens is still active in the open source community, but he is now focused on defining a new paradigm for software license he calls "Post-Open" (Perens, 2024). The Post-Open license is motivated by changes in the way computing is done since the early 2000s, including specific language about the training and use of machine learning models. It also includes a system of paid contracts that makes it fundamentally different than open source. While open-source licenses

must not discriminate on use, the Post-Open license limits large scale commercial usage without a contract for payment from the user. This term essentially codifies the informal cycle of corporate support in the open source community. This would apply to cloud providers like Amazon, limiting their ability to include Post-Open licensed tools in their AWS platform.

Open Source Non-Profits

Open source non-profits like the Linux and Mozilla foundations support many smaller open source projects (Perlow, 2020). In the case of Linux, Mozilla, and Apache, these foundations were established to support the development of an early open source project and grew to encompass many smaller projects. These early foundations were important for establishing open source norms by guiding these projects (Mozilla Foundation, n.d.). Other foundations like NumFOCUS are created to support many related projects to begin with. Open source foundations provide a single place for corporate users of open source software to contribute to many current projects and any future projects supported by the foundation (Linux Foundation, n.d.). Some foundations like Mozilla are also funded through taxable subsidiaries offering paid services, such as Mozilla offering a VPN service (Mozilla Foundation, 2020).

For-Profit Open Source Companies

Although many open source projects are managed by non-profit organizations, for-profit companies can also take advantage of open source community development and the potential for rapid widespread adoption of their software (Riehle, 2012). Early open source companies followed a business model that targeted professional services and custom tooling as revenue streams. This could include enterprise setup, support, and training (Weber, 2004). This model is particularly applicable developers of Linux distributions like Red Hat and SUSE since operating systems are large and complex, with greater need for training and potential for customization

than simpler tools. Open source companies may also offer their software as a service, earning revenue by handling setup and hosting for clients. This approach has increased in popularity with the decline of business servers but is currently competing with cloud providers with more complete platforms and greater consumer reach. Most open source projects are now “Open core” where core functionality is under an open source license, but advanced or new features are kept proprietary (Riehle, 2012). This allows for the community to build on the open core for new software while retaining a niche for the developing company to earn revenue. Examples of open core projects include Chromium, the core for Google Chrome, and Git, which GitHub is built on.

Very large companies like Amazon, Google, and Microsoft have similar but distinct reasons to smaller firms for releasing open source software. As examined in the series of case studies on Microsoft projects by Kochar et al. (2019), these companies are motivated both by increased efficiency in development but also by a philosophical commitment to open source. For practical benefits, community involvement increases development efficiency in many ways. If a project is one that developers are the primary users of, integrated development environments or software libraries for example, then opening development to the community shrinks the gap between user and developer. This means developers who regularly use these tools and are the most familiar with them can contribute or suggest features they would use, rather than switching to or building a new tool. Since open source projects have many times as many developers working on a project than a closed source one, bugs are found and fixed much faster. Increased the number of developers through community development also allows for features to be included that would have been cut by a smaller team like support for infrequently used operating systems. Involving the community in development increases diversity of ideas, potentially producing better software than a relatively closed-minded internal team.

Beyond the development process, opening projects to the community provides an easily accessible group of skilled developers for hiring. Code transparency greatly increases trust in the software and may be required by some clients with security requirements. Finally, firms like Amazon, Microsoft, and Google are motivated to release open source tools that may draw clients to their cloud services, which generate significantly more revenue than any potential revenue lost from not charging license fees.

Cloud Providers

Cloud computing has grown massively recently, with most companies moving away from managing their own servers and instead relying on cloud providers like Microsoft Azure, Amazon Web Services, and Google Cloud. Cloud providers can take advantage of economies of scale to offer economical on-demand computing. Businesses using cloud providers need less IT staff, never have to be concerned with updates or issues and always have access to the state of the art in computing. As an extension of this offloading of concerns, cloud providers have shifted to a platform as a service (PaaS) model, which integrates many tools needed for development into a cloud suite (Microsoft, n.d.). This is convenient for businesses using the cloud provider, but it cuts out market opportunities for the companies that develop the included tools to offer them as a service. Notably, Amazon's inclusion of Elastic NV and MongoDB's open source tools in their Amazon Web Services (AWS) platform.

Overview of License Change Controversy

MongoDB and Elastic NV caused controversy in the open source world by switching from open source licenses to the SSPL, which specifically disallows offering the product as a service. MongoDB was first to do this in October of 2018, stating in a press that the large cloud providers are threatening the open source community by offering open source products as a

service and that shifting to the SSPL is a defensive move that protects open innovation (Horowitz, 2018). Elastic NV specifically called out Amazon for trademark infringement in addition to echoing these complaints (Banon 2021). The SSPL was rejected by the OSI as not open source, emblematic of the negative response from the greater open source community (OSI Board of Directors, 2021). Open source developers like Red Hat dropped support for MongoDB and any other software licensed under SSPL (Krazit, 2019). These moves were responded to by Amazon by forking both projects and maintaining parallel versions as open source projects (Meadows et al., 2021).

Conclusion

In reflecting on the early history of the open source and free software movements, the philosophy of Raymond and open source have dominated those of Stallman and free software, since convincing others to join the movement wasn't about a philosophy about rights or freedom, but instead about the practical benefits of the development model. To Stallman, ideology is core to the movement, not evangelizing. This contrasts to the goal of the OSI to make the biggest tent possible, shirking political discussions in the process. As an apolitical movement, the open source movement set out by the OSI implicitly supports the current liberal capitalist status quo. The goal of the open source movement is simply the growth of a common toolbox of software which will result in software as a whole improving.

This view is illustrative when examining the dispute between MongoDB and Elastic NV against Amazon. As a much larger company, it should be expected in a capitalist system that Amazon would be able to make better use of common tools than a midsize firm like MongoDB or Elastic. Amazon can take advantage of economies of scale and its capital resources enable it to take part in the oligopoly of large-scale cloud computing, a revenue stream not available to

smaller firms. As both MongoDB and Elastic NV are public companies with a corporate responsibility to their shareholders, their actions must be explained economically. Involvement in the open source community was beneficial during development and market capture but became a hinderance when focus shifted to profitability. Statements from Elastic NV about how they are “doubling down on open” serve to paint cloud providers like Amazon as disturbing the open source ecosystem and their new license changes as more “open”. This is demonstrated in the terms of the SSPL, which are very similar to those of the AGPLv3, their previous open source license. While the AGPLv3 requires some server infrastructure code to be open source, the SSPL extends that requirement to the entire cloud computing system and software platform. While this can be viewed as more “open” in a way, it directly contradicts with the provision of the open source definition to not discriminate on types of use. This reframing of “open” does not align with the established principles of the open source movement, instead aligning more with alternative philosophies like Perens’s “Post-Open”.

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