Open-Source Projects: A Need for Funding

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Introduction

Technological integration has become key in modern society. Specifically, 97% of all technology utilizes open-source code (Synopsis, 2022) — code that is made publicly available for free with limited or no restrictions (Open Source Initiative, n.d.). However, despite the code's intent to benefit everyone, open-source code has been targeted by large corporations. Companies' behavior towards the communities that write open-source software exposes the relationship between givers and takers. One example is the case of former Microsoft CEO Steve Ballmer who compared the license of the free and open-source operating system Linux to "a cancer that attaches itself in an intellectual property sense to everything it touches" (Branscombe, 2020). Still, after consideration, Microsoft currently provides monetary support to open-source code (Linux Foundation, n.d.). In fact, Microsoft's shift in its relationship with open-source communities is due to the unique benefits to speed and cost of development. Open-source communities mirror Tocqueville's findings of early American Democracy. Allowing anyone to freely contribute to open-source motivates people to care more about the project parallelling how "local freedom … leads a great number of citizens to value the affection of their neighbors and… perpetually brings [people] together and forces them to help one another" (Tocqueville, 1835). This style of open leadership has allowed open-source to dominate the software community, appearing in almost all projects is due to its faster development than traditional proprietary[1] software.

Unfortunately, even if open-source projects have high usage rates, many are underfunded or lack sufficient support. This holds true even when the code is critical to online platforms,

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[1] Owned by one company and not open-source

general companies, or the entire internet's safety. This leads to drastic consequences such as the recent 2021 vulnerability in open-source Log4J[2], used in many different applications and servers, easily allowing hackers to run malicious programs like viruses on programs using Log4J (CVE, 2021)[3]. Despite Log4J being used by numerous companies, a clear lack of financial support from these companies led to the vulnerability. This would have been avoided if the team writing Log4J had more funding allowing more developers to review its code (CTO et. al., 2022). To prevent and fix future vulnerabilities in open-source, this paper looks towards existing government provided tax credit in renewable energy as a solution to increase funding from current open-source software companies. Tax credits will be given to companies supporting open-source software similarly to how renewable energy tax credits are given to encourage companies to the programs they use. Something this valuable must be protected.

Psychology of Open-Source

To develop a solution involving open-source communities, an understanding of what they are and how they function is required. In brief, open-source software is code that is publicly available using an open-source license, which, according to the internationally recognized Open Source Initiative, allows for the code to be "freely used, modified, and shared" (Open Source Initiative, n.d.). As the code for these programs is publicly available on the internet and allows anyone to contribute, the communities that form around open-source are large and unique. As a result, they have a unique structure fundamentally different from traditional companies. Open-source communities thrive due to a concept known as "egoless programming" where developers and communities encourage anyone to look for problems in the code (Raymond,

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[2] Also called Log4Shell in some news sources
[3] CVE is a database of known vulnerabilities in computer software

1999). This is more efficient in finding problems than closed-source code's method of only

allowing select people to view the code. Democracy requires participation from the entire

community rather than a single entity, likewise, as proved by open-source, "[s]ociologists years

ago discovered that the averaged opinion of a mass of equally expert (or equally ignorant)

observers is quite a bit more reliable a predictor than that of a single randomly-chosen one of the

observers" (Raymond, 1999). As long as open-source has enough developers working on it, it

will be better than closed-source in finding potential problems. As more people discover and join

these communities, the differences in governing compared to companies becomes apparent. Eric

S. Raymond, co-founder of the Open Source Initiative, compares the governing of open-source

projects as a "great babbling bazaar of differing agendas and approaches (aptly symbolized by

the Linux archive sites, who'd take submissions from anyone) out of which a coherent and stable

system could seemingly emerge only by a succession of miracles" (Raymond, 1999). This format

follows Tocqueville's concept of human nature where "every man seeks for his opinions within

himself" (Tocqueville, 1835). The individualism exemplified by open-source communities

allows it to ignore problems observed with high group synchrony — group think and loss of

creativity (Gelfand et. al., 2020). Open-source's individualism allows it to ignore problems

closed-source programs face.

Economic Efficiency

Open-source software provides users with immense benefits. In the European Union, a

study on the impact of open-source found that "[t]he existing base of quality [open-source]

applications with reasonable quality control and distribution would cost firms almost … 12

billion [Euro] to reproduce internally" (Ghosh, 2006). Remarkably, money is saved by allowing

parts of the company's code to be written as open-source by external developers at no cost to the

company itself. Open-source developers are not always employees of the companies using their

code; they are not always paid for their work, simply working as a passion. However, as the

software is open-source, the company loses the direct control they have over it compared to their

internal proprietary projects. This parallels Tocqueville's view of the differences between

aristocracy, symbolized by the company, and democracy, open-source code. Additionally,

open-source software "potentially saves industry over 36% in software R&D investment that can

result in increased profits or be more usefully spent in further innovation" (Ghosh, 2006). Due to

more money being spent on innovation, a Harvard study found that an increase in open-source

contributions in a country sees an increase in new technological innovation there (Wright et. al.,

2021). This makes open-source not only important to companies but also to society at large:

open-source is a public good. It is in governments' best interest to provide the necessary policies

for open-source communities to flourish (Nagle, 2019).

Open-Source Licenses

In order for open-source projects to work with copyright law, they require licenses to

describe how companies and individuals must work with them. In most cases, open-source

licenses can be simplified to two types: copyleft and non-copyleft. Copyleft licenses have heavy

restrictions on what can be done with the code. Any program which wishes to use software under

copyleft is required by the license to publish any changes made to the code publicly and under a

similar copyleft license ensuring that the code will forever be open-source (Free Software

Foundation, n.d.)[4]. For companies this restriction can be unwanted, as they will be *forced* to

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[4] The Free Software Foundation (FSF) is the creator of the most popular copyleft licenses

publically give back any changes they make to the software. Therefore, many companies such as Google object to using any copyleft licensed code in their projects, even if it will save them money (Google Open Source., n.d.). The copyleft restriction, however, is beneficial to the original open-source project because it ensures that it gains support in the form of contributions. The government simply plays a role in enforcing the conditions of licenses, ensuring companies follow through. However, non-copyleft licenses do not have this condition of giving back. For example, the non-copyleft MIT license states: "Permission is hereby granted, free of charge, to any person … to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software … WITHOUT WARRANTY OF ANY KIND" (The MIT license, n.d). It does not contain any statements requiring its users to return any support. As it does not force companies to do anything, it is more likely to be used by them. Other non-copyleft licenses are similar to the MIT license with only minor differences. The government still only plays a small role ensuring that companies and individuals follow the licenses, however, due to a lack of restrictions this means that the open-source project will not always gain support back, leading to issues such as in non-copyleft licensed Log4J. Governments must encourage support in these licenses since those which have policies supporting open-source have proven economic benefits (Nagle, 2019).

Vulnerabilities

The need for support goes further than just the benefit it will provide companies and society. Many open-source projects, such as Log4J, have found themselves in critical positions in technological infrastructure. Open-source holds up the internet and most software applications (Synopsis, 2022). If those projects do not get sufficient funding, the consequences are drastic.

While the Log4J vulnerability is too recent to observe all long-term damages, the effects of a similar, earlier vulnerability in a different critical program can be explored. OpenSSL is a program that ensures a safe connection between nearly every server and computer and is used to secure extremely sensitive information such as banking data and government connections. Without OpenSSL, hackers can view information, such as passwords, being sent between computers (Dierks, 2008). Despite its critical functionality, the OpenSSL project was severely underfunded, receiving only around $2,000 in yearly donations (The Linux Foundation, 2014). In early 2014, a critical vulnerability which allowed hackers to see passwords stored on websites was discovered and named "Heartbleed." This vulnerability caused serious issues for companies and had an estimated cost of around $500 million to mitigate damages (Turner, 2021). As a prevention measure after Heartbleed, a new initiative was formed: the Open Source Security Foundation (The Linux Foundation, 2014)[5]. However, in light of the recent discovery of the Log4J vulnerability, this is not enough. To prevent large issues from occurring and affecting individuals' privacy and security, governments and companies must provide more support in the future for open-source projects.

Not all vulnerabilities are as destructive as Heartbleed or Log4J, minor vulnerabilities are far more common. A recent report from the software security company Black Duck by Synopsys finds that "Of the 2,409 codebases analyzed … Eighty-one percent contained at least one known open source vulnerability" (Synopsis, 2022). Funding helps in two ways: allowing for more time spent working on the project and alleviating burn-out. With more funding, open-source developers can afford to spend longer times working on the project itself instead of income concerns (Fogel, 2005). Funding also helps sustain interest in a project. If an open-source

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[5] Non-profit organization which supports many open-source projects

program does not get enough support, their developers may decide to simply stop working on it, leading to no further updates or bug fixes. This stagnation is a massive security concern. The same report finds that 85% of the projects audited contained open-source code more than four years out-of-date (Synopsis, 2022). With funding and support from the companies utilizing these products, this would not be an issue. If an open-source project is no longer maintained, a company can step up to maintain it. If a project has few developers or funding, a company can assign its employees to work on the project or provide financial support, thus ensuring the security of the project and public. This support is needed.

Tax Breaks for Open-Source

As the often used non-copyleft licenses give away rights to the code, the government can not intervene in the way it can in copyleft. However, the American government can provide incentives for companies to provide support. Similar to how states provide tax incentives and benefits for companies using renewable energy (Bhutta et. al., 2022), the American government should provide tax relief and other benefits for companies contributing to open-source. Tax credit for the installation and usage of renewable energy has shown to positively affect it (Bhutta et. al., 2022). A proposal with this goal was drafted by the Center for American Progress in 2006: give open-source developers "a tax credit worth 20 percent of their out-of-pocket costs" (Irons et. al., 2006). In 2006, the proposed tax credit for open-source developers was calculated to have a relatively small cost of $29 million (Irons et. al., 2006). While the cost would have risen as the number of open-source developers has increased since 2006, if regarding contributing open-source code as an individual charitable contribution, it can be incorporated into existing tax laws. Further extending this proposal to include companies that fund or

contribute to open-source tax breaks would encourage more companies to give back to open-source communities and not just utilize the code for its sole benefits. Tax breaks would ignore companies that can not work with open-source code directly and they would not be affected negatively or positively.

Just providing tax breaks is not always enough. While more company support and funding will lower the amount of vulnerabilities, human error can always occur and still create vulnerabilities. Apart from not fully stopping vulnerabilities, this support is not guaranteed to go to the projects that need it most. Providing tax breaks simply serves to motivate companies to support projects, not in deciding which projects to support. Despite not guaranteeing funding for all open-source projects, providing tax breaks to companies and developers writing open-source code would increase the chance that dangerous vulnerabilities are caught and benefit the American economy. The economic support of open-source promises to allow this important technology to continue to drive innovation in a safe and secure way, benefitting generations to come.

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