Open Source Software as a Public Good

Open Source Software as a Public Good

Abstract

How does an open source library sustain its growth, maintain the code, and keep contributors and stakeholders engaged? The creation of new projects has rapidly increased as open source practices become more mainstream. This proliferation eccentuates the need for sustainable governance. Out of this need has grown many different organizational approaches. We present a case study of sustaining open source software projects as a public charity.

Introduction

The open source world has evolved quite significantly since the early days of the Cathedral and the Bazaar []. Open source software is created for many reasons: an expression of liberty[], a method for standardizing technology[], a conduit for innovation[], a developer training ground[], or a methodology for transparency[]. Open source software has been integrated into practically every aspect of human life, running everything from cutting edge scientific experiments to refrigerators. Open source software has become a de facto standard in building new businesses and in some cases the core of innovation.

While open source has taken on so many varied roles, it has also evolved in governance structures. These structures have become as varied as business models in the commercial space, including many structures that are wholly owned by commercial entities. The wide variance in project governance has helped build a rich ecosystem of communities, but only a small number are hiring and maintaining their software.

While for many projects, partnering with a commercial partner might be a way to innovate and sustain, it is not always a viable path. Commercial endeavors rely on building incentives for a small number of funders. They often must choose between supporting enterprises with deep pockets or the community that made their project successful. Additionally many open source contributors enjoy working on their projects while performing other work, such as leading a scientific study, which would be difficult to perform at a software business.

Another option that is increasingly becoming more popular is to develop a public charity. The regulations of a public charity require work for the good of the public, not a small set of individuals. These charities can hold the intellectual property of a project in trust to the public. They establish legal status for the projects to negotiate and trade with other established entities. Additionally, they provide necessary services such managerial and legal services. We outline some of the public foundations and categorize methodologies to sustain the software under their trust.

The Open Source Foundation, a popular approach

While any committer on the internet can create an open source project, as the community grows governance and fiscal needs arise. For decades the standard in scientific software was to have a university or government research lab be the entity owning the software in an open source project.

We track the progression of the NumFOCUS Foundation but this trend has been extended to many more communities. Now one can find dozens of nonprofit organizations supporting open source code. Even the scientific projects of famed institutions such as Berkeley and MIT are often quickly sponsored by the Apache or NumFOCUS Foundations. Below you can find an informal list:

- NumFOCUS Foundation
- Apache Foundation
- Mozilla Foundation
- Linux Foundation
- Python Software Foundation
- Django Software Foundation
- Center for Science and Society
- Center for Open Science
- Collaborative Knowledge Foundation
- OpenFoam Foundation
- Brave New Software
- The R Foundation
- Software Conservancy

Our hypothesis is that this worked well until these a few factors emerged. These factors include:

- Software teams have grown in size and complexity,
- The software crossed more borders and university boundaries making the sharing of costs more difficult,
- The plethora or software projects being created presented an undue burden on the current structures.

The first factor has been documented well in software engineering literature []. Software complexity can be measured in numerous ways, e.g. lines of code, modules, contributors, systems supported, all of which are increasing for the majority of the NumFOCUS projects. For example take the NumPy project that would seem to be a straight forward array library except for their deployment requirements on laptops, servers, embedded systems, etc. Today the project has 300K lines of code, 564 contributors, almost 50 million downloads representing an estimated 76 person year effort. Financial support for this library has come in the form of peoples salaries at universities and various companies across the globe, but only this year has the first grant to work directly on the software been made. While one may perceive this complexity as an outlier, the NumFOCUS currently supports 50 projects all with similar growing complexity and needs.

While certainly a university or company could house all this activity, it would be a significant strain on any single departmental budget. This common effort for support is not a task that many organizations that are not solely focused on software development will take. For example even hiring people becomes a challenge at a single institute. Most company employment require numerous confidentiality agreements to protect trade secrets and intellectual property, agreements that often are vague about the contribution of software to the public. Even universities will greatly differ in their technology commercialization policies for work of this nature.

This complexity has followed successful software projects across the globe. A recent analysis of the Jupiter project shows more interest growing in Asian countries and core contributors are spread across Europe, North and South America. An open source foundation is able to work directly with professional

programmers throughout the world. While possible when affiliated with a government or commercial entity, often such engagement is impractical due to the legal hurdles.

Finally we submit that the sheer number of open source projects have saturated the ability even large organizations to support. NumFOCUS in its 6 year history has gone from supporting 3 projects to approximately 50. The Apache Foundation supports over 260 projects. Github reports 24 million active contributors of open source software with 1.5 million organizations. Python and NodeJS report 150K and 350K packages, respectively. However you look at it the amount of open software is growing and sustaining that growth for the past decade. While the nature of organizations supporting open source software might be multifaceted and quite varied, this reality is merely a proxy for the real growth of the open source landscape.

The open source foundation has become an archetypical organization in the software business world. The trend for these organizations are growing and have become a natural place to land the intellectual and communal assets of open source projects. But how are these organization serving the needs of our open source community?

Benefits to Open Source Projects

Looking at the plethora of foundations one must certainly conclude that they have a large amount of benefits to the open source world. This may be the case but each organization has chosen different types and varieties of services. Here we do not dive into the specific merits of each service but a taxonomy of the different services and comments on which organizations have included them or not.

Roughly speaking we break down the benefits into four categories: Organizational Health and Culture, Project Governance, Legal Services, and Fiscal Services. We discuss them in this order as the case for the NumFOCUS foundation, the most straight forward services were the Legal and Fiscal but along the way we found the Organization Health and Project Governance to be more impactful over all.

Organizational Health and Culture

In the business world a marked difference in the latest generation is a focus on Organizational Health and Culture. This is not news for the readers of Patrick Lencioni's The Advantage, or Harvard Business Reviews numerous articles on on Organizational Culture, including the famous Peter Drucker quote "Culture eats strategy for breakfast." This difference has been a value that is hard to measure but often touted as the reason for some of the largest companies success, e.g. Google [], Pixar [], Southwest Airlines[]. It is not surprising that the open source foundation fills this value for many projects.

While Universities, Corporations and Laboratories have their own individual culture, groups of projects often bond together in an open source foundation to share a culture. It is no coincidence that the Open Stack Foundation is very heavily biased to the needs of system administrators and devops engineers. These cultures come from the set of principles, communities and needs shared by a common set of people. NumFOCUS concentrates on the needs of the science user, Apache Foundation ensures enterprise level legal requirements and so on. We list a few of these types of Organizational Health benefits as the following.

Example organizational health benefits

- Unified mission
- Community Events
- Common Branding
- Cross cutting programming
  - Diversity initiatives
  - Education
  - Software Infrastructure

Project Governance

Each open source project, like every business, makes countless decisions during its lifetime. Just as businesses will start to build policies and procedures to cut down on the time it takes to make such decisions, open source projects will as well. This generally falls into the realm of what we call Project Governance.

It is not clear when a project needs more governance structures, but often the governance of one project heavily influences the structure of others. The Apache Foundation mandates specific structure while NumFOCUS only provides

recommendations from different styles of projects. Many open source foundations, such as the Python Software Foundation, only focus on a single project while others will sponsor many.

Under this umbrella of governance come many different policies. Questions as simple as where to create a new repo to the difficultly of how to choose the next leader of the group. Perhaps a defining question is who can spend money and on what. For example the Apache foundation does not pay any code contributor to keep a completely volunteer force, but many companies provide in-kind donations of employee time. While the NumFOCUS and Software Conservancy foundations will hire contractors and professional coders for projects that have raised funds. This might be the most contentious part of governance as an organization that has more funds can direct the nature of a project just by only working on the pieces that are useful to them. Creating committees to determine the roadmap of a project and only allowing developers to stick to the plan is one alternative, but with the drawback of creating a slow and bureaucratic process.

While each of these examples below have many books written about them, the organization of a foundation will bring a larger group dedicated to the needs. Governance doesn't ensure a project will succeed but does set it up to receive larger responsibilities from the communities. At NumFOCUS we have found many grant making institutions much more amenable to project funding whereas supporting code of an individual research group more often leads to unmaintained projects.

Example governance benefits

- Governance Structure
- Licensing guidance
- Coding standards
- Codes of conduct

Fiscal Services

For many projects, the primary motivation to join a foundation is to receive money. As any parent knows, the point at which money management enters a life so does a much greater responsibility. But fiscal services are not as simple as just a checking account. Fiscal services allow organizations to bill vendors, apply for credit and

insurance to hold events, provide a substantial audit to donors. In short the mission of an open source project will fall short without a significant effort to manage all the fiscal policies.

Perhaps a non-obvious, very specific relationship that exists in the United States is that of the Fiscal Sponsorship. Fiscal Sponsorships allow projects to use the legal status of the parent entity for conducting itself as effectively its own non-profit organization. Organizations such as NumFOCUS and Software Conservancy, use this model to give projects the maximum amount of flexibility in determining their projects organization.

A few more benefits falling into the fiscal category include professional employment services, e.g. payroll and benefits management, and grant administration. While many project manage these services at universities and host corporations, it often becomes impractical as the organization grows. In the case of universities it is often the case that the hiring track doesn't include a structure for the types of employees that open source software needs, hence the creation of the Research Software Engineering career in the UK and the EU.

Example fiscal benefits

- Fiscal Sponsorship
- Professional Employment Services
- Grant administration

Legal Services

Perhaps the more straight forward set of services are the legal services. Its good to have a set of lawyers that already understand the business of open source software and non-profits at the ready. It also turns out that universities and corporations don't hire for these special skills.

While in the United States a volunteer may be protected this is not quite the case in all the world. By having a legal entity that can represent the group, the project is able to better defend itself from unwanted legal attacks. The most prevalent of which is a trademark infringement where companies will capitalize on a projects name for their own gains. Many cases of this happening are documented but perhaps one of the most absurd was a company in the EU trademarking the name Python almost 20 years after the Python language was established. By having a foundation with members in numerous EU countries the Python Software

Foundation avoided damages to its brand and potentially a requirement to rename itself in the EU. While such problems are not a hinderance to building better tools, they are distractions from the projects core purpose.

While keeping a legal team fully booked would be very difficult for many projects, foundations often have negotiated retainers and access that don't exist elsewhere. Its a service that one doesn't know they need until they are in desperate need, thus one we would point out as a unique feature to foundations over corporations or universities.

Example legal benefits

- Trademark protections
- Contractural agreements
- Business negotiation
- Liability insurance
- Royalty contracts

Outcomes from the Public Good Software Foundations

The large number of services that foundations provide are helping many project thrive. While it is true the complexity and popularity of the open source movement is growing, it is also a result of the services that foundations are providing projects. The amount of activity on projects can be directly correlated to the work of open source foundations. Although is a bit of a circular feat, having processes to make projects bigger just to make it possible doesn't serve the wider world well.

Fortunately, it doesn't take looking at various business and economic drivers to see that as open source has thrived so has many other parts of the world. In every sector and at most companies with a technical team, one will find open source. In fact it is hard to point to a technical company that survives without benefitting from the zero cost licensing.

From the vantage point of NumFOCUS, we can point to scientific discoveries that are only possible because of our sponsored projects. The Phalae lander, the mars rover missions, the LIGO gravitational wave detection are a few in major

achievements in physics. Additionally Apache Foundation will point to the explosion of big data web companies that depend on their projects to deliver global content.

While its hard to say that operating a project with an open foundation is a necessary condition for success, it is certainly becoming more standard.