

What is Open Source Software?

1. Free has two meanings - one, as in not limited or controlled as in freedom of speech or freedom to distribute. Second meaning could be as in no cost or payment.
2. In 1998, people began to use the term Open Source to be clear what freedom meant.
3. Source code is made available with a licence which provides the right to :
examine, modify and **redistribute** ; without restriction on user's identity and purpose.
4. **Licensing Classifications :**
Permissive : Any code changes need not to be available to recipients. Often preferred by companies.
Example - BSD free licence software.
Restrictive : Any code changes must be available to all recipients. Sometimes called "Copyleft".
Example - GPL Licence software

What Is Proprietary Software?

1. Historically only the real model used by commercial projects until the rise of OSS, only Software owners had full legal access to the source code.
2. Trusted partners can be granted access rights if they sign a Non-Disclosure Agreement (NDA).
3. Software owners may or may not be authors of the code.
4. To use proprietary software, end users must accept a licence accepting their rights .
Such licences generally :
 - Restrict user's redistribution rights.
 - Indemnify the product from damages due to either malfunction or misuse.
 - Prohibit trying to reconstruct source code or use inside a product.
5. They may also sometimes restrict how a product is used.

The difference between Proprietary and OSS has nothing to do with the price. The licence differences has to do with the redistribution, modification, reuse of code, etc.

Pragmatism v/s Idealism

Pragmatism	Idealism
<ul style="list-style-type: none">• The primary considerations are technical:<ul style="list-style-type: none">- faster and better development (e.g. more contributors and review)- easier debugging, etc.	<ul style="list-style-type: none">• "Free" as in freedom, not beer• Software open for ideological and ethical reasons, not just technological ones

Open Source Governance Models

What is a Governance Model?

1. Any project needs organization to achieve its purpose.
2. How decision gets made and who makes it requires thought
3. A project is still open source, whether or not -
 - Anyone can contribute or a selected few.
 - Decisions are made democratically by a authority
 - Plans and discussions are made public before release.
4. How this is done determines Governance model.

Company-led : Mostly closed Process

1. Software development, design and release are controlled by a single entity.
2. External contributions may or may not be solicited.
3. Plan details may or may not be described openly.
4. Internal discussion, controversies might not be aired.
5. Upon release, software is in the open. E.g - Google Android, Red Hat Enterprise Linux

Benevolent Dictatorship : Strong Leadership

1. One individual has overriding influence.
2. Project quality and success depends on overseer's wisdom and management capacity.
3. Dictator's role may be social, political, not structural.
4. Maintainers write less code as project matures.
5. Can avoid endless discussions and lead to quicker development. E.g - Linux, Wikipedia.

Governing Board : Tighter control by smaller groups

1. A body carries out discussion on open mailing lists and all decision made collectively.
2. Decisions about who can contribute, patches to be released, etc made by the group.
3. Much variation in governing structures, rules of organization, etc.
4. Releases are less frequent, but well-debugged. E.g - FreeBSD, Debian.

Advantages of OSS

Collaborative Development

- Enables software projects to build better software
- When progress is shared, not everyone has to solve the same problems and make the same mistakes - faster progress and reduced costs
- Having more eyeballs viewing code and more groups testing it leads to stronger and more secure code
- It is often hard for competitors to get used to the idea of sharing, and grasping that the benefits can be greater than the costs
- Competitors can compete on user-facing interfaces - users see plenty of differentiation and have varying experiences

Security and Quality of Source Code

- Coding standards and styles tend to be cleaner and more consistent on community projects:
 - It's embarrassing to show ugly, sloppy code
 - More people have to understand and work on the code
- More eyeballs examining code looking for security weaknesses before they are discovered by bad actors
- More input in original design to avoid bad ideas
- No "security through obscurity"
- No "just trust me"
- Potentially faster bug repair

Developers

- Makes it easier to not have to re-invent everything
- Helps to make good early decisions on product design
- More eyeballs on code find and fix bugs faster
- Allows for suggestions/contributions from a larger group
- Helps to find the next job
 - Code is readily available for evaluation
 - Shows how well you work and play with others
 - Shows how good you are at mentoring and maintaining projects and sub-projects
- Builds community (you are not alone!)

Contributing to OSS Projects

How to contribute properly to Open Source Software?

1. Investigate the project, its workflow, style and identify the scope of the work.
2. Identify how the project communicates : review mail listings, study archives, join an Internal Relay Channel (IRC) if exists.
3. Understand how contributions are submitted : Mail listing, email, or Revision Control System(e.g **git** or **subversion**).
4. Study previous history.
5. Check if project offers veteran contributors as mentors.
6. Offer your services for testing, finding bugs, etc before submitting your code.

7. Make sure you are competent at programming language you use.
8. Find the right balance between asking for reviews and suggestion early in processes and waiting too long and dumping a lot of work on people at once.

Study and Understand Project DNA

- Unless starting a project of your own, there will be some community established ethos and formal or informal structure.
- Some questions to ask while joining a project:
 - a. Why the project exists and what was it started for?
 - b. Has it diverged from its original purpose?
 - c. Is contributing community large or small and continuously active or sporadically?
 - d. Does it have collective or singular governance structure?
 - e. What kind of licence does it adopt? Do you have to sign a Contributor Licence Agreement (CLA)?

//(NOTE - Most OSS Projects never take off.)

Tips for Successful Contributions

Be Patient, Develop Long-Term Relationships, Be Helpful

- Most projects do not appreciate drive by, one-time contributors, and look for long-term maintenance
- Sometimes good code gets rejected, unless someone offers long-term commitment (think about the future when doing submissions)
- Develop meaningful relationships in the community by offering help in areas that are not directly related to your main interests
- Be viewed as a good citizen and real member of the community, not just someone exploiting it; this is particularly important if you are contributing as part of a commercial organization

Leave Your Ego at the Door: Don't Be Thin-Skinned

- OSS projects tend to attract some rather interesting characters, some of them can be quite irritating, even offensive
- If that's the case, rely on community members with long history to try and calm things down and resolve issues (occasionally, contributors may be purged from a project); don't feed the trolls
- When making criticism or engaging in any discussion thread, be polite and respect other people opinions; maybe your approach is not the best one
- Learn when to yield if you want to get code upstream

Do Not Discriminate or Offend

- Do not engage in behaviors that involve discrimination and offensive conduct with respect to:
 - Race
 - Sex
 - Sexual preferences
 - Religion
 - National origin
 - Politics
 - etc.
- People from rather far sides of the spectrum often work together successfully

Contribute Incremental Bits, Not Large Code Dumps

- Large code dumps overload maintainers and mailing lists, and make it difficult to process the individual parts
- Code contributions are best digested in small, unit-sized bites; for example, you may have a separate patch for each file you are modifying (sequential patches)
- It is possible that your functionality will not work until all patches are included - that's fine

Get Early Input and Work In the Open

- As a new member of the community you probably don't know the history - your bright new idea might actually be an old one (discussed and rejected/brought to life and petered out)
- This doesn't mean your idea is a bad one; maybe it couldn't have been done in the past, but is feasible now as software and hardware evolved
- Never just introduce an idea and suggest someone else do it
- Propose your ideas to the community before you go too far with it; get opinions, suggestions and input; take advantage of institutional memory
- If you are uncomfortable having other people look at your work often, OSS is not for you!

Identify Maintainers, Their Work and Methods

- There are projects that have one maintainer (perhaps the benevolent dictator) or subsystem maintainers (e.g. the Linux kernel community)
- The maintainers have to:
 - Understand and review all submissions
 - Make sure they add something other than complication and do not introduce bugs
 - Make sure they don't conflict with other patches
 - Complete their work in a timely manner
 - Do everything respectfully
- Have a good relationship with relevant maintainers; be respectful and patient; offer help reviewing other contributors' submissions, debugging new features or fixing bugs

Continuous Integration

Why Continuous Integration?

- Once upon a time, most software was written by a relatively small group of developers, often working in the same location and in frequent contact; coordination and division of responsibilities was straightforward
- **Revision control systems** were developed to accommodate more than one contributor working on a project
 - Central **repository** stores the master copy of the project; one or more developers possess the ability to make changes and then check them in
- The Linux kernel was the first really huge distributed development project, and its creator, Linus Torvalds, invented the **git** system for rationalizing distributed development

Why Continuous Integration? (Cont.)

- A revision control system does not solve the problem of making sure what a diverse group of contributors is doing actually works together; that one set of new code or bug fixes does not conflict with another - this can only be done by **testing**
- Testing requires the following considerations:
 - Can overlapping sets of changes be applied simultaneously, or do they conflict?
 - Does the project compile when all changes are applied?
 - Does it work on all possible targets?
 - What does working mean?
 - Are there non-trivial test suites that can exercise a representative workload enough to give confidence things are fine?
- Continuous integration techniques ensure that testing is so frequent that any problems cannot persist for long; distributed developers stay on the same page.

Continuous Integration, Continuous Delivery, Continuous Deployment

We can distinguish three separate steps/stages:

- **Continuous integration** - changes merged into the main branch ("master") as often as possible; automated builds run on as many variations of software and hardware as possible; conflicts are resolved as soon as they arise
- **Continuous delivery** - the release process is automated and projects are ready to be delivered to consumers of the build; thorough testing is done on all relevant platforms
- **Continuous deployment** - the product is released to customers; again, in an automated fashion

Note: Continuous integration can be considered to include both delivery and deployment.

Continuous Integration, Continuous Delivery, Continuous Deployment (Cont.)



The time gap between these steps is meant to be as close to zero as possible. In a perfect word, developer changes can reach end user customers the same day or even in minutes.

Tools

- There are many well-developed continuous integration software tools including:
 - Jenkins (the most widely used)
 - Travis
 - TeamCity
 - GO CD
 - GitLab CI
 - Bamboo
 - Codeship
 - CircleCI
- Some of these products are free in cost, others are not

Costs and Benefits

Costs	Benefits
Changes have to be merged very often, putting a possible strain on developers	Developers don't go down the wrong path and compound fixable mistakes, or get in each other's way
The repository must be monitored by a continuous integration server; staff has to be allocated to do this	The build steps are fully automated; all the work has been done up front, instead of each time build testing needs to be done
Scripts and other tools have to be run to perform automated tests, report their results and take appropriate actions - it can be a lot of work to prepare this infrastructure	Regressions (bugs which break working product) may be minimized; releases should have fewer bugs

The launching of the **Continuous Delivery Foundation (CDF)** was announced by the Linux Foundation in March 2019. It is designed to be a vendor-neutral home for the coalescence of significant projects in the CI/CD (continuous delivery and integration) universe.

By establishing and documenting best practices, working out guidelines and making training available, the goal is to evangelize and spread Ci/CD and DevOps practices and improve product release processes.

Founding projects are:

- **Jenkins**: An OSS Ci/CD system
- **Jenkins X**: Jenkins for Kubernetes
- **Spinnaker**: An OSS multi-cloud CD platform
- **Tekton**: An OSS specification for CI/CD components.

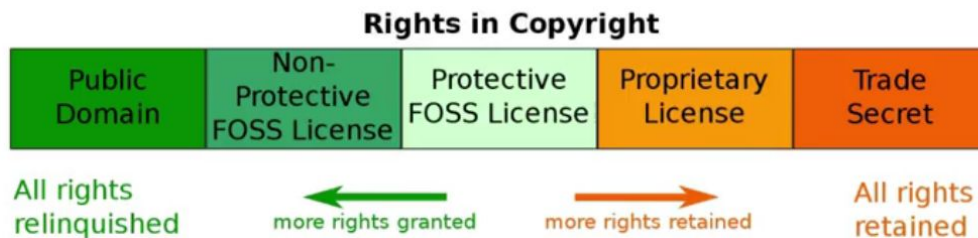
The Technical Oversight Committee (TOC) has an open governance model.

Founding members include: Alauda, Alibaba, Anchore, Armory.io, Atos, Autodesk, Capital One, CircleCI, CloudBees, DeployHub, GitLab, Google, HSBC, Huawei, IBM, JFrog, Netflix, Puppet, Rancher, Red Hat, SAP, Snyk, and SumoLogic.

OSS Licenses and Legal Issues

Choosing a License

- Choosing the best license is a very important decision and requires careful thought
- Switching to a different license later during the life of the project can be difficult if not impossible (especially, if there are many contributors with rights)



Fear, Uncertainty and Doubt (FUD)

- First usage of the term Fear, Uncertainty and Doubt goes back as far as the 1920s; use of the acronymic form seems to date from the 1970s
- FUD means disseminating misinformation to influence recipients to avoid certain strategies, products or classes of products by appealing to fear
- Microsoft was widely accused of spreading FUD about Linux in the 1990s; in present day Microsoft has stopped doing so and it is actually employing OSS widely

FUD statement	Why it is not true
OSS is a virus	One has to be careful about respecting licenses but many prominent companies have learned how to combine open and closed software in their offerings; there are companies and organizations dedicated to helping ensure this is done properly
OSS infringes on software and forces you to grant patent rights to others	Once again proper legal analysis is required
OSS products leave nowhere to turn when they break or to get technical help	Many open source products are supported by serious, long-living companies (such as Red Hat Enterprise Linux), as well as smaller organizations, plus there is a lot of freely available help online, and there are many consultants that can be hired (there is more competition available for such help than there would be with vendor lock-in on a product)
OSS requires a lot of legal help to avoid the above pitfalls and is thus very expensive	Even proprietary software requires significant legal analysis to properly avoid copyright and patent infringement, etc.; OSS is no different and not more expensive, and having all the software being available in source form expedites the auditing process.

Legal Issues

- Companies require interaction with lawyers, either on staff or external, to make sure they do not violate copyrights and licenses
- There are many kinds of licenses and one has to be careful, but once an organization develops proper reasonable procedures, it is just a standard part of any project
- Part of this is training the developers to understand the dos and don'ts of working with OSS

Patents and Licenses

Software Patents

- A software patent gives exclusionary rights to material such as a computer program, library, interfaces or even techniques and algorithms
- Software patents must be filed in for each nation (or trading block such as the European Union) in which coverage is desired → an expensive and time-consuming project
- Exactly what a patent can or cannot cover varies from jurisdiction to jurisdiction
 - USA → exclusion of "abstract ideas"

Do We Need Software Patents?

- Software patents vs copyright and trademark laws
- Software patents have been often used defensively, with corporations cross-licensing each other's work to avoid litigation

Open Invention Network (OIN)

- Founded in 2005 (over 3000 members in 2019, including Google, IBM, NEC, Philips, Red Hat, Sony, SUSE and Toyota)
- Created as a global patent pool
 - Companies and other entities enter in a mutual non-aggression agreement within the Linux-based ecosystem
 - Members agree in return for not suing each other over patent issues
- Microsoft Sells Out
 - Microsoft joined OIN in October 2018, opening up over 60000 patents

openinventionnetwork

Patents and Licenses

- The intersection of software licenses and patents is rather complicated
- A partial table of properties about whether or not a license conveys explicit patent rights from contributors to users:

Yes	No
Apache 2.0 GPL 3.0 and LGPL 3.0 MPL 1.0, 1.1, 2.0 EPL 1.0 CDDL 1.0	BSD 2-Clause, 3-Clause MIT GPL 2.0 and LGPL 2.1

CORRECTION:
GPL 3.0 talks about
patents and GPL 2.0
does not.

- Sometimes, projects will use a license that does not provide an express grant of patents, but then add a grant of patents in a separate file (e.g. **LICENSE** and **PATENTS** file in the source code)

Leadership v/s Control

A good leader listens and empowers all participations to present their ideas, higher quality and imaginative work.

Popular leadership paradigm : **Benevolent Dictator for life (BDLF)**

- Can make the final decision (generally more efficiently than a majority vote or consensus of a committee), but that does not alleviate them from listening and giving proper consideration to debates in the community and even occasionally including changes and contributions they personally have problems with

Mentoring

- Depending on the size of the project, there may be one level of leadership or more, including subsystem maintainers whose responsibilities include:
 - Handling contributions efficiently
 - Knowing when to send patches back for revision
 - Sending them up the chain with or without revision
 - Discarding them with proper explanation
- Obtaining knowledge and skills necessary to become a good maintainer requires training, or more precisely **mentoring**, from those who have done it successfully before

Mentoring (Cont.)

- Another level of mentoring involves new members of a project - if they can attach themselves to more experienced contributors, who may or may not be maintainers, they can learn the ropes with less pain:
 - How to produce patches in the proper form
 - How to phrase questions and proposals
 - How to acquire realistic expectations of how quickly their work might be considered and whether it has a chance of success
- Proper mentoring empowers people, leads to a more efficient workflow, and contributes to long-term vitality and growth of a project

Building Trust

- Without **trust** an open source project cannot function:
 - Contributors must trust that their submissions will be treated with respect and given reasonably prompt consideration
 - Project leaders must trust subsystem maintainers are qualified and capable of doing their job; if they are not living up to their responsibilities, they can be tutored on doing a better job or be asked to transition out of the role
- Trust must be earned and must go beyond the benefit of the doubt
- As a project matures, reputations are earned and new members should be aware of the history

Why Do Many OSS Projects Fail?

Why Projects Fail?

- The vast majority of OSS projects do not succeed; some of the reasons why include:
 - Insufficient interest
 - Competition from more established projects that duplicate the intended functionality (even if the new project seems to have features the older one does not)
 - Poor leadership
 - Not enough developers
 - Insufficient funding
 - Insufficient or uninformed attention to licensing issues
 - Low barrier to entry - projects are very easy to start
- The low survival rate should not be seen as a bad thing; most (but not all) successful open source projects start small and it can be quite difficult to predict which ones will survive and thrive

Diversity in OSS

Diversity and OSS

- The word “**Open**” that appears in OSS might be taken to indicate a friendly, welcoming environment; unfortunately, unless a proper atmosphere permeates a project, this may be a false promise
 - **Diversity** in an OSS project can mean many different things:
 - Race and national origin
 - Sex and gender identity issues
 - Geographical/regional issues (including both language and cultural differences)
 - Religious beliefs and political views
 - Acceptance of different opinions and methods about how the project should take shape and develop in the future
 - While it is just *the right thing to do* to accept contributors and reviewers from divergent backgrounds, diversity also leads to a better project due to unleashing more sources of new ideas, approaches, and contribution
-

Sex and Gender Identity

- In general, software engineering, system administration, and IT have been dominated by men
- Incidents of unwelcome behavior have long been a problem at some conferences
 - The Linux Foundation staff has very stringent policies regarding avoiding and dealing with any improper behavior
- Conference speakers should avoid marketing with sexual pictures, jokes and innuendos, and should try to use sex-neutral terms and pronouns, etc.
- Besides the fact that discrimination is wrong, it also shrinks the potential pool of contributors and users
- Any misogynistic and/or homophobic statements in mailing lists, discussion groups, chats, etc., should be promptly beaten down and criticized; don't contribute if a community accepts demeaning or unwelcoming behavior

Race, National Origin, Geography and Language

- Discrimination based on race and national origin is obviously wrong but is rarely explicit
- Geographical and language differences can lead to misunderstandings and insults
 - The vast majority of open source projects are primarily done in English and developers tend to have at least a working familiarity with it, but that is quite different than everyone being on the same page
 - Even among English speakers, words can have quite different meanings and usage in various countries
 - We can choose our words with sufficient care, try to be inoffensive and clear (e.g. be careful when using idioms and metaphors)
- Localization/internationalization - providing translated documents, using standard methods to provide help and error messages in multiple languages

Tone and Criticism

- Another aspect is tone; in some cultures cursing is rather routine and coarse and not offensive in the way it is in others
- It is important how criticism is offered; adopting the proper criticism methods is a two way street
 - Those used to a very direct approach should continue to do so but should avoid unnecessary nastiness
 - Those not used to such an approach need to develop a thicker skin and pay attention to the content as much as possible, not the wrapping it comes in
- The goal is to promote healthy and rapid development from as large a pool of contributors and users as possible, not just to behave nicely because it is good manners

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Religion and Politics

- Discussion of religion is generally inappropriate (denigration of anyone's beliefs and proselytizing in favor of any religion) and has nothing to do with either technical or governance aspects of an open source project
- The same is true with political opinions extraneous to the project (e.g. national or international affairs)
- OSS is built on the concept of freely available intellectual product; once freedom is in the air, it becomes hard to avoid political discussions
- Once a discussion with political aspects veers away from direct bearing on the project it should be moved into other channels
- One should not dissuade anyone from participating in a project based on their political or religious views - this limits the potential pool of contributors and hurts a project

Differences of Opinion

- Collaboration involves:
 - Dividing work among more than one group or individual, to be merged later
 - Reviewing it, accepting as is, sending back for revisions, or changing and sending further along
 - Competition between differing approaches
- Besides the usual advice about being civil and respectful, it is also very important to keep in mind that different people do things in different ways
 - Accept someone else's contribution that has the same effect as yours even if you think yours is better; if you do not prevail in the discussions of which approach to merge, you may just have to accept your less desired outcome
 - Or you can think more of things your approach can take care of the other cannot and add increased functionality and try again
- With more debate and more opinions, often a better project can be built