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Open Source Software: A Prominent Requirement of Information Technology

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Abstract-In today's scenario, Open source software needs no formal introduction. In this technological era everyone is using this in their own way. Multinational companies come up with new versions of their software regularly; these are called open source software. Thousands of researchers building some tools or techniques on a global platform together which are in no way lesser in features when compared to their commercial counterparts. In fact if we go ask and discuss with Open Source enthusiast, we feel that they are much more efficient, reliable, and over all customizable. Most of the demanding software of these days is based on open-source technology. IBM to Google, Firefox to Wikipedia. Open Source communities like Ubuntu share the principle of "Shared efforts, Shared principles, No cost." that's why we get some free software easily with less effort.

Keywords- Open Source Software (OSS), Ubuntu

I. Introduction

In production and development terminology, Open source is a most vital concept which is spreading all over the world. It is a methodology which promotes free re-distribution which enables any user to access about product's designs or ideas or implementation details. The Development community released open source software which is evolved by a secondary phase whereas closed source software is developed under the supervision of small team developers. Through open source, developer support and helps large community. Collaborative programmer developed open source software under uncoordinated manner by using freely distributed source code and communication takes place over the internet. Open source is more secure which provides better quality, more flexibility, higher reliability and lower cost. The whole world is connected with open source code. The open source came in existence in contrast of propriety software, the propriety software are basically computer program that are property of their developers or publishers and it can't be copied or distributed without complying with their license agreements, almost all commercial products are came under propriety software, whereas open source has free to be modified and distributed with others. Any one access open source anytime, anywhere because it is not closed and it also supports the concept of reusability. The source code of an application or software can be view as well as modify also. In this paper we have focused the analysis of Open-source software. Section II contains a formal definition of OSS. In Section III, we have covered history and section IV is specifically related to the need of open source. Section V has discussed criteria of open source whereas section VI covered closed source vs free software. Section VII deals the working principle of OSS whereas section VIII covers open source development model. A part from this section IX contains advantage as well as section X focused disadvantage of open source software. Some examples are elaborated in section XI and lastly in section XII conclusion has covered.

II. Definition

Open-source software (**OSS**) is computer software whose source code is available with a license in which the user gets the rights to study, change, and distribute the software to anyone, for any purpose by copyright holder. It is an example of open collaboration which developed in public collaborative manner. The software usually includes a license for programmers to change the software in any way they choose. The user can fix bugs, improve functions, or update the software as per their needs or requirements. The Open Source Initiative (OSI) is a leading authority on OSS; their definition of open-source software includes certain parameter they are: Software redistribution, Source code availability, Distribution of licenses, License properties and Anti-discrimination.

III. History

When computer did not exist, at that time the concept of free sharing of technological information also existed. Researchers which have the access of ARPANET follow a process which is called request; it is used to develop telecommunication network protocol on the basis of commenting which tends to the birth of internet in 1969. In Palo Alto, California, The term open source was coined by a group of people. In April 1998, open source summit organized by technology publisher Tim O'Reilly. "Free

software" is developed by Richard Stallman (Free used as freedom) in the 1980's by the movement "Free Software Foundation (FSF)", Richard Stallman and other members of his community wanted to avoid the potential moral dilemma of either denying his neighbor a copy (of software or source code) or breaking either copyright or nondisclosure agreement. To fulfill this goal he started GNU project and a definition for free software was crafted. Therefore the term free software is focused on the freedom to share with your neighbor. The goal of free software movement is to ensure user rights to use modify and re-distribute code. Richard Stallman is a great man with open vision and he is an American software freedom activist and programmer. There is a famous quote that accompanying Richard Stallman's software:

"Share this code with your fellow users. Learn from it. Improve upon it. And when you are done, please give something back to the community."

As compare to free software some researchers thought that freedom is important but developing technically good software is most important. Thus the open source movement was born. The idea behind this movement is to emphasize the technical merits and profitability rather than talking about ethical or political issues. Therefore the term Open Source was later introduced by another community. Eric Raymond published a paper named "The Cathedral and the Bazaar" in 1997, it was a reflective analysis of the hacker community and free software principles. This paper was one of the crucial factors which motivated Netscape to release their popular Netscape Communicator Internet suite as free software. Although Eric Raymond ad other members of the FSF thought about the need of 'rebrand

To achieve that goal, in 1998 they created the Open Source Initiative (OSI) to promote the creation and usages of open source software.

IV. Need of Open Source

The one of the important question which comes in our mind is, why open source and what is the need of this? The idea of open source came into existence from the technical community. From the starting days of computers, programmers and engineers developed new technologies through collaboration of each other. For example, a programmer in San Jose develops a new application, and then another programmer in Singapore studies the application and discovers ways to improve it. The knowledge is shared between them, and the entire community gets benefit from the collective effort or innovation. There are several parameters which are considered if a project is developed under open source, they are:

Quality and Reliability-Any project which is actively developed under some community of developers, the peer reviewed process of that project is done under several developers this will enhance the quality of project as well as reliability of the project also. According to a statistics report 80% of the web servers and websites are powered by open source web servers. Apache HTTP Server, NGNIX, Apache Tomcat, Node.js, Lighttpd, these are some top open source web servers in recent scenario. According to a survey report, 66% of web servers use Apache HTTP Server.

Security- A numbers of users prefer open source software because this software is considered as more secure than proprietary software. The open source is visible for any one, so that any user can view as well as modify it; it might be possible a user might spot and correct errors that are missed by a programmer. Several programmers can work on a piece of software without asking any permission so that due to scrutiny of peer developers, security problem perceived by very fast and resolved quickly.

Support- A large number of companies offer open source product in different form like: FAQ, online documentation, mailing list and form for the support of their project. No any type of mechanism which will stop support and pressurized customers to enhance as always happen in commercial products. Through this a user gets great support by online community on basis of 24/7 because that responds very quickly.

Stability- As compared with proprietary software, large number of users prefers open source software for long term projects. If the original programmer of software stops working on their tools then the tools won't disappear or fall into disrepair.

Training- Open source software helps user to become better programmers. Because open source code is publicly accessible, anyone can easily study rectify it to learn and make better software. They can also share their work with others, inviting comment and critique, as they develop their skills. When users find any mistakes in programs source code, they can share those mistakes with others to help them avoid making those same mistakes themselves.

Control- As per the need, many people prefer open source software because they have more control over propriety software. Users can check the code weather it is doing something or not. Anything the user don't want to do, they can change parts of it they don't like. Users who aren't programmers also get benefits from open source software,

because they can use this software for their requirements, not merely the way someone else thinks they should.

Cost effectiveness- Open source software are cost effectiveness because a user can freely redistribute the code, no need to buy a costly software after paying huge amount of money. Only need to modify the code as per user needs and share that updates so that others get benefited.

Reduce dependency on closed source vendors- Open source software reduce the dependency on closed source vendors, because a customer don't have to wait for software completion.

More tools to access- There are several different types of tools available for user to enhance the software. Some of them are: development or testing tools, project and portfolio management tools, network monitoring, security, content management, etc. without having to ask anyone, the user have effectively used these tools.

V. Criteria for open source

To accomplish the open source in successful manner, there are certain criteria which must be satisfied so that the open source software will be beneficial for everyone. These criteria are summarized as below:

Source code-The source code must be available online for any user, so that they can use it properly.

Derived works- The derived work or enhanced work of a user must be accepted if it is correct in every manner.

Free redistribution- The source code must be freely distributed so that communication takes place over the internet, therefore collaborative programmer developed open source software under uncoordinated manner

Distribution of License-In open source software, the license must be distributed among collaborative programmers, so that they can easily access the source code without taking prior permission.

Integrity of the Author's source code – A user using open source software has the right to know about the author. In the similar manner, author also have right to know about each other enhancement.

License must not restrict other software- Open source software authors have the right to make their own choices about their own software.

License must be technology neutral- There is no any provision of the license may be predicated on any individual technology or any particular style of interface.

License not specific to a product- If the source code of open source software is accessed by any user or group, the software is distributed within the terms of the program's license. All the groups to whom the source code is redistributed must have the same right as those are granted with the original software distribution.

Same distribution license- The distribution of license is same for all the programmers or developers, so that they will do work on same platform with same license.

No discrimination against persons or groups- To access or utilize the piece of source code of open source software, no any type of discrimination exist against persons or groups. All users have the right to study, update of open source.

No discrimination against fields of endeavor- In open source, no discrimination exist against fields of endeavor, they are free to access the source code.

VI. What is closed source and free software?

In software terminology, the source code of closed source software is hidden from public and competitors so that they can't modify, reproduce or resell the product. Software companies, those want to protect their products from software piracy or misuse follow the closed source model. The closed source software is also known as propriety software.

The term free software is coined by Richard Stallman in 1983, to create free operating system Stallman created GNU project and founded Free Software Foundation (FSF). According to the FSF, any piece of software to be considered truly "free," if its license must guarantee four essential freedoms to its users:

- For any purpose, we will have freedom to run the program as our choice.
- The freedom to study or know about the working of programs, and have right to change it according to required computation. Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor.
- The freedom to distribute copies of your modified versions to others. By doing this whole community get a chance to be benefitted from your changes.

Therefore we can say that, in free software users have the freedom for the run, distribute, study, change and improve the software. The open source is preceded form of free software.

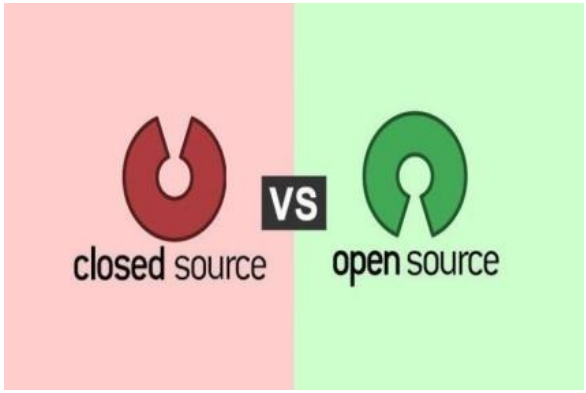


Fig:1 Closed Source logo and open source logo

VII. How open source works?

Mostly project has a core team of contributors who strive on building the project and working on future roadmap with strict set of guidelines. The technical lead and team of core developers of the project always help in achieving the enhancement. If a project is big every subproject has technical lead along with core developers. They are responsible for the workflow along with future roadmap. The working principle of open source software contains certain stages, they are:

Contributing- The first stage of open source software is contributing your own source code, if you find it useful for others also. Then user gets in contact with the team. If any issues came in source code, then it is submitted to a bug tracker. Some developers like your ideas and fix the issue. In some cases user fix the issues and rewrite on your own.

Initiating- A user can share their source code or program as a zip, github, codeplex etc. Then other users start liking it and submit any report based on issues if come. Some users maintain their own code based on others, or they ask for joining the project.

Team Open Source Software- When users interacting with each others in the community, there might be a possibility that everybody has a slightly different agenda: that is good for the project but it makes it hard to make decisions.

Joining an organization- After completion of above mentioned stages, there is a need for good process and infrastructure. The processes are hosting, build servers, issue tracker etc. These all are organized in a platform like Eclipse Foundation, Apache Software Foundation, Outercurve Foundation or Codehaus etc. Apache also offers some infrastructure: a CMS for documentation, Jira for issue-tracking, Hudson and Teamcity for Continuous Builds, SVN+GIT for Version Control, Mailing Lists (users, dev, private), committer directory and so on.

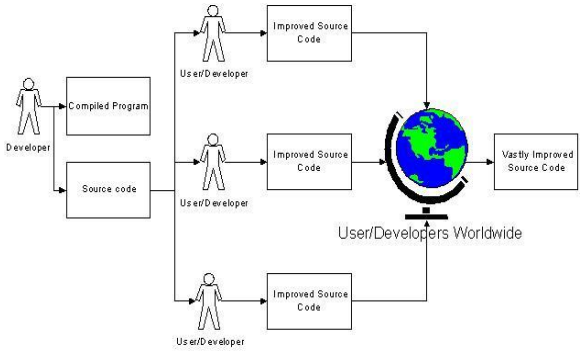
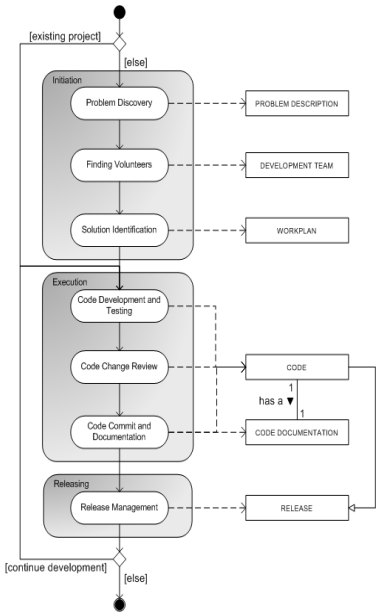


Fig:2 Working structure of open source software

VIII. Open Source Software Development Model-

To develop open source software or similar software whose source code is publically available, a process is required that process is known as open source software development. Some popular open-source software products are Mozilla Firefox, Google Chromium, Android, LibreOffice and the VLC media player. For creation of World Wide Web, the Open source software development has contributing a major role. Tim Berners-Lee contributing his HTML code development as the original platform upon which the internet is now built. Open-source software development can be divided into several phases. The process-data structure of open-source software development is displayed through below diagram. The phases of open-source software development along with their corresponding data elements are displayed in the diagram. This diagram is made using the meta-modeling and meta-process modeling techniques.



An open-source project work can be done in several ways. Any user sense the need for a project can publish to develop

a project publically. If any developer worked on this project, after completion of the project developer release the first version of the open source program to the public. Through this approach a sophisticated source code is publically available for the users

IX. Advantages of Open Source Software –

To use open source software, there are several advantages which came into existence. Some of them are listed below:

Availability of source code- Source code is freely available for any user.

Better Quality and customizability- Open source software effectively used for real time because programmer enhance and modify the source code time to time, which means it can be better quality and more secure and less prone to bugs than proprietary systems, because several users consider the problem efficiently.

Less cost as compared propriety counterparts – To use open source software, it helps the user to minimize his expenses. A user can save on licensing fees and maintenance fees. The only expenses that you would encounter would be expenditure for documentation, media and support.

Does not depend on vendor - Using open source software also means a user is not limited for a particular vendor's system that only work with their other systems.

Transparency- A user can efficiently modify and enhance the source code or programs for their own business requirements, which is not possible with proprietary systems.

Free- According to a survey after using open source software, collaborative programmers saves businesses $60 billion a year. It means a user can operate source code without the need for expensive licenses. Especially for a small business open source software saves companies a tremendous sum every year.

Redistributable & Flexibility- Open source code is flexible to all, a user can do any change in it and redistribute the code as other get benefited.

Continuous improvement- Collaborative programmer continuously improves the source code of open source software to fix bugs, make tweaks, and add something new. A large number of programmers are engaged to improve the source code and anyone can take the initiative to improve the software.

X. Disadvantage of open source-

- No financial incentives.
- Software quality process is widely not transparent
- Bad codes and some unqualified people use it
- Incompatibility issues with software and hardware (3rd party drivers)

- **Hidden costs**-A lot of companies are initially attracted by the fact that open source software is free, but it's important to factor in the cost of deploying and integrating the software. You'll also have to consider ongoing maintenance and support costs.
- **Learning curve**-Do you have the internal expertise to work effectively with your chosen open source product? You can't necessarily find well-documented help or get support on the phone. Open source software often isn't user friendly because that's not a priority for the developers. It may be necessary to hire and train to fill the skills gap.
- **Risk of abandonment**-If key programmers lose interest or no longer have time to work on the project, then it could be abandoned quite quickly. Open source projects do sometimes die out and if you've invested a lot into the software it could prove to be a serious problem if the updates stop.
- **Security risks**-You benefit from the software being open, but that means it's open for others too. Malicious users can view the code and look for exploits and vulnerabilities. If companies don't take the time to analyze the open source code for security vulnerabilities and take action to mitigate them, then it's dangerous to assume it's safe. Ignoring security risks could lead to serious exposure.

The potential benefits of the pros outweigh the risks of the cons, which is why open source software dominates the landscape. However, it's important to analyze on a case-by-case basis and keep security in mind. Many companies also lack a formal policy for open source use and employee contributions. In many cases adopting open source will be a smart move, but make sure your strategy is fully thought out.

XI. Examples of open source-

There are several categories of open source, they are

Application Software: - 7-Zip, Eclipse, GIMP, Chromium, Blender, Mozilla Firefox, Open office

Operating systems: - Android, Linux, FreeBSD, ReactOS, Haiku, FreeDOS

Programming Languages: - Perl, PHP, Ruby, Python, PHDL, Prolog

Server Software- Joomla, Drupal, Wordpress, mambo, oscommerce. Several types of open source digital content has available for users.

Wikimedia - It is a nonprofit organization owed and operated by Wikimedia foundation, whose motive is to bringing free content to the world. There are several Wikimedia projects which actively assess nowadays. Wikipedia, Wiktionary, Wikisource, Wikinews, Wikiversity etc are famous examples of OSS.

Some important open source project

Linux- Linux distributions have several of other open source package. Linux kernel, tools, services etc provide all of a fully functional operating system.

Programmer's tools- A high quality set of programmer's utilities has created by GNU project of Free Software Foundation, which include gcc C compiler, the g++ c++ compiler, the gdb debugger, the emacs editor.

Web Browser- There is several web browsers which are based on open source, like Mozilla, Chromium, Midori, Brave, Falcon, Pale Moon etc.

XII. Conclusion

The open source software grown very rapidly in today's scenario. It emerged as a dominant standard as in some sectors of the software industry, open source programs have become popular enough to provide real competition to proprietary alternatives. Open source is the revolution in the world of software development as open source contains operating systems, web servers, and development tools have become very popular, open source office software and games are examples of software categories that have not really taken hold.

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