Impact of Open Source Software in Research

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ABSTRACT

The software industry is growing very fast and often promises new development. It initially promises to change the market, but ultimately fails to remain as it is. Open source software (OSS) is software whose source code is published openly, usually available at no charge, and often developed by voluntary efforts. Open-source software is everywhere whether specifically in the form of applications nurtured by dedicated users or as a built-in digital platform used by millions of people. This type of software is developed, maintained and expanded both within and outside the private sector, through contributions from businesses, universities, government research institutes, non-profits, and people. The open source model presents a new paradigm for financing software in the interest of communities (e.g. health and education) also. It can be said that such projects are developing in some countries and the government is focusing on running pilot projects to test the feasibility of OSS approach for such software. OSS has also gained prominence in some specific segments of the software infrastructure market by beginning to take a significant share and a particular example of this is that Linux has been the fastest growing server operating system since 1998. In addition, open-source software (OSS) has attracted the attention of researchers as well as practitioners in recent years. Keeping this objective in mind, this paper has done a comparative study of the characteristics of OSS and CSS, reason of its use by researchers, and the study of the major and particularly useful OSS.

1. INTRODUCTION

Currently, the use of technology is prevalent in every field, whether it is in medicine, trade, small scale industry, education, or any other field. In the current era of technology and computerization, Open source software is being used more and more in day to day operations. Which type of software is used in particular technique, depends on its basic requirement.
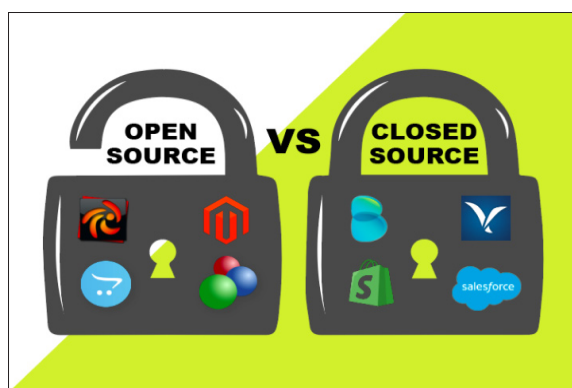
Figure 1. *OSS/ CSS*

So there are two covering categories of software: open source software and closed source software. In Open-source software (OSS) source code is issued to the user under a set of rules

(licenses) (Colazo et al., 2009). In OSS, the developers give users the right to use it for study, required change and moderated the software for any purpose. Hence Open-source software can be established in a collective and freeway. CSS i.e. closed source software is software that keeps source code secure and keeps it encrypted. In this, the user can neither copy parts of the code nor modify or delete it without some special permission. This can lead to zero warranty to legal consequences if the user uses it without permission.

2. COMPARISON OF FEATURES OF OSS AND CSS

Open source is often referred to as free software, although it carries some additional costs for additional support, additional services, or additional functionality. Closed source software is typically waged software. In CSS different costs are determined on the basis of complexity of the software (Zhonghua et al., 2003). So the employer need of software become complete with a improved invention, complete provision, functionality and revolution.

Figure2. *Features of OSS/ CSS*

In selecting the best type of software it may be OSS/CSS be subject to the requirements and purposes of the employer. The best way to compare between the two types of software is to look at some of the biggest features. To better understand the features of both software's, some basic aspects have been compared and studied.

Table1. *Comparison of Open Source Software/ Closed Source Software*

S. No.	Type	Open Source Software	Closed Source Software	Advantage
1	Development	OSS development is controlled by the collective association of the user. In this, development and improvement usually continue as long as the user community is active.	Closed source software manufacturers typically handle development and improvement, meaning it depends on the manufacturer whether they continue their ongoing development or not.	The advantage here is in open source software, because if the community is large and active, new updates, features or improvements can be expected over the long term.
2	Support	There are no support options for OSS such as a FAQ or contacting person. The only way of support options are through receiving feedback through forums, reading related articles, or through a subject matter expert.	Closed source software usually has a dedicated FAQ, manual and options for contacting someone. If at any time user faced the problem at any step in using the software, then he get a quick response by using 'help' option. All these options are well organized and well documented.	This has the advantage of closed source support as many support prices are factored into the price of the software. (Except 24/7 or specialized support types such as individual experts)
3	Flexibility/ Innovation	Open source software provides much greater flexibility. It can modify functions as per requirement of the user needs.	Closed source software has only as much flexibility as manufacturers want and restricted to what was programmed. Changing these things can void the warranty or cause even bigger problems.	Open source becomes easier than closed source due to the flexibility in the option to change your code.
4	Cost	Open source does not have the cost associated with core functionality. However, there may be a cost for its features, support, or additional functionality.	In CSS, developer set some costs for the software. In CSS user have pay some price as an upfront cost or subscription, which includes the right to use the software by that user.	Here both OSS and CSS a cost is on an equal basis and depends on user requirement.
5	Usability	Usability is often a most important area of condemnation for open source software because the technology used in it is not reviewed by usability experts. This does not require a user guide and is therefore often overlooked.	It has a high selling point of usability due to user manuals are provided for immediate reference, quick training and support services which helps in maximizing the use of the software.	Here user and developers are efficient to use a diversity of mechanisms to enhance CSS.

6	**Security**	Security in OS is most concerned because software is not always established in a exact environment. Among software developers, there is a lack of consistency and general direction with individual users which prevents effective communication.	CSS is more secure in comparison of OSS because it is developed by a focused team with a controlled direction so that risk is minimized.	CSS depends mainly on developer methodological knowledge and capitals to preserve and apprise the software.
7	**Reliability**	Reliability of Open Source is high because it is critically inspected by numerous self-determining and passionate developers during all its expansion.	The reliability of closed source is lesser because it twisted by a lesser number of developers who controlled against fitted time limit under much pressure.	Open source has increased reliability over closed source.

3. Extensive use of OSS by the Researcher

Educational researchers rely on a variety of specialized software to carry out their research work. Closed source software / commercial software options in common use are expensive. For this, the researcher also has to purchase licenses for general applications for data analysis, or they have to buy expensive licenses for particular software, which is not possible for all the researchers. This is why; a greater number of researchers are using open source rather than expensive commercial software (Lougee-Heimer et al., 2003). This not only saves the researcher cost on open-source business options but this cost can be invested back into the research by the researcher again. Along with this it also provides an opportunity for researchers to develop software for their specific requirements.

Researcher demands OSS over CSS for many reasons (Edelson et al., 2002). Some of the major reasons are as follows:
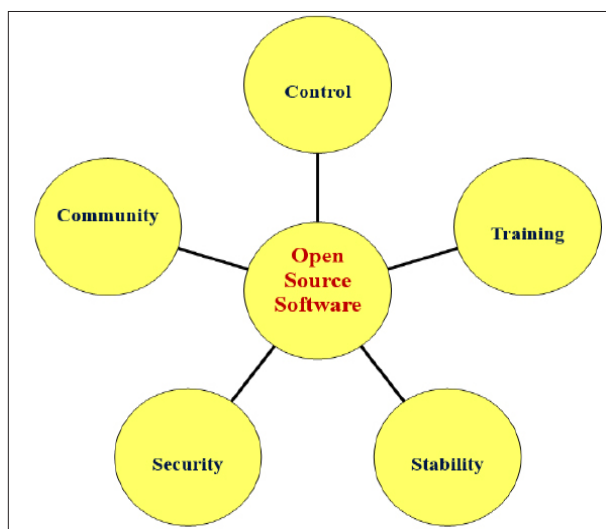

Figure 3. *Demand Parameters of OSS/ CSS*

3.1. Control

Many people prefer open source software because they have more control over it. They can make parts of it according to their needs. Important in this is that users who are not programmers also benefit from using open source software for any of their purposes.

3.2. Community

Open-source software inspires groups of users and developers to use it. It is not unique to open source; but in the case of open source, the community is not just a fan. It is an elite user group that tests, uses, promotes, and ultimately influences open-source software.

3.3. Training

Open-source software is publicly accessible. Researchers widely demands OSS because it help them in improving their programming skills. In OSS students are able to study code easily and they can share their work with others. When they received the comments and criticism in their software code, indirectly improve their coding skills.

3.4. Stability

Open-source software works according to open standards. Programmers rely on software for important tasks in which the user ensures that the code they create will not disappear if their original creator stops working on them.

3.5. Security

Users consider and prefer open-source software more secure and stable than proprietary software. The important reason for this is that open-source software can be modified; any person can fix or cancel errors and omissions and upgrade it as per their requirement.

4. Commonly Used Open Source Software

The use of open source has increased significantly in recent years. Many other decent options for well-known proprietary products are available in the market (Fitzgerald et al., 2006). Some of the major open source software is shown in the figure below.

Table 2. *Commonly Used Open Source Software*

S. No.	OSS	Description	Operating system	Features
1	**Libre Office**	Open source alternative to Microsoft Office	Windows, macOS, Linux	Full set of office apps
				Supports Microsoft files
				Lots of templates
				Not cloud-based
2	**VLC Media Player**	Open source media player that can play virtually anything	Windows, macOS, Linux, Android, iOS	Runs well on old hardware
				Plays virtually any media file
				Optimizes playback
				Complex menu system
3	**GIMP**	A powerful open source editing tool for photos/ images	Windows, macOS, Linux	Fully customizable interface
				Layers, filters and masks
				Advanced editing tools
				May confuse first-time users
4	**Shotcut**	Open source program for advanced video editing	Windows	HDMI preview and capture
				Hundreds of codecs supported
				Advanced effects
				Steep learning curve
5	**FileZilla**	An Open source FTP client that's refreshingly user-friendly	Windows, macOS, Linux	Resumes dropped connections
				Intuitive interface
				Remote file editing
				Looks slightly dated
6	**Linux**	Open source operating system	OS	Increasingly accessible
				Good features
				Strong security
				Overwhelming choice of distros

Apart from the main common open source software given above, some sources openly used in research in various streams are as follows:

Table 3. *Commonly Used Open Source Software in Research*

S. No.	Area	OSS	Description
1	**Numerical Computing**	**SciPy**	It is a free and open-source Python library used for scientific/ technical computing. It contains modules solving interpolation, linear algebra, special function and optimization problems etc.
		Scilab	It is a free and open-source numerical computational package. It can be used image enrichment, statistical analysis, FD Simulation, Signal processing, numerical optimization etc.
		Gnu plot	Gnu plot is a used for forming 2D or 3D plots of given functions, data, and for fitting curve. It is command-line program that can runs on all operating systems like Linux, Unix, Microsoft Windows, and others.
		GNU Octave	GNU Octave is software featuring a high-level programming language and used for numerical computations. It helps in solving the linear/ nonlinear problems by using with MATLAB.
2	**Computer Algebra Systems**	**Maxima**	It is a computer algebra system (CAS) based on Macsyma. It is written in Common Lisp and runs on all platforms such as macOS, Unix, BSD, and Linux.
		Axiom	It is a free, all-purpose computer algebra system. It consists of an interpreter environment, a compiler and a library, which describes a powerfully typed, mathematically hierarchy.
		Sympy	It is an open-source Python library for symbolic computation. It provides computer algebra capabilities either as a stand-alone application, as a library to other applications, or live on the web.

3	**Statistics**	**PSPP**	It is a free software application for analysis of sampled data. It has a GUI and conventional command-line interface and also an alternative for IBM SPSS Statistics.
		R (language)	It is a programming language and free software tool for statistical computing and graphics. The R language is widely used among statisticians for developing statistical software and data analysis.
		SOFA Statistics	It is an open-source statistical package. The name stands for Statistics Open For All. It also has a GUI and can connect directly to MySQL, Postgre SQL. SOFA Statistics is written in Python.
4	**Optimization Software**	**CUTEr**	CUTEr stands for Constrained and Unconstrained Testing Environment revisited and are an open source solver for optimization and linear algebra. It offers a collection of test problems along with a set of tools to help developers in designing and improving new test problems.
		ASCEND	It is an open source, mathematical modelling tool. It includes different mathematical solver such as NL-Algebraic solvers, Differential/Algebraic equation solvers, NL-Optimization and Modelling solver.
		ADMB	ADMB or AD Model Builder is a free and open source software suite for NL-Statistical modelling. It uses MC-Monte Carlo methods and is useful for Bayesian modelling.

5. Conclusion

The article describes here gives a brief about the open-source software and closed source software. in this article author tries to explain the importance of OSS by explaining its features. Also this shows that why it has been increasingly popular among the researchers. In this article author also discussed the commonly used OSS and its uses so that it more helpful for a new researcher in starting their work if he/she whenever required. A discussion of all currently used software is not possible here. The reason behind this is, certainly in the next few years, the current software will also change with the need for less expensive and more flexible options and this process will continuously give useful options.

6. References

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