Understanding the Development Model of Open Source Software and its Applications

Madhu Kumari[1], Sanjay Misra[2] and V.B.Singh[3]

Abstract-*The popularity and usages of open source software(OSS) are getting an edge due to the advancement in communication and internet technologies. In some of the areas, open source software is dominating over proprietary software. Open source software is robust, reliable and more dependable. In this paper, we have done an exhaustive study on different aspects and challenges of open source software namely, the development model, the growth of OSS, why OSS fails, what makes OSS more dependable, the business model of OSS,OSS in developing countries and last but not the least the research interest in OSS products .*

Key Words: Development model, Open Source software

Introduction: During the last two decades, enormous advancement has been taken place in the field of communication and internet technology. This advancement has added different tools and techniques in information technology. Today'sInformation technology has changed the dynamics of life and society. It has added new dimensions like e-learning, e-conferencing, e- commerce, e-meeting, e-governance…, and the list is now becoming endless.

There is also a paradigm shift in the development softwareas we are moving from closed source software to open source software. There is countless number of success stories of open source software. Sanjiva Weerawarana and Jivakaweerawarana in his book "Open Source in Developing Countries"states that "The reality of the Open Source(OS) phenomenon today is that the majority of theInternet infrastructure is based on OS products including send mail,BIND, Linux and Apache HTTPD, the latter running more than 69% ofall active websites (approximately 15 million) with Microsoft IIS cominga distant second with less than 23% share. Similarly Linux has made arelentless assault on the server operating systems market, and the business models driven by this outcome demonstrate their viability andprofitability". The development of Open Source Software has lowered the setup cost of Information and Communication Technology (ICT) as we are getting software free of cost.

Some of the quotes of Richard Stallman's (American software freedom activist and computer programmer)are

1. Proprietary software is an injustice
2. Control over the use of one's ideas really constitutes control over other people's lives; and it is usually used to make their lives more difficult
3. The idea of copyright did not exist in ancient times, when authors frequently copied other authors at length in works of non-fiction. This practice was useful, and is the only way many authors' works have survived even in part.

In India an ancient doha support the basic idea behind Open Source Software

[1]Delhi College of Arts & Commerce, University of Delhi
[2]Department of Computer and Information Sciences,Covenant University, Nigeria
[3] Delhi College of Arts & Commerce, University of Delhi

It cannot be stolen by thieves, nor can it be taken away by kings. It cannot be divided among brothers and it does not cause a load on your shoulders. If spent, it indeed always keeps growing. The wealth of knowledge is the most superior wealth of all!

Definition of Open Source Software:
Open source software is software whose source code available to the general public, does not require license fee,it can be redistributed, and anyone can modify the source code and distribute the modified version of the software. Means, Open Source software is by the users and for the users.

Close source vs Open Source Software
In proprietary/ close source software users have to pay price for license and they can not redistribute the software to other users. The source code of software is also not available in proprietary/closed source. In open source software, software and its source code is freely available to its users.

Free vs Open Source Software
Free Software, Open Source and Open Source Software terms have been used interchangeably in the literature. FOSS (free and open source software) term has been also evolvedto give impetus to philosophy of open source software and motivate the users for creating and modifying the codes.Here, the term free does not mean to free cost or zero price but related to software without any constraints.

2. Open Source Software Development Model
"Good programmers know what to write.
Great ones know what to rewrite (and reuse)[1]"
The OSS development paradigm challenges many conventional theories in economics, softwareengineering, business strategy, and IT management. Thousands of users are spending stupendous amount of time and great effort to write and debug software, without the greed of any compensation. Sometimes the software becomes very large and complex, since modification involves number of users without the benefit of traditional project management, tracking system, or error checking techniques.
It has number of bug tracking system (e.g.

BugZilla) where any user can report the bug and once bug has reported, it is open to all users to get it fixed and send back to the authors of the software. Also, any user can request for any new feature. It maintains all repositories namely bug, source code, different versions, comments, mailing list and communication which helps in improving the quality of open source software. So, the OSS development paradigm can produce innovative, high-quality software because it involves many ideas because it is developed by many users.
Following diagram explains the development model of open source software [2].
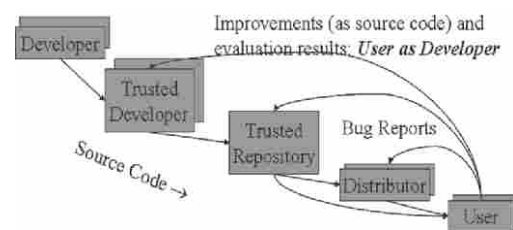
Above diagram explain the development model of open source projects. In OSS, there are two types of users (i) active users and (ii) passive users. Active users are responsible for bug reporting, source code writing, maintenance and bug fixing activities.The passive users only use the software. In developing country, most of the users of OSS are passive users. All the OSS projects have a trusted repository which maintains different releases of software, source code, mailing list, reported bugs and their status. Users can get their software directly from the trusted repository, or get it through distributors who acquire it (and provide additional value such as integration with other components, testing, special configuration, support, and so on).

The users who are actively involved and come under the code developer are allowed to modify the trusted repository directly: the trusted developers. At project start, the project creators (who create the initial trusted repository) are the trusted developers, and they determine who else may become a trusted developer of this initial trusted repository. Users can send bug reports to the distributor or trusted repository, just as they

could for a proprietary program. But what is radically different is that a user can actually make a change to the program itself.

2.1 Open Source Licensing Models

Open Source Initiative(OSI), a non profit organization has been formed to promote and advocate for the benefit of open source software. It also builds bridges among different constituencies in the open source community.

Open source licenses are licenses that comply with the Open Source Definition — in brief, they allow software to be freely used, modified and shared.

There are various licensing models for open source software. The main licensing models are
  i.   GPL(GNU General Public License)
  ii. LGPL(GNU Lesser GPL)
  iii. BSD(Berkeley Software Distribution License
  iv. QPL(Q Public license)
  v.   IBM Public License
 vi. MPL(Mozilla Public License)

All the licensing models mentioned above give users a freedom to use source code, modify the source code, share the code and redistribute the software. But the licensing models namely BSD, IBM and MPL can follow closed source concept, means source code cannot given to users. In all the licensing model GPL has impact on derived works, means if we take a code, modify it and produce a software then that contribution will also be released under the GPL. The meaning is that you cannot make it private.GPL has impact on derived works too.

3. Growth of Open Source Software

In many areas open source software is a reasonable or even superior approach over close source software or proprietary software. According to the various measures given below,we see thatopen source software has received great attention amongst software users. Various study show that the open source projects and size of source code are increasing exponentially.

a) The most popular web server has always been OSS/FS since such data have been collected. For example, Apache is the current #1 web server.

Market Share for Web Servers across All Domains, August 1995 - April 2007[3]
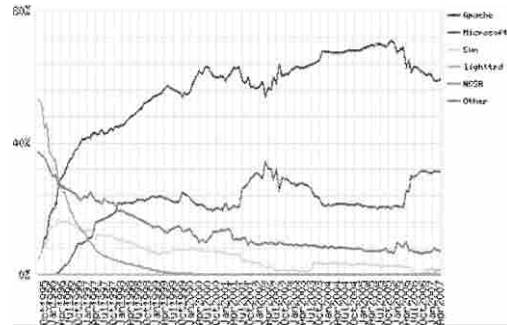
a) GNU/Linux is the #1 server OS on the public Internet (counting by domain name), according to a 1999 survey of primarily European and educational sites

Operating System	Market Share	Composition
GNU/Linux	28.5%	GNU/Linux
Windows	24.4%	All Windows combined (including 95, 98, NT)
Sun	17.7%	Sun Solaris or SunOS
BSD	15.0%	BSD Family (FreeBSD, NetBSD, OpenBSD, BSDI, ...)
IRIX	5.3%	SGI IRIX

4.Why OSS Fails? There are number of OSS projects which are most successful in different domain butthere are some projects that got fail due to less interest of active users. The one important reason is that the team which started the project left during the development of project due to business reasons. And in some cases, once the developer's interest is satisfied then he takes less interest in the development of project and project got fail.

5. What makes OSS more dependable? In

his seminal work the Cathedral and the Bazaar, Eric Raymond put forward the claim that "given enough eyeballs, all bugs are shallow."

It is proven that Open source quality is on par with proprietary code quality, particularly in cases where codebases are of similar size. Organizations that make a commitment to software quality by adopting development testing as a part of their development workflow, by the open source and proprietary codebases analyzed, reap the benefits of high code quality and continue to see quality improvements over time. Various reliability models used to predict the reliability of OSS also claim that the OSS products are more reliable. The download of OSS product is also good in number which proves that this software is more dependable.

6. Business model of OSS

The quality and adoption of Open source projects are measured by the size of their active users, the number of downloads, and other such metrics; companies are measured in terms of revenue and profit.

Business models for such OSS can be broadly classified into two categories:

(a) distributer and retailers of various open source products; and

(b) OSS related services.

- The business of retailers of OSS complementary products has however been very successful. Successful business models here include publishers such as O'Reilley as well as organizations that operate user conferences.

- The second major category of OSS business models are OSS related services. These can be subdivided into two major categories:

➢ OSS development and Interest enablers and/or

➢ Service and support for OSS products providers.

The recently developed ADHAAR CARD has been developed using OSS products because the OSS products gives more scalability and robustness.

The hierarchy of OSS businesss models
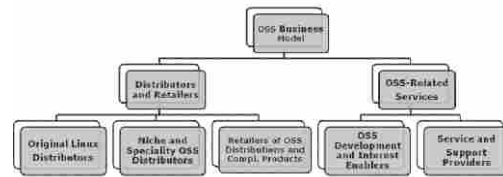
5. OSS for Developing Country

The automation work of different departments is taking place in developing and developed country. The digital literacy rate is also low in these countries. The uses of OSS products can help in imparting different services. Different key are as can be identified for developing countries for the economy through IT like Enhanced or new business opportunities in the IT sector for private firms, Reduction of IT cost in the economy for both Government and private firms and Improvement in the effectiveness and efficiency of Government (and Governance).

Open Source Strategy for Developing Countries illustrated in Figure given below[6]

5. Research Opportunity in OSS

The development model of OSS has given opportunity to researchers of different domain of subjects and mainly from software engineering. In open source software, the software repositories namely, reported and fixed bugs, source code, mailing list, bug triaging information, release schedule are available to all users. The software repositories are only available with OSS and not available with any closed source software. All these repositories are available with CVS i.e. concurrent versioning system. The researchers can do an empirical research; validate their method, models and theory by using these repositories.Different mining tools are used to extract valuation information from the repositories. Researchers

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used different software tools like SPSS, MATLAB, RAPIDMINER,R SOFTWARE, STATISTICA and WEKA for extracting valuable information, classification and clustering.

6. Applications of Open Source Software

Open source is a buzz word now days in the software industry, Universities, research institutions and other sphere of human activities. Open source is fundamentally a model of distributed, shared, open software development. Recently, however, the economic benefits of open source technologies have attracted a growing move towards adopting open source software (OSS) options in developing countries to a point that now the developing world is leading the developed world in open source adoption. The case for a developing country to adopt open source software (OSS) driven Information Technology strategy is a compelling one[6].

There is thousands of popular OSS used in different domains. Developing countries need to more focus on OSS in terms of development and usage. Open source tool is also available for education like MOODLE, BODINGTON.

Following are some application's areas of OSS:

Areas	OSS Used
Audio & Video	Media Player Classic Home Cinema(MPC-HC)
Business & Enterprise	Apache OpenOffice
Communications	Ares Galaxy
Development	Apache OpenOffice
Home & Education	Programming Without Coding Technology
Games	UltraStar Deluxe
Graphics	Sweet Home 3D
Science & Engineering	Sweet Home 3D
Security & Utilities	7-Zip
System Administration	FileZilla

- **MPC-HC (Media Player Classic - Home Cinema)-** MPC-HC is an extremely light-weight, open source media player for Windows®. It supports all common video and audio file formats available for playback.

- **Apache OpenOffice –**Apache OpenOfficeis a multi-platform and multi lingual **open-source office software suite** for **word processing, spreadsheets, presentations, graphics, databases** and more .

- **Ares Galaxy -Ares Galaxy** is an open source peer-to-peer file sharing application .

- **Programming Without Coding Technology** –PWCT is a Free-Open Source general-purpose visual programming tool designed for novice and expert programmers

- **UltraStar Deluxe** – *UltraStar Deluxe* is a free OpenSource game for PC .

- **Sweet Home 3D -***Sweet Home 3D* is a free interior design software application

- **7-Zip -**7-Zip is an extremely popular file archiver for Windows, which, although free, outperforms Winzip .

- **FileZilla -**FileZillais a hugely successful, cross-platform FTP client. It's also available as a server, for Windows only.

Linux OS (Operating System)

The Linux open source operating system, or Linux OS, is a freely distributable, cross-platform operating system based on Unix that can be installed on PCs, laptops, notebooks, mobile and tablet devices, video game consoles, servers, supercomputers and more.

The Linux OS is frequently packaged as a Linux distribution for both desktop and server use, and includes the Linux kernel (the core of the operating system) as well as supporting tools and libraries. Popular Linux OS distributions include Debian, Ubuntu, Fedora, Red Hat and openSUSE.

Basics of Linux

Linux is a *free* version of UNIX (or UN*X). The *free* part is not mean in money terms but rather that the source code for Linux is freely available for inspection, modification and what you feel you can/should do...

Linux is a **multitask** and **multiuser** operating system. Now, a little explanation of this terminology.

An **operating system** is a collection of programs that run in a computer so that a person can easily

access the hardware and all resources of the computers. The operating system is the big program that makes your computer life easy (or difficult, it the operating system is a bad one).

A **multitask** operating system is capable of doing several tasks at the same time (well, not quite so, but it seems like that from the human point of view).

A **multiuser** operating system has a concept of "user quote;, a way to identify the person that is using the system, and can allow different users to perform different tasks in the computer, and protect one user's tasks from interfering with another user's programs.

Open Office

OpenOffice.org is a powerful office suite. It comes with everything you have come to expect from a world-class office package.

OpenOffice.org comes with high-quality and completely free tech support through ourvolunteer-run mailing lists and forums. OpenOffice.org is available in many different languages. These include French, Spanish,Portuguese, Chinese (both traditional and simplified), Italian, Japanese, Hindi, Romanian,

Thai, Danish, and Dutch, to name but a few.

The following table compares the packages contained in Microsoft Office and those in OpenOffice.org.

➢ OpenOffice.org Writer is a full-featured word processor.

It features unique tools such as the Navigator and Stylist.These make changing the formatting throughout a largedocument easy as 1-2-3.

➢ OpenOffice.org Calc is a full-featured spreadsheet. It has a vast number of statistical and scientific functions. It can create pivot tables, charts and more**.**

➢ OpenOffice.org Impress is a full-featured presentation tool that allows the user to create and modify diagrams and pictures right within the application.

➢ OpenOffice.org Draw is a powerful drawing tool. It has support for both vector and bitmap images. With the Connectors tool you can create complex diagrams and charts.

➢ OpenOffice.org is able to read and write Microsoft Office files. Users can open and save Word, Excel and PowerPoint files on several platforms. These include Windows, Linux, Mac OS X and Solaris.

➢ OpenOffice.org has a one-click PDF export feature that lets you create PDF files. This feature makes exchanging documents in a standard read-only file format a simpletask. The creation of PDF files normally requires third party add-on tools. With OpenOffice.org this feature comes built-in.

➢ OpenOffice.org can export presentations and drawings to the Macromedia Flash format (.swf). You can view your presentations in any web browser with the Flash plug-in.Now recipients do not have to install any special viewer in order to view your presentation.

➢ OpenOffice.org has accessibility options for the handicapped. There is a high contrast mode for some kinds of visual impairment. Also, it is possible to use it with certain special entry devices.

➢ OpenOffice.org supports bi-directional and vertical text. Hence, it can be translated into languages with complex layouts like Chinese and Hebrew. OpenOffice.org has been translated into more than 30 languages.

➢ OpenOffice.org uses an open XML-based file format. Unlike others, it is not held secret. The file specification is publically available. Thus, anyone can write alternative software to manipulate OpenOffice.org files. You will never be forced to upgrade due to secret file format changes. This format is now the basis for the OASIS industry standard for office documents. The macro recorder lets you automate recurring tasks. For more complex functions, OpenOffice.org has a Software Development Kit (SDK). The SDK lets you extend OpenOffice.org using the Java programming language, C++, Python, Basic, OLE and XML.

➢ OpenOffice.org has an ActiveX control to let Windows users view documents withing an Explorer window. The

ActiveX control can also be used within native Windows applications

➢ OpenOffice.org can export documents to some specialized file formats like Daybook and various small device formats such as Aportis Doc. Users can then carry documents on a Palm Pilot or Pocket PDA.

➢ OpenOffice.org has support for various databases, including open source databases such as MySQL and PostgreSQL. This combination allows users to do tasks that used to be done with Microsoft Access.

5. Conclusions

In this paper, we have discussed different aspects and challenges of OSS. The popularity and usages of OSS is also increasing exponentially in developing countries. The usages of OSS reduce the setup cost of ICT program. We have discussed the development model, the growth of OSS, why OSS fails, what makes OSS more dependable, the business model of OSS, OSS in developing countries and last but not the least the research interest in OSS. We have also described some popular open source software. The paper also mention about the popular software used in different domains based on their downloads.

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