Open Source Software And Its Utility In Education

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Abstract-The advances in all academic disciplines and the human knowledge are the result of the open sharing of ideas, studies, theories, and research. The use of open source software is increasing rapidly and its role is becoming high in different domains ranging from commercial, educational, to research. Todays, Information and Communication Technologies (ICT) plays an important role in imparting quality education in all the academic disciplines across any geographical location with the help of advanced internet technologies. The role of ICT cuts all the barriers of cost, religion and location. Educational institutions are often faced with financial constraints. Competing demands for resources and the high costs of ICTs can be a major obstacle to providing ICT facilities in educational institutions. The major component in setup of ICT is hardware and software cost and the overall cost of ICT in educational institutions can be reduced by using open source software. In this paper, we will discuss some important open source software which can help to students and benefit institutions.

1. Introduction

Since, the last two decades, advancement in the information technology has changed the dynamics of life and society as well as software development. It has added new dimensions like e-learning, e-conferencing, e- commerce, e-meeting e-governance, e-chatting …, and the list is now becoming endless. The development and usages of open sources software (OSS) as well as interest of academics and practitioner has grown up since 1990 due to advanced in internet technologies and availability of higher bandwidth at cheaper cost. The design and development of open source software is significantly different from that of proprietary software. Open source software is developed by community for community. The development of OSS is of interdisciplinary nature and needs knowledge and expertise from many scientific disciplines such as computer science,

management and organization, social sciences, law, economics and psychology. According to Gartner's report, about 80 percent of all commercial software will include elements of open source technology 2012 [1]. Governments' interest in OSS is increasing, due to their reliance on sophisticated software. The UK Office of Government Commerce released a series of case studies in October 2004 outlining how OSS has been used in the public sector. However, UK parliamentary responses to questions on the use of OSS in government show that uptake is still limited. The Office of the Deputy Prime Minister is funding the 'Open Source Academy' project. This is intended to overcome barriers to uptake of OSS in local government such as lack of information, skills, confidence and lack of suitable products [2].

Open source was first evolved during 1970s. Richard Stallman, an American software

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developer, who believes that sharing source code and ideas is fundamental to freedom of speech, developed a free version of the widely used Unix operating system under GNU [2 and 3]. The spirit of open source software is the free right of using, reproducing, distributing and modifying the software, which creates an efficient economical, productive software development model: establishing commercial projects through the concept of open source, implementing collaborative development through the open source community based on the network, allocating resources optimizedly, increasing the transparency of projects, and reducing the risk of development [4]. Eric Raymond, the main proponent and co-founder of the open source project, is generally credited with establishing the movement of OS through his seminal paper "The cathedral and the Bazar" [5] and attributed the open-source software development approach as:

"Given enough eyeballs, all bugs are shallow."

1.1 Development Paradigm of Open Source Software

Open source softwares are developed by community for the community. Different users irrespective of their geographical locations contribute towards the development of open source software. Development structure of open source software and classification of users and
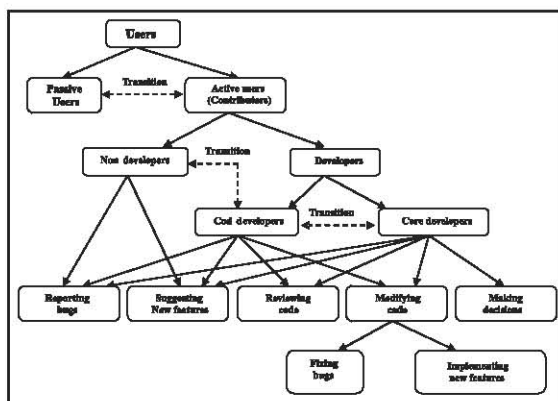
developers and their role is described in following figure as follows in [6].
In above diagram it is shown how users have been categories into active and passive category. Different categories of users are also upgraded

and they move up to the level of core developers and code developers. Transition also takes between users at different levels. Responsibility and functions of different level of users have been also shown in above diagram.

Free/Open Source Software is software that is made available along with source code as a distinctive feature. It is often available at no cost. Users can use and distribute the software. And if they so wish, they can study the source code and modify it to suit their needs. The modified version of the software can also be redistributed. In contrast, proprietary software is licensed to users for a fee and the source code is usually closely guarded and not made available to users.
The Free Software movement focuses on moral and ethical issues relating to the freedom of users to use, study, modify and redistribute software. Open Source advocates take a more corporate approach, focusing on the advantages of the Open Source software development method.

2. Learning and Digitization

The digitization of education is a relatively new phenomenon that has transformed the education sector as follows in [7].

Corporations and academic institutions have joined forces to further explore the potential for digitizing education through
- Virtual universities courses
- Education portals
- E-courses with multimedia features

Online courses are offered in a variety of forms by various sources. Some courses are offered by subsidiaries of renowned traditional universities, although many such courses are not accredited. The parent universities' names act as a powerful draw for online students. Courses are also offered by organizations that create digital online courses.

Most universities annually pay large sums to software companies to use their products, but open source licenses are free.

- Flexibility. Open source products are

customable and can involve third parties. New features and tools can be imported from the open source community.

- Service continuity. The huge collaborative network of the open source community minimizes, although it does not eliminate, the risk of discontinued service. Volunteer help is available through open source support systems such as forums.

- Continuous improvement. Extensive collaboration ensures that software products keep improving. Programmers from different institutions and organizations, along with volunteers, contribute freely to projects.

- Tax benefits. Governments of many countries have implemented tax- exemption policies to boost open source projects, although the govern- mental role in promoting open source software is controversial.

3. Open Source Software in Education

Open source software usages in educational institutions provide a quality education. It provides many benefits to students, researchers and institutions. Following are the benefits of using OSS in education.

- Total setup cost of ICT can be lowered by using OSS.
- Open source software are more reliable. Openness of software makes more reliable.
- Its performance is good as more intelligent and volunteer/self motivated people are working towards the development of OSS.
- The open philosophy of development of OSS makes it more innovative and also it encourages innovations. Students can use source code of software for better research and customized for their own purpose.
- Its provide an alternative to illegal copying/piracy
- Students and teachers can learn a lot from seeing the source code of the software. They can understand how the software has been

written and how additional functionality can be added to software by writing new patches.

Open source resources are available from the following initiatives:

Curriki, the Global Education and Learning Community, is a nonprofit body dedicated to the creation of free, open source curricula for all users and one of the most popular OSC online esources.10 Curriki pro- vides course materials for primary and secondary education, primarily focusing on the creation of complete curricula for courses distributed and used globally.

Connexions is a pioneering venture set apart from other open-education resources by its scope. The site provides instructional material for primary, secondary, and post secondary levels, as well as the industrial sector. Contributions are invited from all segments of society. The materials are available in different languages, and users from all over the world can download, customize, and reload them. Authors get credit for their contributions.

MIT Open CourseWare makes under- graduate and graduate course materials from MIT available on the Internet. This initiative has not damaged the university's reputation but instead has encouraged other institutions to publish their courses online as well.

Requirements of Educational Institutions

Different educational institutions have different ICT infrastructure requirements, depending on the level of education, the nature of the courses they offer and the available funding. Invariably, however, there is a need for computer laboratories in educational institutions for conducting basic computer classes, allowing students to complete their assignments, conducting specialized ICT classes, providing access to the library system, making available learning management systems and facilitating email communications. The number of computers required depends on the student population and the student- computer ratio that the institution considers desirable.

There are often requirements, in an academic setting, for publishing information and providing access to materials via the Web. These include teachers and lecturers providing course materials

online, students putting up Web pages, administrators publishing information on the intranet and the institution maintaining a public website.

All these require appropriate Web server, hardware and software.

Server Software

We use the following server software:
Linux flavors like : **Red-hat, Debian,Cent-OS,Ubuntu** ....etc
E-Mail like SendMail software from sendmail.org
File and print services: like **Samba** (samba.org) can be used as print server
Web server: like **Apache** (Apache.org)
Database server: like **Mysql** as database server and PHP as scripting language or PostgreSQL from postgresql.org as database management system.

Other Softwares:

- **Moodle**: Moodle integrates pedagogical features missing in many LMS tools, allowing instructors to construct customizable, online courses or a wide range of course modules on a flexible platform. Linux, UNIX, Windows, Mac OS X, Downloaded about 500 times a day. http://www.moodle.org

- **Bodington**: This Java-based virtual learning environment was developed by the University of Leeds in the United Kingdom. Bodington aims to provide a flexible, durable learning environment for large, complex institutions with numerous departments. It allows quick upload and management of learning contents. It works under Shibboleth, Linux, Microsoft, Mac OS X, Implemented at University of Leeds, UHI or

UNIX Millennium Institute, and University of Oxford. Provides services to 15,000 users with a single server
(http://www.bodington.org)

- **Claroline**: Built on free technologies such as PHP and MySQL, Claroline addresses the pedagogical needs of teachers and learners, emphasizing training technologies and well-structured online courses. It works under Microsoft, Linux/GNU, Mac OS X; Available in 35 languages
http://www.claroline.net

- **Dokeos** : Dokeos is a web-based application developed on free technologies such as PHP and MySQL. Designed to facilitate e-learning and course management, it provides a flexible, user- friendly platform to simplify the e- learning processes It Supports SCORM import and LDAP. Data can be imported using CSV or XML files. http://www.dokeos.com

- **LRN**: It supports online learning and other interactive digital systems. Originally designed to meet the needs of universities, it was later implemented in schools, organizations, and corporations. Its flexible framework allows easy customization. http://www.dotlrn.com.

- **ATutor**: The ATutor learning content management system was developed by the Adaptive Technology Resource Centre at the University of Toronto. It Complies with W3C WCAG 1.0 and W3C XHTML 1.0; supports content developed in IMS or SCORM. More than 17,000 registered installations http://www.atutor.ca

- **OLAT**: OLAT (Online Learning and Training) began in 1999 at the University of Zurich, where a team of developers continues to enhance the software. Much of it is written in Java. OLAT is registered under Apache License 2.0. It works under Microsoft Windows, Mac OS X, Linux, Solaris, and UNIX. Conforms to SCORM , IMS QTI, and IMS Content Packaging.

Popular within the European higher education community
http://www.olat.org

- **Sakai** : The core software consists of generic collaboration tools, with tools designed for specific applications (such as teaching and portfolio tools) available. Sakai complements commercial software like WebCT, Blackboard, ANGEL Learning, and desire2Learn. Adopted by many reputable universities worldwide.
http://www.sakaiproject.org

Productivity Suite:

- **OpenOffice** (www.openoffice.org), is gaining popularity as its features are becoming comparable to the proprietary Office suite. As noted earlier, OpenOffice can run on various platforms and a complete migration to Linux before it can be used is not necessary. In fact, it can be run on Windows side-by-side with Microsoft Office. A prominent feature of the latest version of OpenOffice is the ability to export documents directly to pdf format.

- **AbiWord** (www.abiword.com) works on most major operating systems, including Windows, and it supports many languages. It can read and write most documents in Word format and has the same look and feel as Word. AbiWord's native document format uses Extensible Markup Language (XML), which is an open standard. This means that an AbiWord document can be read by any other software using an appropriate XML parser.

- **Gnumeric** (www.gnome.org/projects/gnumeric) is a fast and complete spreadsheet programme that is being actively developed. It can support various spreadsheet file formats and has good support for Excel.

- Web Browser : There are a number of Open Source browsers available such as Mozilla, Galeon and Konqueror. Mozilla (www.mozilla.org) is a popular browser that is based on source code released by Netscape.

- **Multimedia:**

- **GIMP** (GNU Image Manipulation Program-www.gimp.org) is the most well-known FOSS for image editing and graphic design. It is a desktop application that can be used for various purposes by both academic staff and students. It is available for GNU/Linux, Unix variants and Windows. As it supports various image file formats, interoperability with other programs should not be an issue. GIMP is considered to be the FOSS equivalent of the proprietary Photoshop software.

- **Audacity** (audacity.sourceforge.net) is a FOSS audio editor through which you can record sounds, play sounds, and import and export files in various formats. It can be used to edit your audio, mix tracks together, or apply effects to your recordings. A media player for workstations is necessary for playback of videos and other multimedia content. This is commonly available on proprietary platforms.

- On FOSS platforms, **Mplayer** (www.mplayerhq.hu) is a programme that provides similar functionalities.It is available for Linux and many other UNIX variants and it supports many video and audio formats.

We are describing some software which can be used for scientific and library purposes.

- **Scilab** (scilabsoft.inria.fr) is a full-featured scientific software package that may be used in numerical analysis or engineering courses at the university level.

- **Dspace**: Used for the management of digitized book contents.

- **Newgenlib, Koha** : These are complete library management software available in any linux flavour and Ms-Window.Koha is full-featured and has modules for cataloging, reserves, Online Public Access Catalogue (OPAC), circulation, patron management and acquisitions. The circulation component

includes issues, renewals, returns and fines, and it can be set up to use bar code scanners. The acquisitions module includes budgets, pricing and supplier information.

There are many such Free Open Source Software which are very useful but all can not be described due to limitation of page size but students and researchers can download other software for different Open Source Software websites. Main website for development of open source software is *www.sourceforge.net.*

Proprietary software designed for the education sector is of very high cost and can not be afford by all institutions. The software may be administrative software such as Library Management Systems or Learning Management Systems. For all these closed source software, some of their equivalent free and open source software is available which are more reliable and dependable. But, it is likely that FOSS for these and other education-specific applications will become available in the future.

4. Advantages of OSS

Computer software is often used in research work and the use of proprietary software and operating systems in such work is inconsistent with the principle of verifiability, as the computation of results by closed-source software is not open to scrutiny. The validity of research findings, arrived at using FOSS can be verified, because the source code is for examination.

Some special view points regarding FOSS are:
- Encourage Innovation: like initially GNU operating system developed by Massachusetts inst
- Alternative to Illegal Copying
- Possibility of localization through source code
- Learning from source code

Open source products have gained considerable grip over the realm of higher education. The question remains, nevertheless: What is the future of open source software in higher education?

From a commercial perspective, open source projects are taking their first tentative steps into the marketplace.

This might be good news for universities because it would remove the threat of market monopolization, but to measure up to industry standards, open source projects need more sophistication. If collaborative contributions continue at their current pace, this might not be difficult to achieve.

They have a long way to go before they enter the mainstream, but together they have great potential to change forever the face of education.

Open source software refers to both the concept and practice of making program source code openly available. Users and developers have access to the core designing functionalities that enable them to modify or add features to the source code and redistribute it. Extensive collaboration and circulation are central to the open source movement.

- Source code distribution. The source code of the entire open source product must be easily modifiable. In the absence of the source code, the product must cite a low-cost resource where users can obtain it.
- Unrestricted distribution. Users can distribute the software without paying royalties.
- Modifications. The license allows modifications, and its terms remain unchanged for distribution of improved versions.
- Author's source code integrity. If the license allows patch file distribution along with the original source code, a user cannot modify the code and distribute it except by giving the new version a new n No personal discrimination. No person or group shall be discriminated against during open source product distribution.
In 1977 the trio began distributing an open source version of UNIX called BSD. The followingyear saw the release of a revised edition called 2BSD. Programmer Richard Stallman founded the GNU Project in 1984.

The GNU General Public License allows users to modify the code and distribute the improved version under the same license. The GNU operating system lacked a kernel, however, until Linus Torvalds developed the Linux kernel. In 1992, the Linux kernel was integrated within the GNU operating system[7].

5. Drawbacks of OSS

Following are drawbacks and limitations of OSS.

- Potential drawback of open source projects for education becomes evident during their implementation. Using the software to its full potential may prove challenging for beginners, and the availability of the source code is irrelevant for end users if they do not find the product useful.
- There are no guarantees that a project will reach completion and deliver the desired results, for example. Progress depends on the interest and time of the collaborative workforce and lack of resources or funding can derail a project.
- Most commercial open source products, however, are self-sufficient. Intellectual property rights can make it difficult to ascertain whether a particular software solution has been patented. If a process used in an open source project has already been patented, the group can be charged with patent infringement.
- Although the availability of source code makes it difficult for patent holders to prove infringement, these issues often cloud over development of open source software.

Conclusion

In this paper, we have discussed Open Source Software from historically point of view. Evolution of OSS has been discussed by considerating the up gradation of users from passive to core and code developers. We have also discussed the most commonly used software developed on open source philosophy and used in education. Any researcher or student want to develop software for some specific application based on open source philosophy, they can registered their product on website www.sourceforge.net and later on more volunteer can join the product and product can get their final shape. If we want to download any software then we can download from www.sourceforge.net. In future, we will discuss the uses of cloud computing in education.

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