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Open Source Software in Higher Education: Oman SQU Case Study

Amal S. Al-Badi, Ali H. Al-Badi

***Abstract*—**Many organizations are opting to adopt Open Source Software (OSS) as it is the current trend to rely on each other rather than on companies (Software vendors). It is a clear shift from organizations to individuals, the concept being to rely on collective participation rather than companies/vendors.

The main objectives of this research are 1) to identify the current level of OSS usage in Sultan Qaboos University; 2) to identify the potential benefits of using OSS in educational institutes; 3) to identify the OSS applications that are most likely to be used within an educational institute; 4) to identify the existing and potential barriers to the successful adoption of OSS in education.

To achieve these objectives a two-stage research method was conducted. First a rigorous literature review of previously published material was performed (interpretive/descriptive approach), and then a set of interviews were conducted with the IT professionals at Sultan Qaboos University in Oman in order to explore the extent and nature of their usage of OSS.

***Keywords*—**Open source software; social software, e-learning 2.0, Web 2.0, connectivism, personal learning environment (PLE), OpenID, OpenSocial and OpenCourseWare.

I. Introduction

THERE are two options in the use of software: 1) buy it from one of the software giants; or 2) use Open Source Software (OSS). The use of OSS is similar to the use of highways, railways, and telecom - everybody uses them equally (both rich and poor) by sharing, not owning, and hence the term software as service (SaaS) came, so that users do not have to own the software but can use it as a service.

The introduction of OSS enables educational institutes to start using more IT-related resources for teaching and learning. It has become very important step for the following reasons: 1) OSS can be customized to suit the educational institute's needs; 2) it can help students practice their software development skills as the source code is available freely to everybody; and 3) using OSS can contribute to a reduction in running costs.

Linux, which was invented by Linus Torvalds (University of Helsinki in Finland), is the best known example of OSS. There are many Open Source applications that are used by educational organizations. Specifically, these are learning management systems (LMSs) and operating systems (OSs).

Most of the educational institutes in Oman rely on purchasing software from software vendors such as Microsoft, and some of them download copies of software believing that it is a viable option. However, Oman recently signed a World Trade Organization (WTO) agreement which brought about new restrictions regarding the use of unlicensed software.

Obviously OSS has become critical to the success of many educational institutes. However, it has a limited usage in Oman, especially at Sultan Qaboos University. Many customers in Oman are not aware of the OSS option; hence this research was conducted to highlight the importance of OSS and explore its usage at SQU.

This research has four main objectives which are: 1) to identify the current level of OSS usage in Sultan Qaboos University; 2) to identify the potential benefits of using OSS in educational institutes; 3) to identify the OSS applications that are most likely to be used within an educational institute; and 4) to identify the existing and potential barriers to the successful adoption of OSS in education.

The paper has been organized in the following way: Section II discusses the literature review; Section III describes the research method; Section IV analyzes and discusses the research results; Section V concludes the research.

II. Literature Review

A. Open Source Software Definition

OSS is computer software with its source code made available and licensed with a license agreement that allows the copyright holder to provide the rights to study; change and distribute the software which can be used for any purpose and at no cost to anyone. OSS is the most distinguished example of open-source development and is often compared to user-generated content or open-content movement. OSS is "any software which aims to be distributed to anyone who wants it. It usually falls under a license agreement that allows people to access and modify the source code." [1]. Also, it can be defined as "software for which users have access to the source code" [2]. In general, a license is defined as the rights and obligations which a licensor grants to a licensee. Open source licenses give licensees the right to copy, convert and redistribute the source code. Also, these licenses may require obligations. For example, amendments and modifications to the code that are distributed must be made available in source code form, and each author attribution must be placed in a program documentation using that open source.

One of the basic fundamentals of the Open Source licenses is that they can be freely used. In addition, because they are free and sometimes based on individual efforts they may crash, so there is no warranty and no one can be held responsible for any data loss that may occur.

Amal S. Al-Badi is with the Department of Information Systems, Sultan Qaboos University, Oman (e-mail: u088639@student.squ.edu.om).

Ali H. Al-Badi is the HOD of Information Systems department at Sultan Qaboos University, Oman (e-mail: aalbadi@squ.edu.om).

B. OSS Examples by Categories/Types

There are three broad types of OSS: Community, Vendor (or Commercial) and Hybrid" [3]. Community-based OSS is software that is developed and managed by a community of people. Often there are key developers in the community, but the community is open to anyone to join. Apache, Netscape and GNU Compiler Collection are all examples of community-based OSS[4].

Vendor-based (or Commercial) OSS is software that is primarily developed and unchained by a company. Usually the seller makes a version of the product available in a community edition that is freely downloadable. The community edition does not come with support and typically has less functionality than their commercial version (often called a Professional or Enterprise version). Examples of this type of OSS are Talend, SugarCRM, and Jaspersoft[5].

The third type of OSS is the Hybrid model, which often evolves from a community-based system. This happens when a company forms around the open source project. The company often sells pre-packaged releases of the software and offers training, support and other services. Moreover, the company often develops and offers proprietary add-ons or customizations to the to OpenSource product. Examples of this type are Red Hat (selling Linux), Horton Works (selling Apache Hadoop), and Enterprise DB (selling PostgreSQL) [4].

C. OSS Benefits and Applications for Educational Institutes

OSS Benefits

"Adoption of OSS models has resulted in great savings for consumers (about $60 billion per year)" [3]. Most OSS can be integrated easily with other software products. As a result, it has been used for the purpose of teaching and other activities. In addition, it brings to educational institutions other benefits such as:

- The software can be completely customized to the local needs.
- The licenses are almost free, so there is no increase in license fee.
- Educators and students are not forced to use illegal software copies.

Many Open Source initiatives can be used to improve the learning of millions of people, and especially higher education students such as OpenSocial, Open ID, and OpenCourseWare. These terms are outlined below.

OpenSocial provides a suitable way for developers to build applications that encourage social and relational learning. For example, in the past if someone wanted to design three websites he would have to write a code for each site. Now, with the OpenSocial program we may create an application that can be used for all sites [6]. OpenSocial can help people change the way information is being shown rather than just in displaying the data as it its [7].

Open ID is a positive Web 2.0 feature which is also important for open education. It is sometimes known as Identity 2.0. For example, a driver's license is the best life situation for Open ID. It works as a person-centric identity that proves who a person is to other people and institutions. People have an ID (username and password) for email, another for PayPal, and another for Amazon. But with Open ID a person only needs a single access to all these services, saving time and space [6].

The third initiative is OpenCourseWare (OCW) or Open Education Resources. It has free course content. The Massachusetts Institute of Technology (MIT) is the faculty responsible for starting this trend by publishing over 1800 courses which anyone can download and work through on their own" [6], [8]. "OpenCourseWare is an innovative and cost-effective opportunity for institutions because it takes a more active role in strengthening health sciences education worldwide" [3]. "A lot of courses have been made available in the United States through university-based projects such as MIT OpenCourseWare, Rice University's Connexions project etc." [8].

OSS has many benefits for teachers, students and places of education. School can take control of its computer resources and manage its IT in the future with OSS. OSS has a lower total cost of ownership (TCO). However, not all of OSS is available for free; neither does the free software come without cost in managing it. Most open source operating systems are lowcost or free for educational use. They come with many different and very useful administration tools and user applications. All these can be setup to have either total, limited or no access to the internet. Also, if you use an open source operating system, you won't have to pay large license fees for each computer's operating system. There are many OSS packages that also come at lower cost but provide equivalent functionality to the propriety alternatives.

In addition, OSS has lower costs for students' home systems. Many of the OSS products run on lower end machines with very little difficulty. What is more, since files are saved in open formats it is possible to move files between different versions of many products (and even between different products sometimes) with very little data loss. Moreover, OSS helps students to learn concepts, instead of training them for products. Linux will have a long term impact on a student's growth in other areas when they are exposed to it [9]. If students use OSS at college and if they're already comfortable with it, it will make it that much easier for OSS to move further into other sectors.

OSS Applications Used in Educational Institutes

OSS can serve as a channel, method, and technology for teaching and learning. OSS applications are used in many educational institutes to achieve educational goals [10]. Johnson (2013) provided an excellent collection of OSSs that are possible to use in higher education institutes, Table I just a snapshot of his effort. Moodle for example, is an OSS application, and is defined as an open-source course management learning system that encourages educators to create effective online learning communities. Its design makes it easy to create new courses and add content that will engage

learners. In addition, it is designed to support a style of learning called 'social constructionist pedagogy'. It helps students to learn best when they interact with the learning material and also helps them to build new material for others. Also, it allows students to interact with other students concerning the material [10].

It helps students when lecturers upload lecture notes, tutorial questions, assignments, and so forth on it for students to download. Also, by using Moodle lecturers can post or update the latest announcement, be it academic or an activity for the students. Moreover, students and lecturers can highlight activities and upcoming events such as the submission date of assignments, presentation date, and any other academic-related notification can be found in the calendar. For students and lecturers who like to share their thinking, Moodle is also a good place for them to put down their personal thoughts [11].

Linux is a free OSS program which helps higher education students. It helps teachers to provide an introduction to OSS in education [9].

Apache is another OSS application that is used by many educational institutes. It is a free system for students with lower cost. Apache is defined as web server software which is used on web server computers and connected to the Internet. It is an open source program which anyone can download and have free access to the source code. Moreover, skilled users of the program can easily make changes to it in order to enhance its functionalities[12].

Wikis, blogs and podcasts are all OSS applications used for education by educational institutes. A wiki is a web site that anyone in the world can access and edit its content. The most popular example of wiki is Wikipedia (The Free Encyclopedia). Wikis can help students in higher education by providing a lot of different information and knowledge which they can use and learn from. In addition, wiki can be defined as a way of virtual collaboration which students can use for sharing and exchanging information and opinions between them. It builds a good environment for learners to collaborate in learning from each other. Wiki, like any other website, has characteristics that distinguish it from others, such as easy editing, versioning capabilities, and article discussions.

A blog is another type of OSS application. It is a website which contains dated entries in reverse chronological order. It contains links to other websites and commentary that can be written by one person or a group of contributors. Blogs help higher education students by engaging them in knowledge sharing, reflection and debate which helps them to learn from each other. The features of this website include easy posting, archives of previous posts, and each post to the blog has a standalone Web page with a unique URL [13].

TABLE I
OSS APPLICATION AND THEIR ALTERNATIVES [14]

Usage/Purpose	*Commercial Software*	*Alternative OSS*	*Usage/Purpose*	*Commercial Software*	*Alternative OSS*
Virtual Learning Environment (VLE)	• Blackboard • Echo 360 • Desire2Learn • StudyWiz • Frog	• Moodle • Sakai CLE • Apereo OAE • Canvas	Lecture Capture/Podcasting	• MediaSite • Panopto	• OpenCast Matterhorn
Online Lectures/Webinars/ Remote Participation	• Adobe Connect • Blackboard Collaborate • Mega Meeting	• OpenMeetings • BigBlueButton		• Camtasia • Adobe Captivate • iSpring Presenter • Jing • SMART Notebook page recording feature	• CamStudio
E-book Authoring	• Microsoft Office • Adobe Acrobat	• ApacheOpenOffice • LibreOffice • NeoOffice		• Windows Sound Recorder • GoldWave • Mobile phone	• Audacity
	• iBooks Author • Adobe InDesign	• Sigil	Video Streaming	• Planet eStream • ClickView • MediaCore • vShare • PHP Motion	• MediaGoblin • Plumi • Kaltura
		• TeX and variants			
E-book management	• iBooks • Google Play Books • Kindle apps	• Calibre	E-book Text-to-Speech	• Hardware DAISY readers • IVONA Reader	• Daisy Player • eBook Speaker
Collaborative Authoring	• Google Docs	• Etherpad • Gobby • Owncloud documents	Interactive Content Creation	• Adobe Authorware • Articulate + Articulate storyline • HotPotatoes • Qwizdom	• Xerte

Podcast is an application that helps to accomplish educational goals. It allows users to listen to podcasts and watch vodcasts on their computer. For example, users use Windows Media Player to listen to podcasts and watch vodcasts. They can also be downloaded as portable MP3/MP4. Podcast helps learners by providing many educational

podcasting and video casting applications. For example, it enables the recording of lectures for students who did not attend the lecture themselves. There are also audio recordings of textbooks which allow the student to read or review texts while walking or driving to class. Moreover, it provides downloadable libraries for higher education students [13].

III. Research Methodology and Design

To achieve the objectives of this research a set of interviews were conducted amongst the IT professionals at SQU; these included one of the systems Engineers (at CIS), the OSS lab superintendent, and the Director of the Centre for Information and Communication Technology (ICT). They were chosen because they are professionals in OSS and much information was gathered by interviewing them. These interviews answer the main research questions.

IV. Findings and Discussion

This section highlights the findings of the set of interviews conducted with the relevant people at SQU.

A. Using OSS in Oman

The interviewees highlighted the fact that OSS has not yet been widely adopted in Oman but currently the IT authority (ITA) is pushing for its use as an alternative to the commercial software. In the interview which was conducted with the CIS systems engineer he said "At SQU they use OSS at the enterprise level e.g. Web servers, OS, CMS, LMS and Backup systems". Moodle is one example of OSS that is used at SQU for e-learning system. It is the most popular example of OSS currently used in education and is used in educational institutes around the world. Moreover, Tomcat and Apache are used in SQU as web servers and application engines.

Linux is another example of OSS which is used as an operating system in SQU. Recently Linux has become a popular development and production open source program for many Internet service providers and web hosting. Finally, Backup-pc is also mentioned as an open source application used at SQU as well as in other educational institutes worldwide.

In Oman the current level of OSS use is low compared to other countries. Neither is it used to its full potential in education.

B. OSS Benefits

Many of the IT professionals interviewed seemed to realize the great benefits brought by OSS in educational institutes. Despite the low level of usage in Oman,, the interviewees highlighted the fact that OSS is free of cost. The user may only need to pay for support as needed.

Moreover, the source code is available, which enables integration and interoperability. This code can be modified and customized by both the users and developers. This availability of the source code can help the developers and users to discover and fix vulnerabilities easily.

OSS is particularly useful at higher education institutes when it is used as a learning tool for computer science (CS) students, where they can customize it to suit their needs. CS students can use OSS applications to aid their studies and fulfil their needs. Many general benefits are highlighted in the literature review in this paper.

C. Barriers to Adopting OSS in Education

On the other hand, OSS users do face some challenges, mainly due to the lack of support and lack of skills in dealing with OSS in cases where errors occur, or in fixing/modifying the systems in cases where there is a change in requirements. Many teachers/instructors prefer to continue to use what they are used to using rather than shifting to new software that will require putting in considerable time and effort to learn how to use, which they claim that they cannot afford.

Also, sometimes it is hard to find local support. Although OSS is free to use, support is still needed. Many users tend to think that they will not pay anything because they believe that OSS is free of charge. In fact, they have to pay for support which can be expensive in some cases. Furthermore, some users do not trust OSS because they believe that anyone can have access to the source code which enables them to change or modify it. Moreover, there is a lack of business applications and documentation.

V. Conclusion

Despite the stated benefits of using OSS in education and the encouragement of the IT authority in Oman to adopt it, the usage of OSS is still in its infancy. This could be due to many users not being familiar with OSS that it is hard to find local support, or that users feel like the odd ones out because everybody else is using the commercial software. Another issue is lack of compatibility with the existing software. Furthermore, there is a debate about the availability of business applications.

For all the above-mentioned reasons educational institutions are not encouraged as yet to adopt OSS and they prefer to wait until they receive more assurance for such a move.

For many technical, financial and political reasons the authors believe that Oman needs to facilitate and support the use of OSS in education.

References

[1] Rooij, v. and Williams, S., (2007), Open Source software in US higher education: Reality or illusion?, Education and Information Technologies, vol. 12 (4), pp. 191-209.

[2] Madey, G., Freeh, V. and Tynan, R., (2002), The open source software development phenomenon: An analysis based on social network theory, In the proceeding of Americas conf. on Information Systems (AMCIS2002), 1806-1813

[3] Lee, M. Y., Albright, S., O'Leary, L., Terkla, D. G. and Wilson, N., (2008), Expanding the reach of health sciences education and empowering others: the OpenCourseWare initiative at Tufts University, Medical Teacher, vol. 30 (2), pp. 159-163.

[4] Sharma, S., Sugumaran, V. and Rajagopalan, B., (2002), A framework for creating hybrid open source software communities, Information Systems Journal, vol. 12 (1), pp. 7-25.

[5] Brown, A. W. and Booch, G. (2002), Reusing open-source software and practices: The impact of open-source on commercial vendors, In Software Reuse: Methods, Techniques, and ToolsSpringer, pp. 123-136.

[6] Moriarty, G. L., (2009), Web 2.0 LMS opportunities and obstacles: exploring OpenSocial, OpenID, and OpenCourseWare in NIXTY, On the Horizon, vol. 17 (3), pp. 226-231.
[7] Bogdanov, E., Salzmann, C. and Gillet, D., (2011), Contextual Spaces with Functional Skins as OpenSocial Extension, In the proceeding of ACHI 2011, The Fourth International Conference on Advances in Computer-Human Interactions, 158-163
[8] CETIS, J., (2008), Open educational resources–Opportunities and challenges for higher education.
[9] O'Hara, K. J. and Kay, J. S., (2003), Open source software and computer science education, Journal of Computing Sciences in Colleges, vol. 18 (3), pp. 1-7.
[10] Romero, C., Ventura, S. and García, E., (2008), Data mining in course management systems: Moodle case study and tutorial, Computers & Education, vol. 51 (1), pp. 368-384.
[11] Melis, E., Andres, E., Budenbender, J., Frischauf, A., Goduadze, G., Libbrecht, P., Pollet, M. and Ullrich, C., (2001), ActiveMath: A generic and adaptive web-based learning environment, International Journal of Artificial Intelligence in Education (IJAIED), vol. 12, pp. 385-407.
[12] Lakhani, K. R. and Von Hippel, E., (2003), How open source software works:“free” user-to-user assistance, Research policy, vol. 32 (6), pp. 923-943.
[13] Boulos, M., Maramba, I. and Wheeler, S., (2006), Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education, BMC medical education, vol. 6 (1), pp. 41.
[14] Johnson, M., (2013), Open Source Options For Education, Accessed on Available at: http://oss-watch.ac.uk/resources/ossoptionseducation