Open Source in Education: an overview

Malcolm Herbert

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1 Introduction

Open Source is not just about computer programming. In the same way the Internet is not just about network infrastructure, Open Source is emerging more as a methodology than a product, one that can be applied to a range of different technology areas. Its core principles are about the freedom to use, distribute and modify computer software, something which can significantly change the approach to developing, implementing and using Information Communications Technology (ICT). Open Source applications are currently widely used and support much of the Internet backbone, such as web sites and mail servers. With the development of school broadband connectivity through the adoption of the Internet model, Open Source is becoming of increasing importance to schools. It has been described as *counter-culture* and provides the basis for a growing number of projects in areas such as publishing, digital art and content development. The paper contrentrates on Open Source Software (OSS), but many of the issues discussed are relevant to other activities associated with ICT.

This short paper explains what Open Source is and looks at its current benefits and weaknesses. It discusses its position in education as well as its potential, before concluding by highlighting avenues for future work.

2 What is Open Source?

2.1 Introduction

Open Source is a relatively recent term use to describe a long establish tradition in computing, where computer programmers have encouraged the free use and modification of their program code. It is really all about free

speech, rather than simply free software. It has been available since the 1950's and 60's, but has only become widely available for a larger user group market since the beginning of 1990's, with the emergence of the Internet.

Open Source software ranges from small, simple scripts to large enterprise applications. It is available via anonymous download or as part of CD-ROM collection (typcially a Linux distribution). It can come as source code, so that you can compile and build it for your particular platform, or increasingly as pre-compiled binary packages for specific platforms, which are usually easier to install. The code itself is usually accompanied by some documentation (READMEs, HTML help files, installation instructions) and links to web-based resources. It will also come with a suitable Open Source license[5].

2.2 Licenses

The license is important, as it defines how the software can be used and distributed. There are now a number of Open Source licenses, the most popular is the Gnu Public License (GPL), which promotes the notion of copyleft:

> *....where everyone has permission to run, copy and modify the program, distribute the modified code, but they do not have permission to add restrictions of their own.*

The main benefit for developers of adopting such a license is that modified versions of the software is will also be freely available. There are other licenses, such as the Mozilla license (set up by Netscape) and the Artistic License (used for the Perl programming language). The Department for Education and Employment (DfEE) has a Public Source, Public Ware (PSPW) license that it uses with suppliers to enable reuse amoungst different divisions within the organisation.

2.3 Scope of Software

The area of Internet Services is area in which Microsoft and other large software companies have been weakest and where Open Source applications thrive[1] This is because the Internet is based on open standards, such

[1]For example Apache, the Open Source web server has 62% market share, against Microsoft's IIS 20% and Netscape's NES at 7%

as those drawn up by Internet Engineering Task Force (IETF), and is an area that thrives on innovation. This is why Open Source is now becoming of increasing interest to schools, although other areas such as software provided by Application Service Providers (ASPs) and local area network integration are where Open Source applications are also beginning to flourish. For nearly all general applications, an Open Source alternative can now usually be found, via a number of distribution sites such as Tucows[2] and RPMFind.

2.4 Development Process

Open Source development projects are usually started because of a specific demand to meet a functional requirement, for which there is no commercial solution or if there is, it is too expensive. This process of defining and managing Open Source development is becoming more organised, with a number of websites providing coordination and skills brokering[3]. The developers are typically geographically disperate and primarily use the Internet for communication. The project will normally have web site and mailing list, copies of the software for download, documentation and Frenquently-Asked Questions (FAQs). The project will also involve a number of active users, who through the policy of 'release-early, release-often' will be engaged in the development process, locating bugs and suggesting feature enhancements. This approach to software development is suprisingly successful[3], with the usage going beyond software. The Open Source approach is being used increasingly to develop online content, books and other resources, usually with a technology remit. For example, in the UK, the *OPEN* initiative of The Arts Council[4] is looking to adopt the approach for the promotion of digital art creation.

2.5 Linux

The most notable example of Open Source software is the Linux operating system. It was originally developed by Linus Torvalds in the early 1990's as a tool for teaching operating system design to undergraduate students and quickly became popular amoungst other computer scientists who'd heard about it via email and newsgroups. As the number of developers grew, the number of users grew even faster, forming a community that continues to

[2]Interestingly enough, one of the UK mirror for Tucows is hosted by Research Machines
[3]Such as sourceforge.org
[4]http://www.thisisnot.com

develop a rich, versatile operating system that is now highly regarded in all sectors of Information Technology and has significant market share.

One of the misconceptions about Open Source software is that is all about Linux. The Linux operating system is a cornerstone of Open Source applications, because it is Open Source itself, There are an increasing number of Open Source applications for Windows and MacOS, as there are also other Open Source operating systems such as http://www.freebsd.org, although the awareness of them has been precluded by the success of Linux.

A typical Linux installation CD from one of the main distributors (such as Red Hat, SuSE, Debian or Caldera) is made up of less than 1% of the operating system itself, the majority is made up of quality-assured Open Source applications. This allows users to construct server, router, workstation or custom configurations, selecting different options during the installation. Once installed, other Open Source applications can be easily added, from other CD's or downloaded. The development of the installation process has nearly reached the same level as the Microsoft Windows process, which is something many users never undetake because of manufacturer pre-installation. Some suppliers are now supporting this for Linux[5], although some of the flexibility in configuration mentioned above is then lost.

3 Benefits

There are a number of key benefits of Open Source software:

a) **Application Quality.** Primarily because of the development process, mature Open Source software is of a high quality and is now the choice of technical staff, especially for Internet services. This is the main reason for the ongoing success of Open Source, not that it doesn't cost anything.

b) **Interoperability.** Open Source applications rarely use propretiary file types, but follow guidelines and standards. Also, many Open Source applications have been written for the purpose of integration, usually originated by people who had specific problems to solve. A notable example is Samba, a server application that supports Microsoft's Server Message Block (SMB) networking protocol on other operating systems, such Linux or Solaris. This is one of the reasons why Linux

[5]Around 10% of Dell's new rack mounted PowerEdge servers are pre-installed with Linux

is so useful, as it can support a wide range of networking protocols and filesystem types that make it work in nearly all network environments. A Linux server can simultaneously support file sharing for Windows, MacOS, RiscOS and other UNIX clients all on the same network.

c) **Support.** The main support model for Open Source software is different and does not soley rely on support contracts with suppliers and call centres. It is much more peer-based, with the use mailing lists, web sites, FAQs and HOWTOs to provide support from both developers and more experience users. To use this support model effectively does require some experience, but is highly effective and can be less frustraiting that traditional methods. However, telephone and onsite support are now available for those users who require it, providing by companies such as Linuxcare.

d) **Flexibility.** Unlike closed source software, it is far easier to change to a different application with Open Source software. Firstly, there is no contractual obligation to a specific supplier and you are no tied to their development timetable. In many cases, if there is functionality that you wish to add to an application you can in most cases find that it has already been developed by someone else.

4 Difficulties

There are a number of potential problems with using Open Source software, most of which eminate from the way in which manufacturers of hardware and software have done business over the last twenty years. There is still a great amount of hardware secrecy, making it difficult for developers to write drivers and appliations for new equipment. There is also the growing threat of software patenting in Europe[1]. This could restrict the development of Open Source alternatives, especially if the same approach and algorithms need to be used.

a) **Packaging** For the uninitiated, installing and configuring Open Source software can be a little on the technical side. Downloading software, then installing on a local system does take some practice, especially for less popular software. This is however changing, with the use of graphical package managers and easy to run Linux installers, as well as preconfigured hardware solutions.

b) **Primarily Server Applications** Open Source development is more mature in the server application area and arguably produces industry leaders in many aspects. The desktop area, including productivity tools, communications clients and desktop windowing systems is no so developed. Recent releases of the latest Gnome and KDE desktops for Linux are viable Windows alternatives, as are office applications like Star Office, ThinkFree and AnyWhere Office.

c) **Less Development in Uninteresting Areas** Much Open Source development is directed at cutting edge applications, say for web development and new technologies, rather than office-based systems. Although the desktop area is currently seeing greater development, positive action may need to be taken to attract developers to educational applications.

d) **Market Share** In many areas of IT, Open Source still has only a small market share and despite its growth, many IT Managers and Coordinators will only adopt Open Source software if they feel that this is the way the whole market is going. Open Source is not backed by large marketing campaigns, and is not an area covered by many IT professionals as part of their education and training.

5 Future Work in Education

As part of the development of Internet services for schools, Open Source software is already being used and this will continue to grow. Becta should undertake further work in the following areas:

a) **Procurement.** Currently many specifications for education ICT procurements do not allow for Open Source solutions to be tendered. For example, many would state a requirement for a specific application or operating system. Although this may be done to ensure compatability with existing infrastructure, it also takes place due to a lack of awareness of Open Source solutions.

b) **Piloting.** Although the Case Studies (see Appendix) have indicated that Open Source is an option for many schools, further pilots managed directly by Becta would provide the basis for opening up contacts with Open Source-based companies and developers and encourage their participation in the education sector. This in effect would be

similar to the role Becta had three years ago with the Internet Service Providers (ISPs). The piloting could be done alongside the proposed NGfL Managed Services pilots or as part of Becta's Technology R&D Small Scale Technology Pilots (SSTPs). Piloting would also allow analysis of how administrators and users apapted to the Open Source approach to support.

c) **Content.** Although Open Source development has centred around software, the same approach could also be used for the development of educational content and associated online delivery mechanisms. Becta's Contributory Database is an example of a potential mechanism for providing Open Source content, although further work would need to be done in setting up a suitable license for use by contributing teachers and those downloading material. Further work would look at small-scale piloting and working with content providers in determining a suitable framework for development.

There is irrefutable evidence that Open Source software already plays a significant role in the provision of Internet services in education, information on which needs to be disseminated to a wider audience, both educational suppliers and users.

6 Conclusions

The issues around Open Source go beyond software programming, it is more about the approach to ICT solutions for schools. The Open Source approach currently offers the best solutions for Internet Service Providers, and in this area of educational ICT it is beginning to have an impact. In other areas, such as desktop tools the picture is less certain although it is having an effect on the current providers. The prescence of Open Source applications and solutions would ensure that there is viable competition to current software and suppliers in education, helping to achieve good quality services and best value for educational customers.

There is also growing evidence of Open Source being adopted by commercial providers, including those in education. Suppliers such as Equiinet[6] offer a Linux-based thin-server which is completely remotely manageable via a web interface, which provides a non-technical route to using Open Source functionality. Other main stream suppliers currently don't offer Open Source solutions for schools, but they are aware of the software it

[6] http://www.equiinet.com

has produced and will in the near future use it to help run distributed Internet functionality, such as cacheing. Just using the Open Source applications provided by the same commercial providers is not the way forward, there will be real benefits from schools making use of the Open Source methodology. This will then provide flexible and predictable resource schools require.

References

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