

Articles

Open source and international health informatics: placebo or panacea?

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ABSTRACT

The authors explore the history of open source software and how the future of this paradigm can affect global changes to healthcare informatics. They identify four key requirements:

1 to establish an international health informatics open source (IHI-OS) community
2 to develop a kernel that is broad enough but also provides sufficient detail to be usable across international boundaries and across medical disciplines
3 to develop a business case for international health informatics open source
4 to develop international standards.

Keywords: health informatics, open source, standards

Introduction

It is estimated that 75% of all large software projects fail.[1] In the arena of health care where resource constraints are notoriously tight and the requirements for information very high, this rate of failure is a major concern. Consequently, the international health informatics community has been investigating other industries for potential solutions. The recent development and fast uptake of open source software in the business community has been followed with interest. A number of health informatics projects are currently in progress based on open source models.[2]

This paper explores the history of open source development and how the future of this paradigm could affect global changes to healthcare informatics. Four key requirements to facilitate the progress of open source in international health informatics are identified and discussed.

What is open source?

Open source is software that has been developed and disseminated in an open forum. As such, it revolutionises the way in which software has historically been developed and distributed. Its roots can be traced to the early 1980s when the GNU General Public Licence (GPL) was established.[3] The GNU GPL allows people to copy, distribute and change at will software licensed under the GPL, as long as they do not prevent

or inhibit others from doing the same. They may not charge for the software or for the changes they make. It was from this movement that the current plethora of free software evolved.

In early 1997, a group of leaders in the free software community met to identify how to promote the ideas surrounding free software to sceptics. They agreed that what was needed was a marketing campaign aimed at winning mind share as well as market share.[3] Out of these discussions came the term 'open source'. This was further developed into a series of guidelines that describe software that qualify as 'open source'. In keeping with the ethos of open source, these guidelines were freely distributed over the Internet.

The 'open source' definition builds on the foundations laid by the GNU GPL Debian Social Contract but goes one step further in that it allows greater mixing with proprietary software.

Why develop open source?

An interesting argument for open source was made by George Dyson that 'in the history of both biology and technology (as well as human culture), open source, in the long run, always wins'. He continued that 'the most successful operating system we know of, the genetic code at the basis of life on earth, enjoys an absolute monopoly – but it is open source. If it wasn't – both open source and a monopoly – we wouldn't be here today discussing why!'.[4]

This argument is fundamental to the foundations of open source development. To extrapolate this further and compare open source with science reveals that, as with our genetic code, science must be open in order to survive. Scientific method depends on reproducibility of experimental results. This is not possible unless the methods, techniques and hypothesis (open source) are shared. In computer science the only means by which you can enable your peers to replicate your results is to share the source code. By doing this, open source developers make their code more robust and bugs are uncovered that otherwise would not get found. Similar parallels can be drawn between Apple Computer (which held its code tightly) and other PCs. Only in March 1999 did Apple change its tactics.

In addition to this robustness, a number of other benefits have been identified with open source software development:

Reduced development costs

Closed source software development is difficult and expensive.[2] By utilising a network of interested programmers, rather than by employing specific individuals, these issues are alleviated and distributed.

Increased customer satisfaction

By developing applications using an open source model, initial purchase costs for customers are significantly reduced.[2] Additionally, customers are no longer locked in to one particular provider and they can readily understand what the software really does.

Increased market share

As the purchase cost is reduced, the cost of entry into high specification software is minimised for the smaller user.[2] This would enable users who previously were priced out of the market to use software more appropriate to their needs and to break away from the strangleholds of proprietary software organisations.

Reduced liability

Software developed by multiple individuals and organisations must inherently be at less risk of litigation than a single entity, should that software be found to be responsible for an adverse event.[2]

Increased security

Due to the rapid development and peer-review nature of open source development, security problems are identified and solutions implemented in a much shorter timescale than with proprietary software development.

Who uses open source?

These identified benefits explain why, in the relatively short time that open source has been developing, the business community has rapidly embraced the concept. Major corporations within the computer industry such as Intel, IBM and Oracle have turned to open source as a business opportunity and the majority of web services are now based on open source platforms.[3,5] The Internet itself is an exemplar of open source development, the growth and use of which has been phenomenal over the last few years.

Open source in international health informatics

Despite the developments of open source within the business community, the health informatics industry has been less quick to investigate the potential benefits. A number of reasons for this that are specific to the healthcare community have been identified:

- requirement for safety critical software
- low level of computer literacy
- fundamental requirement for data security and integrity
- requirements for regular enhancements mandated by legislation and standards.

Whilst these issues do raise concerns, there are counter arguments and mechanisms that can be used to address them.

Requirement for safety critical software

A software-related adverse incident in business is not normally life threatening. In the context of health care it may well be. Therefore, whilst a possible benefit of open source is that, in the event of an adverse incident related to the use of software, there would be less recourse against the developer than with proprietary systems, in the context of health care this is not considered an acceptable scenario.[6,7]

However, simple perusal of the licence agreements pertaining to proprietary software reveals that invariably a disclaimer is included that indemnifies the developer from such recourse. To date, not a single case is known where a developer has been found liable.[8–10]

Already the majority of UK general practice computing clinical systems incorporate some form of user programming, usually related to the development of practice-specific templates and protocols. Are individual general practitioners who utilise these mechanisms potentially jointly liable with their system supplier?[11]

Low level of computer literacy

The majority of healthcare staff are largely technically illiterate.[12] They would not have the skills necessary to download software from open source sites and to install and configure it for use. Neither would they have the ability to review the source code and determine whether to accept or reject the system. The challenge is therefore to provide technical support that is both technically literate and capable of dealing with software that is constantly evolving and being reiterated.[6,7]

However, these are not problems that are unique to open source development. In fact the Linux community has been found to respond much more rapidly than commercial suppliers in response to identified requirements for support.[7]

Fundamental requirement for data security and integrity

Healthcare systems contain data that must be safeguarded for confidentiality and integrity. This is clearly of paramount importance. However, there is no evidence that open source software is any more vulnerable than closed source. In fact, the belief that 'security through obscurity' (STO) is not an effective model is rapidly gaining momentum. The open source community is proving that the critical time to distribution for security fixes is much shorter than it is for closed (proprietary) systems. This is simply a factor of the number of people looking at the code. Proprietary companies do not have that luxury.

STO does have its uses, especially in regard to getting an attacker to inadvertently expose themselves. However, hiding the source code has little, if any, effect on overall security. In fact, if we refer to Linux as an exemplar of open source development, security is deemed to be 'as secure as you can make a computer'.[13]

Requirements for regular enhancements mandated by legislation and standards

Health care is not a stable environment. Legislation and standards are developed regularly and iteratively. This leads to a requirement for software enhancements. In a traditional open source development model there are no deadlines; software develops at its own pace. A solution to this, often referred to as a benevolent dictatorship, is that used by Linus Torvalds and Alan Cox *et al.* regarding the development of Linux. At the core of Linux is a kernel. Torvalds and Cox are the central authority for adding and modifying the source. So far, this has meant that Linux retains a tightly written kernel with very little extraneous content and Linux itself has experienced very little divergence in its development. It would not be a great extrapolation to suggest that, should a similar model be developed in health care, if a specific enhancement was required by a specific date to conform to standards and legislation, this benevolent dictatorship could commission the necessary work should the open

source community prove deficient. However, it is unlikely that this would be necessary as, to date, the open source community has been found to respond much more rapidly than commercial suppliers in response to identified needs.[7]

Is open source plausible in health care?

A number of potential benefits and domain-specific problems have been identified with the development of open source in health care. A post-conference retreat of the AMIA Primary Care Informatics Working Group (PCIWG) resulted in four recommendations to further progress open source in international health informatics.[a] These are as follows:

Establishment of an IHI-OS development community

The establishment of an international health informatics open source (IHI-OS) development community would need to be based on a decentralised framework that is constituted as a large, active community whereby the risk of failures and benefits of success could be distributed.[7]

Development of an IHI-OS kernel

To address the concerns regarding data security and integrity, a kernel for clinical systems needs to be developed. Following in the example of Linux, this kernel should be very tightly controlled and maintained through some form of oversight scheme. This oversight scheme should be managed by a small core group of experts who vet all changes made by anybody – a core control group (CCG).[14]

Whilst it is acknowledged that the development of this kernel would not be simple, it is certainly possible, and there are a few projects being undertaken throughout the world which are currently working in this direction.

Development of a business case for IHI-OS

As in 1997, when the free software community decided actively to win the minds and market share of the business community, a strong business case must be developed if open source in international health informatics is to progress further.

Currently, health informatics organisations enjoy a strong monopoly, based for the most part on product rather than service. For them to be convinced that open source is the way of the future is a huge cultural change that will not be easy to achieve.

Development of international standards

It is recognised that, whilst the development of a kernel and associated applications might be the ideal solution, an integrated or alternative interim solution might be to define strictly the format of communication between different programs. If standards are set and legislated for, the health informatics community will have both a carrot in the form of the potential benefits as well as a stick in the form of legislation as incentives to develop open source solutions.[15,16]

CEN/HL7 are working on a format for messaging between different parties in the health industry. This format would not only encompass the different types of information but also their relations to each other and their meaning in the health environment. The Medical Informatics Department of the Erasmus University in Rotterdam is, on behalf of the Dutch GP user groups, working on just such a model.

By standardising the exchange of health information, health informatics develops not only open source but also an 'open target model' effectively making users less dependent on the proprietary data models of their IT providers.

It is hoped that the outcome of these recommendations would lead to the point where the core of all clinical systems would be identical – the kernel – but that different organisations would develop different views and applications based around this core. The core would be in an XML-based system, and modifiable for particular organisations. The software would be open source and organisations would give it away freely. Organisations would then move towards a

[a]AMIA Annual Fall Symposium November 2000. Post-conference retreat of the AMIA PCIWG held in Fresno, CA. In attendance were: David Pepper, MS MD, Associate Professor of Family Medicine UCSF@ Fresno, President and CEO MAP-Masters (USA); Rob Hausam, MD, Director, EMR Product Development, TheraDoc Inc, Salt Lake City, Utah (Chair AMIA PCI WG) (USA); Mike Bainbridge, BMedSci BM BS MRCGP CompBCS, Chair British Computer Society Primary Health Care Specialist Group (BCS PHCSG) (UK); Alex Caldwell, MD, Chief Technology Officer, MAP-Masters (USA); Tim Cook, President and Chief Technology Officer, Free PM (USA); Pieter Houwink, NedHIS International Relations (Netherlands); Nikki Shaw, PhD, Research Fellow, Lancashire Postgraduate School of Medicine and Health, University of Central Lancashire (Co-Chair EFMI WG7, Chair British Computer Society Northern Medical Specialist Group (BCS NMSG)) (UK); Sheila Teasdale, MMedSci, Service Director, PRIMIS, Editor, *Informatics in Primary Care* (UK).

service culture whereby their income is obtained from the additional services and support they provide rather than the software itself.

Panacea or placebo?

Open source in international health informatics, like a new drug, offers the potential to be either a placebo or a panacea for all our ills. However, it must be remembered that the development of open source does not remove the need for good software design and user interfaces.[6,17] It does not automatically address the inadequacy of current health information systems, or the fact that the real cost in health informatics is in the collection of data, inputting it and getting useful information back out.[18,19]

However, what open source in international health informatics does offer is the potential to work collaboratively at both a policy and practice level, allowing all potential users the opportunity to influence the development, as they deem appropriate.

Conclusion

Is open source a panacea or placebo for international health informatics? At this point we simply don't have an answer but, to paraphrase Dr Florence Sabin [1871–1953], 'If we didn't believe the answer could be found, we wouldn't be working on it'.

ACKNOWLEDGEMENTS

The authors wish to make it clear that the views expressed are personal and not necessarily representative of their employing bodies.

SOURCES OF SUPPORT

Dr Shaw is an NHS Executive North West Regional Post-doctoral Research & Development Training Fellow and gratefully acknowledges this financial support.

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Accepted August 2001