

Open source software in healthcare

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Healthcare is information intensive, but most of the business at the sharp end--the interaction between professional and patient--is still making the transition from paper to digital media. Douglas Carnall surveys the current state of the art in open source software for healthcare, and sees a good fit with the egalitarian ideals that informed the founding of the national health service in the UK

The history of information system development in British healthcare is not a happy one. High profile cases of duplication and waste make it an area of considerable managerial and political nervousness. And when managers get nervous, bureaucracy burgeons. Britain spends less on healthcare than other comparable nations, which means that IT professionals who want the highest financial rewards will work in other sectors.

The commissioning system for IT within the NHS is cumbersome and bureaucratic, and despite much talk of "customer need" within the new look NHS Information Authority, it remains rigidly hierarchical, narrowly focussed, and based on outdated business models. NHS organisations usually buy approved commercial systems and have no access to the source code of the applications they run.

Gradually, though, an appreciation of what open source might offer health informatics is developing. The fact that the software is free is plainly a major attraction. But for most organisations licensing and hardware is only a fraction of the the total cost of ownership of an information system: customisation, maintenance, training and upgrading cost far more.

It is here that open source has the potential to excel: every application is open from top to bottom making extensive customisation and maintenance possible. And because thousands of users have submitted bug reports and fixes for the basic system software over the years, open source operating systems are famed for their reliability.

Open source in primary care

The most straightforward aspect of the penetration of open source software into healthcare is using Linux for what it does best: acting as a solid network server. Sheffield GP David Bellamy discovered Linux several years ago. He runs the commercial EMIS database system--the English market leader--for clinical applications in his practice. But when he needed a server and firewall for his upgraded network 18 months ago, he installed Redhat 5.0 on a Pentium 75 box he had retired from personal use at home.

"It started out as a personal hobby, but I could immediately see the potential for it to be useful to the practice. Reliability is superb -

the system has been rebooted twice in the last six months: to install software for NHSnet, and when my practice manager turned it off by accident. You do have to be a bit of an anorak to get to use the system, but once you are familiar with it, it's OK. I can administer the system from anywhere on the net, including three miles away in the branch surgery."

Standards on the NHSnet, a private network maintained by BT, are a mixture of X.400 and TCP/IP applications. Connection to it has been contentious because of professional concerns about confidentiality, widespread doubt about the technical approach adopted, and perhaps most importantly until recently, an unrealistic per message pricing structure which was uncompetitive with standard dial-up or leased line connections from an internet service provider.

Linux works well within this difficult environment though. "EMIS and the local Health Authority know my system very well," says Bellamy, "and have not tried to change a thing. I allocated all the IP numbers to fit with our strategy when we put in the new network in 18 months ago we had support from EMIS and HA engineers when we connected to the NHSnet 4 months ago."

The largest single GP system supplier (EMIS) in England has over 3,000 users running MUMPS-based software (Massachusetts General Hospital Utility Multi-Programming System); proprietary work by suppliers such as Torex and Vamp Vision in Windows is also common. A smaller supplier, Exeter Systems, is moving to FreeM (an open source implementation of MUMPS), and has already deployed a browser-based interface which will combine Apache, Linux and their own M database back end.

In Scotland, 84% of general practitioners run GPASS, which in its latest incarnations runs on Microsoft NT4. An open API for GPASS has been published which enables third party software authors to interact with the core system, though the government (which owns the copyright to the software) has yet to recognise the benefits of open sourcing the entire system.

We are still a long way from a vision of the future in which practices enjoy complete control over both their software environment and their data using open source paradigms. In such a small and specialised area as healthcare computing, single or two-developer outfits are common, and vendor lock can come, not just from failure of the supplier to agree a reasonable pricing structure or make required changes to the functionality of the software, but from straightforward business failure, retirement or career change.

Hospital systems

Just such a situation that faced the Walton NHS Trust five years ago, when the supplier of their HISS (Hospital Information System), a company called CHC, went belly up, leaving them facing the need to

completely recommission their system, or rescue source code from the ashes.

Fortunately, their agreement with the software house had included lodgement of the source code with a third party under an escrow agreement, and that software ran on HP-UX. With some tickling (you can read a compelling account of how it was done, with no documentation or support at <http://www.spence-n.demon.co.uk/wenn.htm>) this ported over to a Linux box at a cost substantially less than the original price of £160,000 for the HP9000/H30 mini computer it had previously run on.

According to the software manager who co-ordinated the rescue, Neil Spencer-Jones, now a consultant for escrow specialists the NCC Group, such scenarios are not uncommon: "In niche markets such as specialised healthcare applications software houses regularly fail and leave their customers in the lurch: and not everyone will have third-party escrow written into the contract.

The open source model is obviously attractive for this reason, but writing medical systems is such an intensive process that I can't personally see the GPL [GNU General Public License] happening for applications software any time soon. We've had a lot of enquiries from Eastern Europe asking whether we could release the code for our system, but unfortunately the license precluded us from releasing source to third parties."

Third party escrow is one way to reduce the risk of vendor lock, but going straight to open source seems even more likely to be desirable for users. While it is certainly true that most system vendors for healthcare have dealt using traditional business models, interest in open source development models is increasing, and the internet enables them to organise.

A recognised prerequisite of most successful open source project has been the establishment or discovery of a code base. According to Spencer-Jones as many as 50% of legacy healthcare systems were written in some form of Unix, and the Posix-compliance of Linux generally means that porting them is reasonably straightforward. "You'll find most of the application software's owners don't see the benefits of open source," says Spencer-Jones. "In fact, small locally developed applications might find a new lease of life if they were released to a wider audience under less restrictive licenses."

Possible alternatives to the radicalism of the GPL might include Crown Copyright which would enable free usage within the NHS and potential exploitation of the licenses abroad (the model the NHS Centre for Clinical Classification (CCC) has decided to follow). Quite how profitable the Read codes will ever be is open to question. Its recent merger with the American SNOMED system may provide a critical mass, but languages are most readily adopted when they are free, and the licensing arrangements may prove an obstacle.

It is a customary

Anglo-Saxon habit to laugh at the Academie Francais as it attempts to legislate for the language--yet we seem to be happy to allow our own institutions to do the same for our technical language--and charge us twice for the privilege: once from taxation as the system is developed, and a second time as publicly funded organisations buy licenses. The cost of sharing free code is very low, and the potential benefits are great: widespread adoption enables developers to solve problems easily and avoid duplication of effort.

Still, although the UK government has yet to grasp the open source idea with any conviction, a worldwide group of committed and talented developers is accumulating. The best place to find a <http://linuxmednews.com/linuxmednews/955216338/index.html> currently extant is at LinuxMedNews, a slashdot-like site run by Ignacio Valdes. Valdes has just returned from a project installing recycled machines running Linux in a mission hospital in Guatemala, which he will administer from his Houston base using ssh. The machines will run the GPL'd FreeMed Software, which is written in the web database guru's favourite, PHP.

In future the Good Electronic Health Record project--an international attempt to develop open standards for the interchange of records between different systems--may bear fruit. Originally funded by the EU, the code base will be open sourced and is under active development by an Australian team. The aim is to support records compliant with any of the major standards (HL7, CEN 251), and will enable and enable ready construction of archetypes which can be adapted for local usage (for example, the requirement that NHS GP systems connecting to the NHS net comply with RF4+).

Although not strictly open source, the National Library of Medicine's UMLS (Unified Medical Language System) is publicly available, and importantly, is increasingly widely used by ordinary doctors as they search the Medline database: its MeSH terms are a subset of the UMLS.

Another project that attempts to extract meaning from codes for medical use is the OpenGalen project presided over by Professor Alan Rector of the Department of Computer Science at Manchester University. Another medical semantic mapping system, it is notoriously difficult to use (the Galen slogan is: "Making the impossible very difficult") but now third parties are free to tackle that difficulty and, more importantly, extend and develop it in a way that would not be possible in other nomenclature systems that are more rigidly controlled.

Software futures

With some honourable exceptions, most healthcare professionals are not technophiles. This is partly because the software currently written for them has failed dismally to address real clinical needs, and because the difficulty of addressing those clinical needs is immense. It also

reflects the time it takes to learn to use software well, and a reluctance to engage in non-clinical training when there are so many pressing clinical demands.

Doctors' time is extremely precious. If they are to devote time to learning an interface, that interface should be free, so that their investment can retain its value along an entire career trajectory.

Behind the interface, doctors need the right to assemble and maintain their own custom suite of tools, for use wherever they might happen to be on the internet. Their acquisition will be organic, accreting over the years as they move up through medical school to training jobs and career posts.

As they learn a new knowledge and skills and adapt them to local needs they will add them to the familiar knowledge sources that they love. As these resources change and develop, so they may pick up new resources and gain distance from the old, but the essence will be of a gradually revising core of applications, knowledge and data, accessible at the speed of thought.

Those standard interfaces between knowledge sources, tools of communication, and the records of the patients, together with good interpersonal communication skills, will enable the presentation of new material, and the revision of the old, to proceed in real time in the consultation, enabling doctors to be a better guides and teachers for those whom they serve.

Good software forms seamless connections; as George Orwell said of prose, the best is like a window pane: transparent. The obscurity of commercial binaries is an obstacle to good quality communication between systems. In healthcare, good communication is too important to remain proprietary.

Software developers should remain confident that there will always be work for the future in discovering, providing, and adapting applications for organisations, and training people to use them. This, rather than the sharp-suited gouging of Bill Gates wannabees, should become the predominant business model for software in the British NHS.

Software engineering will become a profession more like medicine and the law: in which practitioners earn a fair hourly reward for their experience at interpreting, evaluating and applying knowledge from a specialised domain to the benefit of their clients. Current models, which restrict the sharing and development of knowledge, are certainly counterproductive and arguably unethical.

Open source is the future: all we have to do is built it.

Further reading:

Raymond ES. The cathedral and the bazaar. Sebastapol, CA:O'Reilly and Associates,1999 (also available at <http://www.catb.org/esr/writings/homesteading/cathedral-bazaar/>)

DiBona C, Ockman S, Stone M. [Open sources](#): voices from the open source revolution. Sebastapol, CA:O'Reilly and Associates,1999

Key websites:

<http://www.linuxmednews.org/>

Slashdot-like site with links to most significant open source based projects in the world of health care.

For an introductory discussion of open source ideas in healthcare try [Medicine's Dirty Software Secret](#) and Will Vendors of Medical Software [Taste Forbidden Fruit?](#)

For a more general discussion of the ideas behind open source start here: <http://www.opensource.org/>

The Good Electronic Health Record project is at <http://www.gehr.org/>

Useful essay discussing the strengths and weaknesses of open source software in the context of healthcare:
<http://www.minoru-development.com/en/opensource.html>

EU information society's Yves Paindaveine's exhaustive page of annotated links on open source in general, and in healthcare in particular.
<http://homeusers.brutele.be/ypaindaveine/opensource/inventory.html> Wow!

Key mailing lists:

The open health mailing list is a community of developers of applications in the healthcare domain dedicated to the open source ideals, and using open source tools to do their work. Traffic is moderate--around 10 posts a day.

Send subscribe/unsubscribe commands to openhealth-list-request@minoru-development.com

archive available at:
<http://www.shout.net/~milan/research/IN.openhealth/>

Box: Linux in intensive care

<http://scotland-xml.uk.eu.org/viva/index.html>

If you walk into any intensive care unit in the country, you'll see an array of high tech equipment with digital displays attached to the patient: and a nurse writing the output from all of these displays on a large paper chart. VITAL is a new standard that enables the machines that go beep to talk to each other, and the hospital information system.

Paul Woolman is the Glasgow academic who has received EU funding to develop the standard, and has chosen Linux as the operating system at the heart of the system. "Linux is very reliable, and obviously in this setting that's vital. The fact that we'll later be able to embed the system within EPROMs as part of the device's hardware also made Linux a sensible choice.

We'll be open sourcing our work in this area: our Spanish partner, hardware manufacturer RGB has to leverage the power of open source to be able to compete with the big boys like Siemens and Hewlett-Packard." Dr Woolman has run Linux as his default webserver since 1997.

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