osni.info—Using free/libre/open source software to build a virtual international community for open source nursing informatics

Karl Øyri\textsuperscript{a,b,*}, Peter J. Murray\textsuperscript{c,d}

\textsuperscript{a} The Interventional Centre, Rikshospitalet University Hospital, 0027 Oslo, Norway
\textsuperscript{b} Norwegian Society for Medical Informatics, Norway
\textsuperscript{c} Centre for Health Informatics Research and Development (CHIRAD), UK
\textsuperscript{d} IMIA-NI Open Source Nursing Informatics Working Group (OSNI), UK

KEYWORDS

FLOSS; OSNI; CMS

Summary Many health informatics organizations seem to be slow to take up the advantages of dynamic, web-based technologies for providing services to, and interaction with, their members; these are often the very technologies they promote for use within healthcare environments. This paper aims to introduce some of the many free/libre/open source (FLOSS) applications that are now available to develop interactive websites and dynamic online communities as part of the structure of health informatics organizations, and to show how the Open Source Nursing Informatics Working Group (OSNI) of the special interest group in nursing informatics of the International Medical Informatics Association (IMIA-NI) is using some of these tools to develop an online community of nurse informaticians through their website, at http://www.osni.info. Some background introduction to FLOSS applications is used for the benefit of those less familiar with such tools, and examples of some of the FLOSS content management systems (CMS) being used by OSNI are described. The experiences of the OSNI will facilitate a knowledgeable nursing contribution to the wider discussions on the applications of FLOSS within health and healthcare, and provides a model that many other groups could adopt.

© 2005 Elsevier Ireland Ltd. All rights reserved.

1. Introduction

Many health informatics organizations, although they discuss and advocate the appropriate use of technologies, seem to be relatively slow in terms of uptake of the technologies to support the day-to-day operation of their organizations. This seems to be especially the case in respect of the use of web-based technologies for providing information and for interacting with members and their wider constituencies of interest. Available applications currently appear with a broad variety of multimedia-based \cite{1} modular functionality to enhance organizational information exchange, collaboration and research where knowledge sharing is essential. The websites of many health informatics organizations, where any significant
web presence exists, do not seem to do justice in promoting the image of the organization.

The aim of this paper is two-fold: to introduce some of the many free/libre/open source applications that are now available to develop interactive websites and dynamic online communities as part of the structure of health informatics organizations; and to show how one group in particular, the Open Source Nursing Informatics Working Group (OSNI) of the special interest group in nursing informatics of the International Medical Informatics Association (IMIA-NI) is using some of these tools for precisely those purposes on the website with the domain osni.info. The objective of this international group of nurses was developing a specific nursing focus to input to the wider international developments in open source. The work of the group will facilitate a knowledgeable nursing contribution to the wider discussions on the applications of open source within health and healthcare, and the identification of any specific nursing issues.

Before addressing the central issues of using content management systems (CMS) to provide interactive web services, a number of pertinent background issues are addressed. The paper provides a brief introduction, for the benefit of those less familiar with the concepts, to the principles underlying free/libre and open source software (FLOSS) [2]. A few examples of FLOSS applications, for use in general desktop environments, and within healthcare environments are also provided, although these are not dwelt on as it is not the purpose of this paper to describe them in detail.

For the purposes of this paper, we use the term ‘open source’ or the acronym free/libre and open source software (FLOSS) to generically cover open source, free software, and GNU/Linux [3]; other widely used acronyms also exist, e.g. FLOSS [4].

The main focus of the paper is to show how the use of FLOSS applications, and in particular a content management systems named PostNuke [5], which has been used by the OSNI WG to develop an online community to meet the aims of the group. The model that can be derived from this could be of benefit to many other health informatics organizations, especially those in developing countries or other environments where scarce resources limit expenditure on costly proprietary systems.

2. What is free/libre and open source software (FLOSS)?

Shaw et al. describe open source software (OSS) as “developed and disseminated in an open forum. As such, it revolutionises the way in which software has historically been developed and distributed” [6]. A UK Government report emphasizes that the ‘source code is openly published, is usually available at no charge, and which is often developed by voluntary efforts’ [7]. The advocates of the FLOSS approach to the development and use of applications within health, healthcare, and health informatics, and within other industry sectors, describe many benefits, including:

- flexibility in development processes, including ability to react to changing needs;
- rapid spread of innovation;
- developments are not being controlled by any single organisation, enterprise, or vested interest;
- re-usability of components, collaborative development, and resource sharing;
- reduced development costs and minimisation of license fees, allowing users to better deploy budgets to other areas (e.g. to support and training);
- encouraging accessibility to products in developing countries;
- transparency of software, facilitating peer review and better quality;
- increased security.

Proponents claim the open, community-based development of FLOSS as one of the major factors leading to its robust nature. There is a growing body of evidence to support many of these benefits, with sources such as Pandaveine's catalogue [8] listing many examples of health projects that are based in FLOSS developments, although many are small scale and have not had lengthy evaluation. The Linux medical news website (http://www.linuxmednews.com) also lists many examples of FLOSS healthcare applications. Wheeler [9] collates numerous examples of FLOSS being superior to proprietary software, especially Windows/Microsoft systems, in respect of security, vulnerability to virus attacks, etc. The European commission interchange of data between administrations (IDA) programme’s open source observatory [10] also collates an increasing number of case studies of the benefits of introducing FLOSS in public sector and healthcare environments. The UK Office of Government Commerce’s ‘open source software trials in government’ report [11] provides other public sector examples from around the world. The Beaumont Hospital, Dublin, provides one of the most frequently-cited success stories for the implementation of FLOSS desktop applications and the resultant financial savings and other benefits from within the healthcare [12].

Evidence is growing to support the idea that FLOSS and Linux have quality and security
advantages, with numerous examples of migrations to Linux for exactly these reasons. Security of many systems is vital, and the Office of Government Commerce states that 'properly configured OSS can be at least as secure as proprietary systems' [13], citing examples such as the UK Ministry of Defence's Academy basing its server infrastructure on FLOSS due to its being 'inherently more secure than one based on proprietary software'. In addition, they cite the US National Security Agency's security extensions to Linux and the deployment of Linux in secure projects such as for the US Department of Homeland Security as primary reasons for migration. Similar arguments exist for the benefits in securing healthcare systems.

3. Some FLOSS applications

3.1. Local and desktop software

Many public sector bodies within Europe and elsewhere are starting to look to FLOSS application packages, for reasons of cost, flexibility, and reliability, among other factors [14]. Applications, such as the popular OpenOffice.org suite (with word processor, spreadsheet, presentation tool and other applications) are available for use in Windows, Linux and other environments. It has many benefits, including being freely available (in all senses of the word), and can import from and export to many other similar packages, including Microsoft applications. FLOSS web browsers are readily available (e.g. Mozilla, Firefox, Opera), and alternatives exist for many other applications.

3.2. Web server software

Many people use FLOSS on a daily basis without even realizing it. Much of the infrastructure of the Internet is based on open source, and the most popular web server has always been FLOSS. Apache is the number one web server, with over 68% market share in early 2005, more than three times the market share of its nearest competitor. This is illustrated in Fig. 1 by the UK based Internet services company Netcraft [15].

Almost all domain name servers, the core of Internet functionality, use Berkeley Internet Name Domain (BIND) [16], which is FLOSS.

3.3. Server-side applications

Server-side applications are applications that can be installed and configured on Internet servers with file transfer programs (FTP), and accessed through any computer on the Internet with web clients in browsers. The applications referred in this paper are mainly programmed in the programming language PHP (http://www.php.net), and use the MySQL database (http://www.mysql.org). When installed on an Apache server, these three applications constitute a very strong platform for a broad variety of open source web-based applications based on a dynamic, fully searchable relational database structure.

![Fig. 1 Web server market penetration, Netcraft January 2005.](image-url)
This combination is often referred to as LAMP, the Linux, Apache, MySQL, PHP architecture [17], which has become very popular in the industry as a way of cheaply deploying reliable, scalable, and secure web applications. (the 'P' in LAMP can also stand for Perl or Python.) MySQL is a multi-threaded, multi-user, structured query language (SQL) relational database server, using the general public license (GNU). The PHP—MySQL combination is also cross-platform, i.e. will run on Windows as well as Linux servers.

Fig. 1 gives a schematic view of the server-side application architecture.

3.4. Education and e-learning

The open source approach is also gaining widespread consideration within the tertiary education sector. The development of open courseware, for example using the model being pioneered by MIT in the USA (http://web.mit.edu/ocw), and the availability of open source virtual learning environment software (e.g. Fle3, http://fle3.uah.fi) all have implications that educators in the health and informatics spheres will need to take into account.

A very strong e-learning application is Moodle [18] (http://www.moodle.org/). Moodle is a complete e-learning software suite or course management system, with a modular software package designed to help educators create quality, multimedia-based online courses. Such e-learning systems are sometimes also called learning management systems or virtual learning environments. Moodle is currently translated to more than 30 languages, and is used in a large number of educational settings worldwide. The application handles thematic-, or topic-based classes and courses. Teachers and students can be assigned to groups according to roles and preferences. E-learning courses can be developed with a great variety of didactic elements, and interactivity between groups of students and students and teachers strengthen collaborative processes. As Moodle is based in social constructivist pedagogy (http://moodle.org/doc/?frame=philosophy.html), it also allows the construction of e-learning materials that are based around discussion and interaction, rather than static content. Several OSNI members, working with the Centre for Health Informatics Research and Development (CHIRAD) are developing an open access health informatics repository using Moodle (see http://www.differance-engine.net/hivle/).

3.5. Content management systems

There is a broad variety in content management systems (CMS) designed for websites with dynamic, fully searchable content. As the title indicates, CMS’s are generic applications developed to store and retrieve content by various ways of presentations. A CMS is a flexible, modular framework that separates the content of a web site (the text, images, and other content) from the framework of linking the pages together and controlling how the pages appear. In most cases, this is done to make a site easier to maintain than would be the case if it was built exclusively out of hard-coded html pages. Most systems have groups of developers and users...
assigned to the community, and information about any relevant topic is available for any registered user. In addition to large groups of developers, large groups of users contribute to report on bugs, make improvement proposals in a continuous refinement process far faster than traditional commercial software development where users and developers not necessarily are in contact with each other.

A CMS can be administered and moderated at several levels from an administration panel. Material can be defined as public, as belonging to open or closed user groups, editors, moderators, or administrators. Registration of members is necessary to ensure and keep record of the users. Registered members of the site can submit material for publication to moderators who gives approval and publish on the web site. This gives complete control of compliance to the organization's policy for published material. In addition, the work-load relating to publication of new material can be spread to large groups, securing frequent updates of content. The initial user registration is automated, and redistribution of passwords and access is also carried out automatically by user requests. Assignment to user groups is made manually by the site administrator or moderators. CMS functionality can contain:

- modular structure;
- articles and news;
- sections based on topics;
- AvantGo-automated re-formatting of content for display on personal digital assistant (PDA) screens;
- links and directories;
- Wiki (a Web site that allows users to add and update content on the site using their own Web browser, resulting in a site that is collaboratively developed and maintained by its users). (ref: http://www.sharpened.net/glossary/definition.php?wiki);
- chat.

In addition, blogs, bulletin boards, discussion forums and photograph or picture galleries can be contained within, or linked to a CMS; we explore some of these in a little more detail in the next section.

3.6. Other server-side dynamic applications

Bulletin board (BB)/discussion forums (DF) are computer systems running open source software that allows users to perform functions, such as downloading software and data, uploading data, reading news, and exchanging messages with other users. There are several open source BB/DF applications available, with very strong functionality. OSNI has incorporated phpBB [19] (http://www.phpbb.com) as an external application linked to its OSNI PostNuke CMS web site with the URL: http://www.osni.info/phpBB2/index.php. The OSNI BB statistics on 9th January, includes 17 registered users from Spain, United Kingdom, Norway, USA, India, and Cuba. There are 52 articles, one open and three closed forums.

The advantage with open source BBS/DF is that the overview of discussions and topics is very clear, as the thread in posts of the discussion is displayed and can easily be followed. Some material can be made open in public forums, and sensitive information can be available in closed sections for particular user groups. Iterations of documents and topic-based discussions can be handled effectively, directly available to those concerned. Thus, the communication becomes much more efficient than communicating via e-mail as it is available to all with user permissions to view. In addition, as the discussions are automatically archived, they are available for later review by new members of an online community, or available to as valuable resources for researchers.

Image galleries are web-based albums where images can be uploaded and downloaded by users. In the same way as for CMS's and BB/DF's, registration of users, user groups, and communication between them is handled by the application. Such online galleries can be linked, for example, to health informatics events, providing participants with valuable recollections of the event, and non-participants with the opportunity to gain a flavor of such events. In addition, they may provide a valuable addition to the historical record of such events. One example is the photo gallery developed with the Coppermine open source tool at and following the medInfo2004 world congress of medical informatics (http://www.differance-engine.net/medInfo2004pix/).

Web surveys, queries and polls are available as stand-alone applications, or as modules embedded in the CMS. In addition to display interactive web-based surveys, queries or polls, these applications present the results in on-line statistics including graphics.

Blogs (weblogs) are open source web applications which contain periodic, reverse chronologically ordered posts on common web pages typically be accessible to any Internet user. Their use is being explored to provide reports on health informatics events for those unable to attend, and may be used to provide a form of distant interaction with such events [20]. An example of the use of such a blog is the one used to provide real-time reporting at
4. The IMIA-NI OSNI

The International Medical Informatics Association (IMIA) established an Open Source Health Informatics Working Group (OSWG) at its general assembly in Taipei, Taiwan, in October 2002. This group’s objective is to provide a forum for discussion and a collaborative, non-judgmental work environment (primarily through virtual working) to explore, and where appropriate promote and facilitate, the application of open source software solutions within health, healthcare and health informatics.

The IMIA OSWG aims to bring together experts and interested individuals from a wide range of health professions and with a variety of interests in the potential application of FLOSS methodologies within their domains of expertise. The OSWG intends to explore the implications of the open source approach to health informatics, and work with other IMIA working groups and special interest groups to examine the possibilities of open source approaches within their respective areas of interest. Through interaction with, and possible cross-membership of, other open source groups outside IMIA, the OSWG has facilitated both the use of other groups’ expertise in the areas under consideration, and input from the field of health informatics to those other groups’ work and discussions. The official web site is http://www.chirad.info/imiaoswg.

At present, few nurses are aware of open source and free software. The IMIA nursing informatics (NI) special interest group decided to establish a working group on open source nursing informatics (OSNI) in June 2003 to address arrange of issues, including raising awareness among nurses and exploring the existence or case for nursing-specific components to FLOSS developments and discussions. The IMIA-NI OSNI working group developed out of open nurse — the nursing open source network — an initiative to explore the application of open source software in nursing, healthcare and nursing informatics which was initially based around the development of the open-nurse.info website in 2002. This aimed to provide a collaborative forum within which to explore, promote and facilitate the use of open source software and approaches in nursing, healthcare and nursing informatics. However, it was soon realized that such a development might be better situated within an existing organization, such as IMIA-NI, which is the world body for nursing informatics. During the international conference nursing informatics 2003 in Rio de Janeiro in Brazil, the first official OSNI meeting took place [21]. The network built in Rio de Janeiro resulted in the launch of the osni.info web site in March 2004 with the URL http://www.osni.info/html/index.php, replacing open-nurse.info as the WG’s official website.

The group seeks to work with other bodies, such as the IMIA OSWG, the open source working group of the American Medical Informatics Association (AMIA) (http://www.amia.org/working/os/main.html) and other relevant organizations in nursing, healthcare, informatics, education, and other pertinent fields.

At present, the OSNI website aims to compile a comprehensive listing of other online resources. In the longer term, the OSNI network aims to publish a number of papers and other resources outlining for nurses some of the issues around the use of open source and free software within nursing and healthcare.

The aim of the OSNI network is to work in a manner akin to that by which open source and free software is developed. We welcome all contributions, and will share all the contributions we receive with anyone who wishes to use them. In the same way that the development of open source software provides for transparency of processes, we wish to provide a transparent process that others can use as they see fit.

5. osni.info as a model

Healthcare informatics organizations like International Medical Informatics Association (IMIA) (http://www.imia.org) and European Federation for Medical Informatics (EFMI) (http://www.efmi.org) represent large international communities. They have as organizations broad ranges of activities including conferences, working groups and various activities. However, they have not yet fully implemented open source CMS as platforms for websites, and are in some sense suffering from lack of updated and dynamic information handling. Nursing informatics organizations like IMIA-NI have used available technologies — i.e. most have email lists; some are well used, others not; most websites are static html and even some leading organizations do not seem to make much use of even those in terms of updating content on a frequent basis to reflect their activities.

5.1. The change of OSNI website from static html to CMS

The problem with lack of updated content was the reason for the redevelopment of the OSNI from a
static platform to a CMS. osni.info was based on the FLOSS CMS platform PostNuke (http://www.postnuke.com/). The PostNuke community has a strong appearance on the PostNuke.com website, with more than 67,000 registered users (09 January 2005). In addition to comprehensive forums about the PostNuke CMS itself, the support forum section typically serves as an arena for users from inexperienced to programming experts and system developers. The PostNuke forums are operated on an embedded discussion forum application platform called phpBB2.

The OSNI website has had more than 16,000 page-views between its launch in March 2004 and early January 2005. It has the following statistics, 14 modules, 74 international members from all over the world, 25 stories published, five active topics, one special section with three articles, 110
web links in 23 categories. The OSNI start page is illustrated in Fig. 3. On the left side of the figure, the main menu and the modules navigation buttons can be seen. In the middle section, news articles are shown, and on the right side of Fig. 3, the login block, the poll, and other stories are shown. The OSNI website has contributed to establish a new network, where visitors and registered members exchange information and news. The problems traditional international organizations are facing with static flat file web sites have been avoided due to the open source, dynamic CMS used. The number of registered members and site traffic is steadily increasing, indicating a need for this type of virtual organization and network connecting nurses interested in open source and nursing informatics in general.

6. Issues to be addressed

The Internet has the last decade entered a leading role to facilitate communication across borders, becoming more and more important as a source of communication, education, research and collaboration. The penetration in the healthcare setting has been profound, and has changed the professional collaboration and development. The problem with early stage Internet-based communication was related to large costs to develop, maintain and update websites as platforms for collaborative organizational work. Software and hardware costs, Internet service provider cost, and lack of computer literacy within the nursing profession limited the access to good solutions.

One of the problems linked to non-profit organizations development, is related to slow development and progress. International collaboration has been based on workshops, tutorials and work group meetings during international, continental, or national conferences and healthcare informatics events. This limits the possibility to work together effectively with knowledge sharing and development in larger groups with the required continuity.

The cost of running organizations with frequent meetings on an international level also limits the broad involvement by large professional groups.

This scene has changed a lot in the recent years for several reasons. Hardware and software costs have fallen, and the open source movement has created a new situation. Nurses have become more familiar with working with computers, and information and communication technology is used more and more in the educational settings.

The open source movement is changing the situation. Due to the nature of this movement, the sharing of knowledge and access to new development and refined and enhanced functionality in web-based applications, the healthcare informatics scene is going through a major change. The structure and functionality of web sites has changed a lot from static flat-file html sites with hyperlinks and hypertext, to web sites developed on relational databases with completely new dynamic and searchable retrieval of content.

The use of open source CMSs for websites similar to OSNI includes facilitation of international links and collaboration among nurses around the world, who need only a simple web browser to access all the functionality of the site. This has particular advantages for developing countries, and activities to support the development of nursing and nursing informatics in such countries, and supports links to the wider global nursing community.

7. Conclusion

Does open source have a future within health informatics and within the health and healthcare sectors? At the moment, it may be too early to say with any certainty, but it is a question that merits, and is beginning to receive, serious exploration. The OSNI working group aims to use the expertise of existing members to explore many of the issues, and to broaden the discussions within the wider nursing and health informatics communities. While individual members may have strong views pro-FLOSS, the OSNI WG does not seek to uncritically adopt the open source approach, but will critically examine the implications, and where appropriate make recommendations for or against an open source approach to solving particular problems. Similar approaches should be taken by other networks within healthcare informatics to utilize free open source software that has the potential to improve collaboration and sharing of information far beyond traditional html-based websites and e-mail communication.

Exploration of FLOSS is one of the key issues that the field of nursing informatics and its practitioners will need to address in the immediate future as we move to more pro-active involvement in determining the future development of health and healthcare delivery globally.

References


