Library Philosophy and Practice 2007

LPP Special Issue on Libraries and Google

ISSN 1522-0222

Standing up for Open Source

Lee David Jaffe
Interim Assistant to the University Librarian

Greg Careaga
Head, Film and Music Center

University Library
University of California, Santa Cruz
Santa Cruz CA

Introduction

It is time for librarians to stand up for open source. Based upon shared values of openness and accessibility, the library world has common cause with the open source community. Further, open source solutions offer many functional and practical advantages, including potential answers to some of the issues currently frustrating libraries. However, libraries have thus far adopted open source solutions at a rate far below other sectors and, notably, have not made a commitment to development of open source integrated library systems (ILS).

This trend not only means that libraries will continue to depend on expensive, proprietary products but also suggests other, more dire consequences in the future. Lacking experience with open source tools, which represent both core functionality and cutting-edge innovations in the online world, libraries risk becoming increasingly marginal as these new technologies shape the coming information world. Librarians who embrace open source and work for its adoption in our libraries and its integration into our community will gain the tools we need to adapt and evolve in order to become leaders of the information age.

For our purposes, the term "open source" includes an assortment of efforts promoting collaborative development and free exchange of software. These voluntary communities created the tools that gave birth to the Internet, their products still form its backbone, and their initiative and oversight guides its future development.

The case for open source solutions in general and the special relationship between open source and libraries are well established, as can be seen in Brenda Chawner's bibliography. Why then has the library community hesitated to adopt available open source solutions, partner with open source developers, and take the initiative in creating tools and materials using the open source scheme?

The answer can be traced to a lack of appreciation for the potential of open source solutions in libraries combined with a failure to understand that how we do business is integral to the business we are in: we cannot operate in an "information as commodity" mode without undermining the principles of freedom of information we try to promote.

In response, we look for remedies to this situation in a series of possible strategies for raising awareness within our community and overcoming other hurdles. Choosing to stand up for open source requires that we accept a new role, that we become the "shape shifters" who can help librarianship find a new path and ensure that the library's future is not a repetition of the past.

Open Source

Definitions

Literally, "open source" refers to the Open Source Initiative of 1998, but for the purposes of this article we use the term inclusively to encompass a broader array of allied movements: free culture, free software, open source software, open access, open content, open archives, and open standards. All share principles of freedom of access and shared creation of resources for the common good. These initiatives are defined by two features: free distribution and collaborative development. Open source resources are shared without cost, provided with the means to customize and enhance them, and are managed through a licensing process that protects the rights of the creators and their collaborators while allowing users broad access. Adopters may evolve into developers, and all belong to a community centered on a product.

Background

The open source instinct may be traced to the earliest days of computing—freely shared software was more the norm once—but the current movement dates from the 1980s. Important milestones include:

- 1983 - GNU Project was launched to create a free software movement based on open source code and collaborative development.
- 1985 - Free Software Foundation was established by Richard Stallman, founder of the GNU Project, to support the goals of the free software movement.
- 1989 - GNU Public License (GPL) version 1 was the first public license that required derivative works to inherit the same license as the original work and

thus protect the integrity of the GNU Project and other open source projects using the GPL against the potential of privatization.

- 1991 - Linus Torvalds created a free UNIX-like operating system kernel, dubbed Linux. Development of the GNU Project kernel, GNU Hurd, was proceeding slowly, and many of the shell applications developed for GNU found an unexpected home in Linux. This unexpected synergy propelled the open source software movement forward, and the Linux brand quickly overtook its elder sibling GNU in public awareness.
- 1997 - "The Cathedral and the Bazaar" was presented as an essay at the Linux Kongress. The essay described two open source development models and advocated for moving away from an open source, closed development model (the cathedral) toward an open source, open development model (the bazaar). The bazaar model gained great traction with Netscape's decision to release the source code for its browser to be developed openly under the administration of the Mozilla organization.
- 1998 - Open Source Initiative was established as an attempt to re-brand the free software movement in terms that were less hostile to business.
- 1999 - Open Archives Initiative was established to define a technical framework and metadata standards for sharing electronic resources.

These initiatives tapped two important audiences. First were the hackers (not to be confused with illegal “crackers”), whose spirit of sharing had helped launch the computer revolution only to see it subverted as software became a commodity market. Open source provided an arena where they could contribute their skills for the joy of seeing their work put to use. Second were the computer users frustrated with the limited range of available software, each in its lockstep, paid development path. After the first flush of the microcomputer revolution, the software market consolidated, leaving only a few, powerful sources. For these users open source offered the best hope for better tools.

Features

“Open source promotes software reliability and quality by supporting independent peer review and rapid evolution of source code,” according to the Open Source Initiative's FAQ. While “no cost” is often of first interest to users, the ability to modify the product, superior quality control and better security through peer review, and a rapid development cycle through collaboration are keys to the success of open source. Open source software is distributed with source code—a licensing condition—and users can alter the product to meet their needs and so contribute to its development. Open source adopters become part of a community, blurring the distinction between users and developers.

Examples

While the open source movement is fueled by a healthy dose of idealism, its products are serious contenders: open source software forms the backbone of the

Internet, World Wide Web, and other critical data services. In its September, 2006 Web Server Survey, NetCraft reported that open source Apache runs twice as many of the world's Web servers as its closest competitor, Microsoft. The open source suite of Linux, Apache, MySQL, Perl and PHP is such a basic Web server package that it is known collectively as LAMP. The Web depends on many other open source products to drive some of its most used and most innovative services: mailman, sendmail, Python, and MediaWiki are just a few tools we may use without realizing it.

Open source also produces desktop software. The same Linux that runs enterprise servers can be loaded on Intel or Macintosh computers with a choice of open source graphical interfaces and applications programs. Mozilla's Firefox Web browser is open source's most public desktop success. According to OneStat.com's page, "Global usage share Mozilla Firefox has increased," and Firefox has a 12.93% share of the web browser market. While open source's desktop challenge to Microsoft is still numerically insignificant, more applications are introduced all the time and recognition of open source on the desktop continues to grow.

Open Source in Libraries

Background

- In 1996, Jon Knight wrote about a nascent open source community based on the linux4lib mailing list and the successful implementation of the Linux open source operating system for a variety of libraries' server and workstation needs. The concept of open source in libraries has since gained support in key venues. Important milestones include:
- 1997 - Scholarly Publishing and Academic Resources Coalition (SPARC) was founded by the Association for Research Libraries (ARL) "to be a constructive response to market dysfunctions in the scholarly communication system."
- 1999 - "Keystone Principles" were enunciated by ARL leaders meeting in Keystone, Colorado . Keystone leaders acknowledged that libraries were responsible for creating innovative information systems and advocated for the development of open source solutions.
- 1999 - OSS4Lib: Open Source Systems for Libraries was established as an information exchange for librarians developing or interested in open source software solutions.
- 1999 - Dan Chudnov published "Open Source Library Systems: Getting Started," calling on librarians to get onboard the open source movement.
- 1999 - Prospero document delivery software was developed as an open source extension to the proprietary Ariel ILL software.
- 2000 - LITA establishes the Open Source Systems Interest Group to promote the adoption of open source solutions in libraries.
- 2000 - Koha, the first open source ILS was deployed for the Horowhenua Library Trust in New Zealand .
- 2002 - "Open Source Software," a special issue of*Information Technology and Libraries*, raised the profile of open source efforts in libraries.

- 2003 - Sakai Project was launched to create an open source course management solution.
- 2006 - Sakaibrary Project was established to bridge the gap between "library licensed digital content" and the Sakai open source learning environment.
- 2006 - LibX library Firefox extension released, offering an easily customizable open source applet that extends the user's ability to identify a library's holding across a range of external websites.

Features

On its FAQ page, Open-ILS.org describes the philosophical alignment between the library community and the open source community. "We decided on open source for our development model for both pragmatic and philosophical reasons. The open source community is a natural ally of the library community. Both try to enrich their members through sharing and disseminating knowledge, and both are open to everyone, private or public, commercial or non-commercial."

Open source features, such as low cost, rapid development, and high reliability, that motivate other users will also attract libraries. Some features of particular interest for libraries, especially when contrasted with proprietary systems, include:

- local control
- customizability
- interoperability
- vendor independence
- reliance on open standards
- collaborative development
- flexible support options

Other important open source advantages are the service benefits we can deliver to our users, with the most profound enhancements emerging in the open access publication arena. As Peter Suber points out in "A very brief introduction to open access," "The question is not whether scholarly literature can be made costless, but whether there are better ways to pay the bills than by charging readers and creating access barriers."

Examples

Koha is the most successful of several open source ILS projects. Katipo.com's Koha Library System page states that developers decided "to release Koha as Free Open Source Software … as a risk management strategy, to ensure that they could get support and development work done." As Mark Peart points out, further advantages lie in users' ability "get their data out of Koha if they have to change systems later on. Koha can be changed or rewritten without breaking any agreements or license

restrictions." According to the Koha wiki entry "Koha users around the world," Koha has 101 participating institutions, though not yet a single ARL library.

Sakai is generating some excitement in academia, with three conferences in 2006. In a news article on its website entitled "IBM joins educational open-source Sakai Project," Sakai pointed out that it employed the open source model because of "the need to rapidly propagate the innovations in teaching, learning and research that are constantly coming from our faculty, students and learning technologists. Building on totally open source with open standards in an open community makes that possible." In the same article, Patrick Carey stated that IBM entered this partnership because "Embracing Sakai fits with IBM's overall business model, which is focused on open architecture, open standards and open source as the keys to faster innovation in all industries. . . . IBM believes the open-source movement is leading to the next major paradigm shift in the software industry. . . . We think it is important to view the role of open source in the more holistic form of an 'open approach' overall. Together, open source, open standards and open architecture form a powerful combination for the creation of the next generation of applications." Recent acquisition of two courseware companies and legal challenges against other vendors give the Sakai 's open source credentials an extra edge. In 2006, The Mellon Foundation supported the Sakaibrary collaboration between the University of Michigan and Indiana University to create open source tools to link library electronic resources with the Sakai learning environment.

Prospero is a good example of a niche open source utility with a significant benefit for library services. Launched in 1999, this application added document delivery capability to RLG's Ariel, a feature not available from the vendor. Ariel now includes this function and Prospero has been repositioned as a general document delivery tool, but it demonstrated how a homegrown solution could provide innovative tools to a wider community and push proprietary products to a new level.

One of the most recent open source innovations in libraries is LibX, a Firefox extension that provides a customized toolbar for each location. Each library develops its own version available for download at the LibX site. It may seem like a small thing but it is a useful tool, easy to implement and therefore a good demonstration of the open source model. As of October 2006, libx.org reports "30 academic and public libraries are offering LibX editions to their users, an additional 52 libraries are testing editions."

The Problem

Despite the case for open source solutions in libraries, and some heroic work on the part of some libraries and librarians to create, support, and propagate open source solutions, the movement has not caught on within our community. This is clearly demonstrated by the relative absence of open source products in libraries. The vast majority of installed library systems are proprietary products. Libraries have adopted other open source software at a rate significantly below average.

Integrated Library Systems

More than three decades after libraries built the first automated systems, we now depend on commercial black box systems, despite growing evidence that the proprietary ILS has outlived its usefulness. In the intervening years, librarianship has come into its technological maturity, with a generation of tech-savvy librarians proving we have the skills in-house, and yet we cling to the belief that only a commercial entity can provide the solutions we need to manage our services.

The systems available to us, to be sure, are not mechanical beasts of science fiction nightmares. They run, usually reliably, and rarely hurt us or our users. Our issue is with their closed nature. The innards of a proprietary ILS are hidden. Often our own data is hidden from us. If we want a change, we must plead our case to the vendor and, if our request is granted, we pay for the enhancement. Adherence to standards is uncertain and therefore system A cannot talk to B. Without access to the source code we cannot engineer add-on components that we need. We wait years for critical features, then are forced to implement features we do not want. Vendors choose which interfaces to support and which development paths to emphasize. Migrating from one system to another—even migrating within a single vendor's line—can be painful and expensive. And that is the good news, when the systems work and the vendors remain in business.

As Marshall Breeding demonstrates in his 2006 graph of the history of library automation, the number of ILS vendors is dwindling. According to Breeding's article "Reshuffling the Deck," as of April 2006, the top four firms were responsible for 75% of the systems installed in libraries. This figure—the "four-firm concentration ratio" (sometimes called CR4)—for the ILS market is double the historical 37% average for U.S. industry stated by Thomas Gilligan. David Dorman asserts that horizontal integration of the library systems market will continue and deepen. In another study, Paul Courant notes "vendors are reluctant to invest in upgrading these systems because the function of libraries is in such a state of transition, and it is not at all clear what activities the software will need to support five to ten years form [sic] now" (33). So we are buyers in a market with limited competition, a market with diminishing product choices, and a market in which the existing firms have a disincentive to innovate. This is an untenable position.

Just as open source software has been the most effective response to concentration in the general software market, that model is the best hope for library systems. However, despite the highest ideals of the ARL library leaders who met in Keystone, Colorado and declared "libraries will create interoperability in the systems they develop and *create open source software* [our emphasis] for the access, dissemination, and management of information" (ARL/OCLC Strategic Issues Forum), we have not taken advantage of the open source model where it matters most, the systems core to our operations.

Recent discussions within one library system provide little hope this will change. In a 2005 University of California (UC) Bibliographic Services Task Force (BSTF) report the term "open source" does not appear once. The UC Systemwide Operations and Planning Advisory Group (SOPAG) responded to this report with feedback from all eleven UC campuses. In that follow up report, "open source" still received only three mentions. In contrast, "Google" appears 68 times in the BSTF report and 22 times in the SOPAG response. Despite pointed objections to outsourcing in the SOPAG response, including one San Diego librarian's feedback that "one does not usually outsource something that is core to one's business" (24), UC's heads of technical services group recommended partnering with a commercial vendor in a shared development model (25). Such a recommendation is surprising in light of the UC's recent experience with that model. In this approach UC seems to be typical of the library community, following a well-trod path despite experience that would seem to suggest another direction entirely.

Libraries and Other Open Source Applications

One clue to the low rate of open source ILS adoption may be found in a comparable response to other open source products. Searching the Libweb directory of library Web sites we found 41% using open source (Apache, PHP, Perl) and 40% running Microsoft (IIS, ASP). In contrast Security Space's Web Server Survey shows Apache with 73% and Microsoft with only 20% of the broader web market.

Anecdotal evidence suggests that the support for open source in libraries is ebbing. During discussions about replacing our library's open source ht://Dig search engine with Google's University Search service we consulted with other tech managers. We heard the same thing every time: ht://Dig is the better solution where local control is an advantage but there is no resisting the popularity of Google; it is a fight we cannot win. This was confirmed by looking at ht://Dig sites where we discovered many libraries and campuses had switched to Google.

That libraries have not applied open source tools, even where they are the norm elsewhere in the world, suggests an untenable bias against "free" products in favor of "name brands." Without this day-to-day experience with open source, libraries may be more hesitant to adopt such solutions: the library that already uses open source tools does not face the same hurdles as one encountering open source for the first time. In other words, adoption of basic open source tools may be a key point of access to more ambitious endeavors in that arena.

Future Consequences

The information revolution is not over and as new information technologies continue to change the way the world creates, distributes, stores, and retrieves information, libraries may find that we lack the fundamental tools that would allow us to take advantage. Libraries have already been pushed to the sidelines with users increasingly choosing easy-to-use online tools over the less-intuitive services provided

by libraries. According to OCLC's 2005 "Perceptions of Libraries and Information Resources" survey, users rarely consider library resources when looking for information online.

Without fundamental changes in our ability to innovate, or even respond to innovation, libraries risk becoming even more marginal. Continued reliance on proprietary ILS means we will be less able to affect changes in our core operational areas. Low adoption of open source software, one of the engines driving innovation in the online world, means users will see new information tools being offered everywhere but the library.

Perhaps most at risk is our relationship with our users. Key constituencies, such as faculty who depend on academic libraries or local governments and businesses who turn to public libraries for support, are finding they need more and better online tools in their work. How often will these natural partners and potential allies be willing to hear "We can't do that" from the library before they take their needs, and their support, elsewhere?

If libraries wish to turn the tide and reclaim our place as leaders in the information world, we must position ourselves where we can best take advantage of new developments. If we want the flexibility to meet these challenges, we do not have the luxury of relying on information technology solutions that are opaque and inadaptable.

Hurdles to Open Source

Open Source isn't perfect

Despite many advantages, open source is not a panacea and it would be a mistake to undertake such solutions with unrealistic expectations. We need to be aware of the real constraints and requirements inherent in open source solutions. However, most hurdles can be overcome or avoided given foresight and planning.

Open Source isn't easy

An open source project can be costly and daunting when it requires starting from scratch. The debit column can include: bearing the costs for development, finding development partners to share the burden, and grappling with licensing and governance. The credit column includes only potential and remote benefits in the form of better features rather than direct monetary savings. This prospect may be enough to get anyone to sign on the dotted line with a commercial vendor.

Fortunately, libraries have a long history of cooperation, with common tasks and issues built around standards such as MARC, AACR2 and Z39.50. For academic libraries, there is also a history of universities collaborating on administrative and course management software to ease the way (Courant 22).

Alternately, adopting mature open source solutions may have little development burden, instead resembling installation of packaged software. Should we choose to pay for support, we even get an 800 number to call. One of the key advantages of open source is that we can decide how easy or hard it is.

Open Source isn't ready

As recently as 2004, Andrew Pace noted, "a full-scale OSS library system that would work for the largest institutions has yet to emerge." Whether or not this is still true, any large implementation first requires careful evaluation of how far the current release is from your needs. With open source solutions we have the option of real-world testing without committing significant resources, and can then choose how much development burden to take on, or not. The hope, however, is that potential adopters will be willing to do the work to make open source ILS a reality.

Open Source isn't free

While no fees are connected with acquiring open source software, there are costs. Charges for hardware, network access, operator salaries, and printing supplies still apply. The dearth of mature open source ILS products supporting larger institutions means we can plan on some development costs. That is money that would otherwise go to a vendor, but with open source we pay for work to our specifications. As the Free Software Foundation points out "Free as in Freedom."

Open Source is invisible

We cannot depend on popular opinion for support of open source solutions in our libraries. The server market, where open source software dominates, takes place out of sight. Even then, to look at a newspaper's business or technology sections one would think that a handful of commercial concerns are the movers and shakers of the online world. In reality, Apache, the open source Web server software, has double the market as Microsoft's server products (NetCraft) and the open source MySQL outpaces Oracle (MarketShare). Since neither is traded on the stock market or publishes earnings, Apache and MySQL rarely appear in the popular press.

The success of Mozilla Firefox, the Web browser competing head to head with Internet Explorer, could help raise public awareness but "open source" is not mentioned anywhere on the Firefox information page. Users know Firefox is free but then so is the decidedly proprietary Explorer. Similarly, open source adoptions in libraries are trees falling in the forest. There are scores of articles about open source in libraries, but only a few are case studies and therefore we know little of successful implementations.

Is it any wonder that our users and administrators, even our colleagues, ask for "name brand" products and may ignore or even disparage better open source solutions?

Personal Preferences and Organizational Customs

We need to be aware of how personal preferences and institutional customs can influence a library's ability to implement open source. Organizational change is always a challenge with its potential for uncertainty and loss of control. Adopting open source solutions can bump up against any number of individual needs or institutional expectations. The personal issues can include comfort with technology and concerns about job security, such as added responsibility and workload, maintaining authority, and even survivability. The organizational advantages of adopting open source solutions may conflict with the interests of the individuals involved.

Organizational culture and habitual practices may also create obstacles to adopting open source solutions. Bureaucracy promotes consistency but may create obstacles to change. Since open source solutions by definition apply a new model for distribution and support, they may not readily fit existing business practices. If the purchasing department employs the Request for Proposal (RFP) process or requires signed vendor contracts it is going to be that much harder to get open source in the door.

The "You Get What You Pay For" Myth

We all know the stories. The copper-clad contract with a reputable vendor selected after rigorous review and the deal still went south. The product never got out of ßeta, was delivered with major functions unimplemented, never performed up to specifications, was plagued by bugs ("we are giving it our highest priority") that never got resolved. Or the software just went out of production, the company was sold or just closed up shop. Why then does the notion that signing on the dotted line is a guarantee of success persist? This myth, along with its corollary that anything free cannot be any good, is the toughest hurdle open source advocates face. Though patently wrong, debating the issue must not devolve into simply browbeating listeners with one account of system failure after another lest we antagonize the very people we need to cultivate as allies.

Strategies for Implementing and Supporting Open Source

Get educated

When you get the chance to stand up for an open source project in your library, you don't want to get caught flat-footed. Do your homework now. Do not expect to spout all the right facts and figures at a moments notice. Have a few sound bites at hand—"Open source software runs twice as many Web servers as Microsoft!" or "Open access articles are more likely to be cited!"—and know that the other critical information is out there and where you can find it when you need it. Join a discussion list or blog, read items as they are published, and collect articles and bookmark items

for later reference. One good bibliography, a directory of open source cites, one rousing manifesto and a relevant case study should do the trick.

Cultivate allies

Preparing yourself is the first step but if you are the only one in your library who knows about the advantages of open source, it is going to be a very lonely and one-sided campaign. Get colleagues up to speed. Share articles and announcements. Let others know you are a resource for related questions. Respond to calls for comments and make sure that those looking for solutions are aware of open source alternatives to the usual suspects. You can help your case if open source is already a known option.

Endorse the principle

Your library or parent organization may have already signed on to one of the existing declarations—e.g., Keystone, Budapest , Bethesda , Berlin or others—endorsing open source solutions. If your organization has not signed, maybe peer institutions or ones your library emulates are endorsers. Either way, access to these principles may support a case for open source. Bring them to the attention of your peers, professional groups, and library administrators. Advocate for their adoption in your library.

Start small

If this is your library's first open source implementation, a major development project may not be a good starting point. There are plenty of smaller open source implementations, such as LibX, that would be good introductions to open source products, methods and culture to your colleagues. Interested in supporting open access publication? Try developing a Web site directing authors and researchers to useful resources. Want something more ambitious? Install FeedSplitter to pull RSS feeds (news headlines, for instance) directly into your library's Web pages. Try starting a Wiki to support collaborative activities. It is not hard to find open source tools that answer many service needs we have.

Experiment

Implementations are more daunting when they are under scrutiny, especially if they use a lot of resources and generate high expectations. Instead, begin by working out of sight, using cost-free resources without making promises about deliverables. Open source software is ideal for this approach since it is free to install and you can install it on modest, perhaps surplus, equipment. You could have the Koha ILS or Sakai courseware running on a discarded desktop at a negligible cost. This can serve as a "proof of concept" demonstration, leading to the next step.

Pilot projects work for implementations as well. You can install, test, and customize your open source system while your existing ILS remains in operation, so there is no interruption of service. Eventually, you will need to pay for a production server and commit programming resources for the project, but only after you are satisfied that this is a viable path. You do not need to turn off your old system until the new one is tested and ready for primetime.

Don't give up

The open source movement in libraries is barely ten years old. Though the road ahead can look long and steep, there have been some impressive developments with promising packages and services already in place. Though these accomplishments help pave the way, success may not come quickly or easily. Hang in there.

Conclusion

The systems and resources that form the core of our libraries' operations are outside of our direct control. Having given away our birthright—control of the resources we helped create in the first place—we continue to pay for solutions that fail to serve the needs of our patrons or our profession because they are familiar and feel safe. Our dependence on commercial interests is stifling the very innovation we need in order to remain relevant in the information age.

There is an alternative. Open source, though it does not solve all our problems, makes a good start in addressing some of the big ones. Open source software returns local control of crucial systems, allows us to decide which features to change and when, gives us access to the inner workings of our systems and our data, and promotes interoperability with other tools. Open access publication frees the written word, letting us focus once again on access rather than control and its format independence opens yet other doors. Adopting open source will let us be librarians again.

Libraries have a choice between these two paths. While some of the advantages of the open source model are clear and immediate, the longer-term consequences will turn out to be most important. Without the constraints of managing proprietary products and having the decisions of what we can and cannot do decided by market forces, we get to do the work we were meant to do. From there we can take an active role in creating tools and resources that serve the purposes we determine. By standing up for open source within our libraries we stand up for libraries as evolving organizations ready for the challenges of the future.

Works Cited

ARL/OCLC Strategic Issues Forum for Academic Library Directors. “Keystone Principles.” ARL *Bimonthly Report issue 207*. 2 Dec. 1999. 15 Nov. 2006 <http://www.arl.org/newsltr/207/keystone.html>.

Association of Research Libraries. "About SPARC." *SPARC.* 1 Feb. 2006 <http://www.arl.org/sparc/about/index.html>.

"Applications." *Open Source Software for Libraries* n.d. 13 Oct. 2006. <http://oss4lib.org/article/applications>

Bailey Jr., Charles W. *Open Access Bibliography: liberating scholarly literature with e-prints and open access journals.* Wash., D.C.: Association of Research Libraries, 2005 <http://www.escholarlypub.com/oab/oab.pdf>.

"Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities." *Conference on Open Access to Knowledge in the Sciences and Humanities.* 1 Aug. 2006. 13 Oct. 2006 <http://oa.mpg.de/openaccess-berlin/berlindeclaration.html>.

"Bethesda Statement on Open Access Publishing." 20 June 2003. 13 Oct. 2003 <http://www.earlham.edu/~peters/fos/bethesda.htm>.

Breeding, Marshall. "Gradual Evolution--Automated System Marketplace 2005." *Library Journal*. 1 April 2005. 15 Oct. 2006 <http://www.libraryjournal.com/article/CA512267.html>.

Breeding, Marshall. "History of Library Automation." *Library Technology Guides 2006*. 15 Oct. 2006 <http://www.librarytechnology.org/automationhistory.pl>.

Breeding, Marshall. "The open source ILS: still only a distant possibility." *Information Technology and Libraries* 21:1 (March 2002):16-18. 15 Oct. 2006 <http://www.librarytechnology.org/fulldisplay.pl?SID=20030924441131591&UID=&auth=&RC=9681&Row=4&code=BIB&Type=Library+Automation>.

Breeding, Marshall. "Reshuffling the Deck." *Library Journal* 1 April 2006 <http://www.libraryjournal.com/article/CA6319048.html>.

"Budapest Open Access Initiative." *Open Society Institute*. Feb. 2002. 13 October 2006 <http://www.soros.org/openaccess/read.shtml>.

"Categories of Free and Non-Free Software," *The GNU Operating System*. The GNU Project. 15 Nov. 2006 <http://www.gnu.org/philosophy/categories.html>.

"The Cathedral and the Bazaar." *Wikipedia*. 6 October 2006. 13 October 2006 <http://en.wikipedia.org/wiki/Cathedral_and_the_bazaar>.

Chawner, Brenda. Open *Source Software and Libraries Bibliography*. 12 June 2006. 13 October 2006 <http://www.vuw.ac.nz/staff/brenda_chawner/biblio.html>.

Chudnov, Dan. "Open Source Library Systems: Getting Started." *Open Source Software for Libraries.* 1 Feb. 1999. 13 Oct. 2006 <http://oss4lib.org/readings/oss4lib-getting-started.php>.

"Comparison of Selected Open Source Software Library Management Systems." *Rider University Libraries*. 9 Nov. 2004. 15 Nov. 2006 <http://library.rider.edu/scholarly/ecorrado/il2004/ossfeatures.html>.

Corrado, Edward M. "The Importance of Open Access, Open Source, and Open Standards for Libraries." *Issues in Science and Technology Librarianship* 42 (Spring 2005). 15 Nov. 2006 <http://www.istl.org/05-spring/article2.html>.

Courant, Paul N., principal investigator, and Griffiths, Rebecca J. "Software and Collaboration in Higher Education: A Study of Open Source Software." *Ithaka Foundation*. 26 July 2006 <http://www.ithaka.org/strategic/OOSS_Report_FINAL.pdf>.

Courant, Paul N. "Scholarship and Academic Libraries (and their kin) in the World of Google." *First Monday* 11.8 Aug. 2006. 15 Nov. 2006 <http://firstmonday.org/issues/issue11_8/courant/index.html>.

Creative Commons. *Creative Commons*. n.d. 18 Oct. 2006 <http://creativecommons.org/>.

Dorman, David. "The Case for Open Source Software in the Library Market." *Ubiquity: an ACM IT Magazine and Forum* 4.47 Jan. 28 - Feb. 3, 2004. 15 Nov. 2006 <http://www.acm.org/ubiquity/views/v4i47_dorman.html>.

Dowling, Thomas. *Libweb*. 2006. 15 Oct. 2006 <http://lists.webjunction.org/libweb/>.

"The Free Software Definition." *The Free Software Foundation*. 12 Feb. 2005. 13 Oct. 2006 <http://www.fsf.org/licensing/essays/free-sw.html/view?searchterm=definition>.

The Free Software Foundation. *FSF. 11 Oct. 2006. 15 Nov. 2006* <http://www.fsf.org/>.

"Free & Open Source Software Portal: Software: Digital Library." *UNESCO*. n.d. 13 Oct. 2006 <http://www.unesco.org/cgi-bin/webworld/portal_freesoftware/cgi/page.cgi?d=1&g=Software/Digital_Library/index.shtml>.

"Frequently Asked Questions." *Open Source Initiative (OSI)*. 2006. 13 Oct. 2006 <http://www.opensource.org/advocacy/faq.php>.

"Frequently Asked Questions." Open-ILS.org. 2006. 13 Oct. 2006. <http://open-ils.org/faq.html#opensource>.

Gilligan, Thomas. "Industrial Concentration."*The Concise Encyclopedia of Economics*. 2002. 13 Oct. 2006 <http://www.econlib.org/library/Enc/IndustrialConcentration.html>.

"Global usage share Mozilla Firefox has increased." *OneStat*. 9 July 2006. 13 Oct. 2006 <http://www.onestat.com/html/aboutus_pressbox44-mozilla-firefox-has-slightly-increased.html>.

"Halloween Documents." *Eric S. Raymond's Home Page*. n.d. 13 Oct. 2006 <http://www.catb.org/~esr/halloween/>.
More properly "Open Source Software: A (New?) Development Methodology" by Vinod Valloppillil, Microsoft, Aug 11, 1998 -- v1.00.

Ho, Adrian K., and Bailey Jr., Charles W. *Open Access Webliography*. preprint 26 April 2005. 18 Oct. 2006 <http://www.digital-scholarship.com/cwb/oaw.htm>.

The ht://Dig Group. *ht://Dig.* 27 Jan. 2005.. 15 Oct. 2006 <http://www.htdig.org>.

"IBM joins educational open-source Sakai Project." *Sakai Project*. 27 April 2005. 15 Oct. 2006 <http://sakaiproject.org/index.php?option=com_content&task=view&id=234&Itemid=547>.

Indiana University Digital Library Program. *Sakaibrary: Integrating Licensed Library Resources with Sakai*. 5 Sept. 2006. 07 Sept. 2006 <http://www.dlib.indiana.edu/projects/sakai/index.shtml>.

Knight. Jon. "From the Trenches - On the cheap: Linux." *ELib* 2 20 Mar. 1996. 15 Nov. 2006

<http://www.ariadne.ac.uk/issue2/knight/intro.html>.

Koha Developer Wiki. "Koha Users Around the World." 11 Oct. 2006. 15 Oct. 2006 <http://wiki.koha.org/doku.php?id=kohausers>.

The Koha Development Team. *Koha.* 2005. *17 Oct. 2006*. <http://www.koha.org/>.

Katipo Communications. "Koha Library System." 2002. 17 Oct. 2006. <http://www.katipo.com/solutions/koha/>.

Lawrence, Steve. "Online or Invisible?" n.d. 18 Oct. 2006. <http://citeseer.ist.psu.edu/online-nature01/>.

LibX. *LibX – A Firefox Extension for Libraries*. n.d. 18 Oct. 2006 <http://libx.org>.

"Linux." *Wikipedia* 14 Oct. 2006. 15 Oct. 2006 <http://en.wikipedia.org/wiki/Linux>.

"Market Share." *MySQL* 2006. 13 Oct. 2006 <http://www.mysql.com/why-mysql/marketshare/>.

McCallum, Sally. "40 Years of Technology in Libraries: A Brief History of the IFLA Section on Information Technology, 1963/64 – 2003." *IFLA.* July 2003. 16 Oct. 2006 <http://www.ifla.org/VII/s21/publications/40YearsOfSIT.pdf>.

Moody, Glyn. *Rebel Code: the inside story of Linux and the open source revolution.* Cambridge, Mass.: Perseus Pub., 2001.

Morgan, Eric Lease. "Possibilities for Open Source Software in Libraries." *Information Technology and Libraries* 21.1 March 2001 <http://www.lita.org/ala/lita/litapublications/ital/2101morgan.htm>.

"Open Collaboration Principles." *University & Industry Innovation Summit* 19 Dec 2005. 13 Oct. 2006 <http://www.kauffman.org/pdf/open_collaboration_principles_12_05.pdf>.

"The Open Source Definition." *The Open Source Initiative*. 2006. 13 Oct. 2006 <http://www.opensource.org/docs/definition_plain.html>.

"Open Source Software." *Electronic Information for Libraries.* n.d. 13 Oct. 2006 <http://www.eifl.net/opensoft/soft.html>.

"Open Source Systems Interest Group." 2006. *Library and Information Technology Association*. 15 Oct. 2006 <http://www.ala.org/ala/lita/litamembership/litaigs/opensourcesystem/opensourcesystems.htm> .

Ostrowsky, Ben. "Quiet Revolution: Librarians teach and preach Open Source software at convention." *NewsForge* 16 June 2002. 15 Nov 2006 <http://software.newsforge.com/article.pl?sid=02/06/17/1514234>.

Pace, Andrew K. "Dismantling Integrated Library Systems." *Library Journal* 1 Feb. 2004. 15 Nov. 2006 <http://libraryjournal.com/article/CA374953.html>.

Peart, Mark. "Katipo's Koha still wooing librarians around the world." *Computerworld* 11 Feb. 2006. 17 Oct. 2006 <http://idg.net.nz/news.nsf/UNID/3F65C01EAB666AC6CC25710F00805997?opendocument&pub=Computerworld>.

"Perceptions of Libraries and Information Resources." OCLC. 2005<http://www.oclc.org/reports/2005perceptions.htm>

Perens, Bruce. "The Emerging Economic Paradigm of Open Source." *Bruce Perens*. 16 Feb. 2005. 13 Oct. 2006 <http://perens.com/Articles/Economic.html>.

Poynder, Richard. "The Open Source Movement." *InformationToday* 18.9 Oct. 2001 <http://www.infotoday.com/it/oct01/poynder.htm>.

Raymond, Eric S. *The Cathedral & The Bazaar: musings on Linux and open source by an accidental revolutionary. with a foreword by Bob Young.* Beijing; Cambridge, Mass.: O'Reilly, 1999, rev. 2001 <http://www.catb.org/~esr/writings>.

"Reference: Libraries: Library and Information Science: Software." *Open Directory.* 25 Sept. 2006. 13 October 2006 <http://dmoz.org/Reference/Libraries/Library_and_Information_Science/Software/>.

"September 2006 Web Server Survey." NetCraft. 5 Sept. 2006. 15 Oct. 2006<http://news.netcraft.com/archives/2006/09/05/september_2006_web_server_survey.html>.

"Stats Project." *OpenOffice.org*. 2 Sept. 2006. 13 Oct. 2006 <http://stats.openoffice.org/index.html#stats>.

Suber, Peter. "A Very Brief Introduction to Open Access." *The SPARC Open Access Newsletter*. 29 Dec. 2004. 25 Oct. 2006 <http://www.earlham.edu/~peters/fos/brief.htm>.

Suber, Peter. "Open Access Overview," *The SPARC Open Access Newsletter.* 10 March 2006. 12 Oct. 2006 <http://www.earlham.edu/~peters/fos/overview.htm>.

UC Bibliographic Services Task Force. "Rethinking how we provide bibliographic services for the University of California." Dec. 2005. 12 Oct. 2006 <http://libraries.universityofcalifornia.edu/sopag/BSTF/Final.pdf>.

UC Systemwide Operations and Planning Advisory Group. "Invitation to Comment on the Bibliographic Services Task Force Report, Analysis of Feedback." 26 Apr. 2006. 12 Oct. 2006 <http://libraries.universityofcalifornia.edu/sopag/BSTF/AnalysisResponses.pdf#search=%22BSTF%20report%22>.

United States. Executive Office of the President. President's Information Technology Advisory Committee. Panel on Open Source Software for High End Computing. *Developing Open Source Software to Advance High End Computing: Report to the President*. October 2000 <http://www.itrd.gov/pubs/pitac/pres-oss-11sep00.pdf>.

"University Search." *Google*. n.d. 15 Oct. 2006 <http://www.google.com/options/universities.html>.

"Web Server Survey." *Security Space*. 1 Oct. 2006. 15 Oct. 2006 <http://www.securityspace.com/s_survey/data/200609/index.html>.

Wheeler, David A. "Open Source Software / Free Software (OSS/FS) References." *David A. Wheeler's Personal Home Page* n.d. 13 Oct. 2006 <http://www.dwheeler.com/oss_fs_refs.html>.

Wheeler, David A., "Why Open Source Software / Free Software (OSS/FS, FLOSS, or FOSS)? Look at the Numbers!" *David A. Wheeler's Personal Home Page*. Revised as of 14 Nov. 2005. 13 Oct. 2006. <http://www.dwheeler.com/contactme.html>.