

# OSS/OA

A Resource Guide about Open Access, Open Source, and the Convergence between the two

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August 5, 2013  
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A Subject Guide

# Introduction

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Open Source, Open Access, Open Data, Open Science, Open Standards? A lot of terminology and buzzwords have appeared around the concept of openness in recent years, and in many diverse fields, the Open Movement (as the collective surge of these distinct streams is sometimes called) has finally begun to gain support and public visibility. For a newcomer, it can be hard to distinguish the differences between each term – and more importantly, how they relate (if at all), and how they might support each other.

The following resource list has been put together to help highlight the convergence between the Open Access movement and open source software, and to emphasize two key points:

- 1) How the values and philosophies of each movement mirror and reinforce each other, and
- 2) How the tools of one movement can help support the aims of the other

## What is Open Access?

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Peter Suber, one of the most vocal proponents of the Open Access (OA) movement, defines open access literature in his 2012 book, *Open Access*, as “digital, online, free of charge, and free of most copyright and licensing restrictions” (4). The term Open Access first came into widespread use after a meeting of the Open Society Foundation in Budapest in December 2001, where a statement called the Budapest Open Access Initiative Declaration was drafted to give a coherent voice to a growing trend in scholarly research toward unrestricted online access to research. The original statement can be found at: <http://www.budapestopenaccessinitiative.org/read>. In essence, the movement argues that society as a whole benefits from the sharing of scholarly research, that researchers have traditionally been more concerned with dissemination and impact than with money, and that the internet has provided an opportunity for broad dissemination in a new model that can benefit authors, researchers, and even publishers. In contrast, when research disseminations are put behind a paywall, Suber argues that these access gaps “harm authors by limiting their audience and impact, harm readers by limiting what they can retrieve and read, and thereby harm research from both directions” (*Open Access*, 2012, 4). The OA movement has been a strong advocate of Creative Commons licenses (<https://creativecommons.org/>), which provides a means for authors and content creators to license their work permissively, while still retaining the rights which are important to them. As the Creative Commons website states, “Our free, easy-to-use copyright licenses provide a simple, standardized way to give the public permission to share and use your creative work — on conditions of your choice. CC licenses let you easily change your copyright terms from the default of ‘all rights reserved’ to ‘some rights reserved.’” In this way, the OA movement has found a way to allow authors to retain control over their work (such as attribution if desired, for example), while allowing broad dissemination. While OA substantively relates to academic research and relies on the internet as its platform for access, its values around access and its alternate economic models for the publishing industry have implications beyond this narrow field – and of course, more accessible research benefits society as a whole, even those who are not themselves researchers.

For more information, Peter Suber’s book, *Open Access* (MIT Press, 2012) can be freely accessed in multiple formats at: <http://mitpress.mit.edu/books/open-access>

# What is Open Source?

Open Source, on the other hand, is both a development philosophy, and in relation to computer science, a specific method of releasing software that includes its source code, and the right to study, modify, improve, and re-distribute it. While the terms “Open Source” and “Open Source software” are often used interchangeably, it has [been argued](#) that there is a conceptual distinction between the two. Open Source is generally considered a development methodology, characterized by an open (i.e., available to public scrutiny and participation) development process with community involvement, where the lead developers accept contributions that meet clearly defined coding standards, and the final product is released under an open source license – as such, “open source” as a term can apply to concepts such as software, but also hardware, robotics, and beyond: some of the articles below discuss the concept of “open source science,” for example. Open source software, then, is necessarily developed using an open source methodology, but not all open source is software.

Complicating the matter somewhat is that there is not always an agreement over terms. Richard Stallman, best known for launching the [GNU Project](#) and founding the [Free Software Foundation](#) (FSF), has always preferred the term “Free Software,” which Stallman clarifies as having to do with liberty, not price, or “free speech, not free beer”. The FSF maintains the [Free Software Definition](#), which is centered on the freedom to run, study, modify, distribute, and distribute your modified versions. Stallman also coined the term “copyleft,” and authored the original GNU General Public License ([GPL](#)), one of the strongest open source licenses for releasing software available for creators. Meanwhile, the Open Source Initiative ([OSI](#)), a non-profit organization founded in 1998, maintains the [Open Source Definition](#), which is close yet more explicit than the definition of the FSF – the freedom to freely access and modify source code, create derived work, and redistribute both the original and the derived works, is central to each definition, however.

In both cases, and similar to the OA movement’s use of Creative Commons, open source software depends on the creation of permissive and/or “copyleft” licenses to subvert the default copyright that is applied to all works thanks to the 1886 [Berne Convention](#) establishment of copyright as the default status for all creative works originating in countries that are signatories to the Convention. There are dozens of open source licenses that have been created; some require all derivative works to be released under a similar or compatible open source license, while others are more “permissive” and allow the incorporation of open source works into new proprietary works. The FSF has some [resources](#) to help users choose a license, while Wikipedia maintains a [useful table](#) that outlines some of the most common licenses and their compatibility with both OSI and FSF definitions. The OSI also maintains a list of OSI-approved open-source licenses, with information on each, available at: <http://opensource.org/licenses>.

Open Source Software (OSS) then, tends to refer to software that is released with a license that meets the OSI definition, while Free and Open Source Software (FOSS) is often used to describe software that meets the terms of both the OSI and the FSF. For the purposes of simplicity in this guide, the generic term “Open Source” has been used to describe open source software that meets both definitions, and the term “OSS” may include software that could be called FOSS.

# Open Source and Open Access – Opportunities for Convergence

While these two movements and methodologies are clearly distinct, there are several commonalities between their underlying philosophies, as well as great opportunities for each to benefit the growth of the other. Both encourage unrestricted access and dissemination to the results of member creations, while offering community members the opportunity, through licensing, to retain rights such as attribution, or restricting commercial applications of the work. Additionally, the internet is a natural place of convergence for these movements – it is how both communities tend to disseminate the results of their efforts and connect with other community members. More interestingly, several open source software projects have developed software to support the creation of OA repositories and OA journals, just as several OA journals have appeared that are dedicated to scholarship around open source development.

The following guide therefore offers readers interested in learning more about this convergence an entry point. It includes examples of scholarly articles about both OA and OSS, blog posts and other examples on both from around the internet, OA journals focused on open source, and OSS projects that can help to establish and maintain OA repositories and journals. The list is far from exhaustive; instead, it offers a sampling of resources to encourage readers to look further into the subjects of OA and OSS, and ways in which these exciting movements converge.

**Enjoy!**

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## Articles about both OA and OSS

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Wilinsky, John. "The unacknowledged convergence of open source, open access, and open science." *First Monday* 10 no. 8 (August 2005). Accessed July 27, 2013. <http://firstmonday.org/ojs/index.php/fm/article/view/1265/1185#w4>

This article points to the shared values among several different open movements – namely, open source, open access, and open science – and by emphasizing their shared values and goals, seeks to highlight ways in which each movement can, and should, support the other. Wilinsky draws on previous research to shore up his highlighting of shared principles, and borrows language from each movement to draw parallels, noting for example that the “research article is part of a larger, very complex code on which other researchers build, debug, and extend, always with the intent of turning it back to the research community.” He concludes by drawing a parallel to the environmental movement, which he sees as previously being fragmented by a focus on individual, local issues, until they realized “the common cause among all of their different efforts,” and by making a call for increased convergence, particularly from universities.

Corrado, Edward M. "The Importance of Open Access, Open Source, and Open Standards for Libraries." *Issues in Science and Technology Librarianship* (Spring 2005). Accessed July 27, 2013. <http://www.istl.org/05-spring/article2.html>

This article is primarily an introduction to the concepts of open source, open access, and open standards, with an emphasis on how librarians can take advantage of, and support, these movements. It does include a brief section on putting the three together, noting for example that “open standards and open source can help preserve long-term access to open access and other types of electronic journals.” For those looking to introduce these concepts to management in their institutions, this could be a good place to start.

Unsworth, John M. "Open Access, Open Archives And Open Source in Higher Education." National Scholarly Communications Forum: "Open Access, Open Archives And Open Source In Higher Education: The Changing Nature Of Scholarly Communication." State Library Of New South Wales, Sydney, Australia, September 27, 2005. Accessed July 27, 2013. <http://people.lis.illinois.edu/~unsworth/nscf.htm>

This article gives a good overview of the rise of information technology and its relation to both open source and open access, as well as early attempts to bring the two movements together, such as MIT’s OpenCourseWare, which ran into the challenge of creating an “open-source university” model when most textbooks and articles used by its professors are still drawn from commercial publishers, and could therefore not be made available with the course materials. On this Unsworth muses, “open courseware linked to open archives would be a powerful combination indeed.” He discusses several other early projects, and talks about the (then current) emergence of efforts such as DSpace, FEDORA, and the Open Archives Initiative, among others. At a time when the Open Access movement was just beginning to permeate the public conscience, Unsworth notes:

University-press publishers have a golden opportunity here to distinguish themselves from commercial publishers and join with libraries and scholars to create a new model of scholarly communication based on unbundling, interoperability, and non-exclusivity--principles inherent in open-source software development, but applicable in other domains as well. These principles are compatible with commercial activity, as the success of Linux demonstrates: they are hostile only to monopolistic practices.

Murray, Sally, Stephen Choi, John Hoey, Claire Kendall, James Maskalyk, and Anita Palepu. "Open science, open access and open source software at *Open Medicine*." *Open Medicine* 2 no. 1 (2008). Accessed July 27, 2013. <http://www.openmedicine.ca/article/view/205/104>

*Open Medicine* is a peer-reviewed, independent, open-access journal, and in this editorial by members of the journal's editorial team, they discuss the importance of open access and open science, while describing their own experience in establishing the journal and making it available using the Open Journal System, an open-source project developed by the Public Knowledge Project.

Morin, A., J. Urban, P. D. Adams, I. Foster, A. Sali, D. Baker, and P. Sliz. "Shining Light into Black Boxes." *Science* 336 no. 6078 (April 2012): 159-160. DOI: 10.1126/science.1218263

This article focuses on a strange disparity in academic science. While much of the field has moved to open access publishing, and open data sets, the data itself often depends on scientist created computer programs – and the scientists are displaying a disturbing reluctance to release the source code. The authors, pointing to examples such as the "canceled clinical drug trials at Duke University involved unreleased and unreproducible code," argue that the release of source code related to scientific research is critical for the integrity of the results; they further point out that a number of open source licenses exist that allow for open code distribution "while also assuring the attribution and citations customary in scientific research." While the article does not focus explicitly on OA, it takes the assumption of OA as its starting point for the current scientific community and extends this logic further, to open source software. Ironically, however, the article, published in *Science*, is behind a paywall.

Hunter, Ben. "Moving Open Access to Open Source: Transitioning an Open-Access Journal into the Open Journal Systems Journal Management System." *Technical Services Quarterly* 28 no. 1 (2010): 31-40. DOI: 10.1080/07317131.2010.500972

This article provides a case study from the University of Idaho, publishers of the *Electronic Green Journal*, and their experience moving the peer-reviewed journal on environmental issues into the Open Journal Systems open source journal management software. It describes the process of migration, customization, and staff re-training, highlighting successes and offering suggestions for avoiding some of the setbacks the team encountered. It also discusses the cost challenges associated with maintaining an open-access journal, and how using open source software can help to offset some of these costs.

Krishnamurthy, M. "Open access, open source and digital libraries: A current trend in university libraries around the world." *Program: electronic library and information systems* 42 no. 1 (2008): 48-55. DOI: 10.1108/00330330810851582

This article gives an overview of both the OA and OSS movements, highlighting key definitions and historical developments, with a particular focus on their relevance to the library community. Krishnamurthy, who has written a good deal on OSS for libraries, then proceeds to outline several open source "digital library software" solutions, including DSpace, E-Prints, and Greenstone, all of which can be implemented to support the dissemination and maintenance of OA materials. More of an entry point for neophytes looking to understand the relationship between OA and OSS, it nevertheless offers some practical avenues for using one to support the other.

Todd, Matthew H. "Open access and open source in chemistry." *Chemistry Central Journal* 1:3 (2007). DOI: 10.1186/1752-153X-1-3 Accessed July 27, 2013. <http://journal.chemistrycentral.com/content/1/1/3>

This article seeks to highlight the differences as well as similarities between open access and open source, while relating the strengths of each movement and their potential application back to scientific research, particularly in chemistry. The open source discussed here is primarily what Todd calls "open source research" – that is, data sets, research tools, and software that "may be modified by the relevant community and those modifications may be recontributed to the larger whole." Interestingly, he points to existing informal academic communities, who freely exchange experiment sets, data, and notes on public forums, where other users frequently offer improvements, error correction and the like, as a form of open source collaboration. Throughout, Todd compiles an impressive list of open and collaborative tools available to the chemist community, which may not all fit within narrow definitions of OSS or OA, nevertheless embrace the philosophy of open exchange, modification, and collaboration. Finally, he discusses his experience with starting "an open source collaborative group in biomedical research call the Synaptic Leap," whose aim is to "coordinate wide-ranging research projects in chemistry, biology and informatics," and is already showing great promise. Todds expansion and comingling of the definitions of OSS and OA to a broader sense of academic collaboration is interesting, and points to some exciting initiatives in the field.

## About open access on open source based blogs, etc.

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Rutter, Michael Patrick and James Sellman. "Uncovering open access." Open Source.com, November 9, 2010. Accessed July 27, 2013. <http://opensource.com/education/10/10/uncovering-open-access>

This article is primarily focused on open access, but as one released on a website dedicated to news about open source development, it naturally makes links where it can. It offers readers a compelling and well-written summary of the rise of the OA movement and its need, opening with an anecdote about the "lost" research of biologist Gregor Mendel, which, when finally rediscovered, paved the way for the development of modern genetics. The article's meat is loosely structured around the story of Stuart Schieber's efforts to introduce an Open Access policy at Harvard University, branching out to explore the publishing industry, copyright issues, and the rise of open repositories. A great introduction to OA, with quotes from many of its leading figures, such as Peter Suber, appearing throughout.

Wagner, Vivian. "Open Source Science: A Revolution From Within." *LinuxInsider*, November 20, 2009. Accessed August 4, 2013. <http://www.linuxinsider.com/story/68701.html>

This article aims to introduce to a broader readership the concept of Open Source Science – which, in a nutshell, is scientific study that makes a commitment to OA for not only its results, but its datasets and methods, and whenever possible, the software used to generate and maintain these results as well. As Wagner notes, "Just as open source software allows programmers to access the code in order to create new and improved versions of software, open source science gives the scientific community open and easy access to fundamental experiments, methods and data in order to facilitate more research. The goal, ultimately, is better science." The article uses PLOS One, (the Public Library of Science's central OA portal, which itself is run using the open source Ambra journal publishing platform) as one of many examples it offers throughout the article of Open Source Science at work, and offers a basic overview of salient issues such as intellectual property, Open Access, Creative Commons, and open source philosophy.

McGrath, James F. "Open Access, Open Source, and Open Ended Textbooks." *Exploring Our Matrix* blog on Patheos, July 29, 2010. Accessed July 27, 2013. <http://www.patheos.com/blogs/exploringourmatrix/2010/07/open-access-open-source-and-open-ended-textbooks.html>

This article is really just a stub, but it introduces the possibility that open source, when combined with open access content, can lead to the development of customizable textbooks of mixed media. "An open source textbook could be customized by those using it, just like open source software. This involves the creator(s) being willing to loosen their proprietary hold on what their original creation may evolve into." It's interesting that this is hosted on a faith-based website (and features a stock photo of Moses holding up two computer tablets, sheesh), and it misses opportunities to explore the challenges and complexities that could arise – for example, the copyright challenges to making mixed-media, customizable textbooks – but it's also an interesting initial thought on the power and freedom that could arise when content is open access and platforms are open source.

Brumfield, Ben W. "Open Source vs. Open Access." *Collaborative Manuscript Tradition* blog, Saturday May 2, 2009. Accessed July 27, 2013. <http://manuscripttranscription.blogspot.ca/2009/05/open-source-vs-open-access.html>

This brief post explores the author's thoughts about licensing, and releasing open source software, while having a vested interest in seeing it used to support open access. Brumfield is one of the creators behind the open source project, FromThePage, designed to supply users with a platform for collaboratively creating scanned historical document transcripts through a wiki-like platform. In 2009, as the software was ready to be released, Brumfield was considering the licensing options behind open source software. Brumfield notes: "none of the existing Free or Open Source licenses allow me to require that FromThePage be used in conformance with Open Access. Obviously, that's because adding such a restriction -- requiring users of FromThePage not to charge for people reading the documents hosted on or produced through the software -- violates the basic principles of Free Software and Open Source. So where do I find such a license?" The post's comments section includes some interesting proposals, as well as discussion as to whether a true open source advocate *should* attempt to restrict user freedom by determining what kind of content the software is used for.

## OA Journals about Open Source

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### Open Source Science Journal

<http://www.opensourcejournal.ro/>

An open access journal that describes itself as containing "original results obtained by researchers and practitioners in the open source field. Each issue is oriented to an open source theme." Originally published four times a year, the Journal may no longer be active (its "Current Issue" listed is from 2011), but the archives of the Journal remain available. The website is hideous, but the user can view all issues chronologically, or browse all articles organized thematically by topic or focus. The journal does not specify whether it qualifies to be considered truly peer reviewed, but it has both an editorial team and a scientific team, and "Quality evaluation and paper acceptance is done according to known standards."

## International Free and Open Source Software Law Review

<http://www.ifossilr.org/ifossilr/index>

The awkwardly abbreviated IFOSS L. Rev. “is a collaborative legal publication aiming to increase knowledge and understanding among lawyers about Free and Open Source Software issues. Topics covered include copyright, licence implementation, licence interpretation, software patents, open standards, case law and statutory changes.” A fascinating and important topic, the journal remains active. The website for the journal fittingly appears to be maintained using the Open Journals System, itself an open source platform. Available since 2009, the journal appears biannually. With financial support from the NLNet Foundation and facilitated by Free Software Foundation Europe, the editorial team is “drawn from the membership of the European Legal Network, a non-partisan professional network of Free Software legal experts, and its composition rotates regularly among network members.”

## Journal of Free Software & Free Knowledge

<http://www.icfoss.org/ojs/index.php/foss>

The *Journal of Free Software & Free Knowledge* is an “Open Access Journal on the broad philosophies around the FOSS movement, including aspects of software and other intellectual artifacts, emerging developments in this ecosystem, and interfaces with society.” Published in India by the International Centre for Free and Open Source Software, its website is also maintained using the Open Journal Systems platform. Its current status is unclear, and it too may now be defunct, however – after publishing 2 issues in 2012, the journal has had no further activity. Peer reviewed and intended to appear biannually, the two issues available are full of interesting articles worth examining.

## First Monday

<http://journals.uic.edu/ojs/index.php/fm/>

*First Monday* is not specifically focused on open source, but the topic reoccurs frequently, as it aligns very well with the journal’s philosophy of openness. Describing itself as “one of the first openly accessible, peer-reviewed journals on the Internet, solely devoted to the Internet,” the journal began its online publications in 1996, and is a strong advocate for both OA and OSS through the kinds of articles it publishes. The website is maintained using the OJS platform, with a substantive archives of engaging materials. Published monthly, it has become one of the most respected OA journals focused on information technology and online culture.

## Technology Innovation Management Review

<http://timreview.ca/>

The *TIM Review*, formally known as the *Open Source Business Resource*, has broadened its focus somewhat since its name change in 2007; while no longer solely focused on OSS, the journal nevertheless continues to publish a high level of articles related to free and open source innovation, and maintains a thematic section on its journal home page called “Open Source Business”. Published monthly out of Carleton University (Ottawa), the peer-reviewed journal contains a wealth of resources on OSS worth investigating. The journal website might be using OJS - it is difficult to tell, because unlike many others, they have put a lot of work into customizing the interface, which offers a clean and easy to navigate user experience.

## OA Articles about OSS

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There is an abundance of articles about open source published in OA Journals – what follows is merely a brief selection, where I have tried \*not\* to select from those found in journals specifically focused on Open Source (listed above); equally, this selection provides articles that may be of interest to information professionals, educators, and developers in support of open movements.

Raza, Arif, and Luiz Fernando Capretz. "Contributors' Preference in Open Source Software Usability: An Empirical Study." *International Journal of Software Engineering & Applications* 11 no. 2 (April 2010): 45-64. DOI: 10.5121/ijsea.2010.1204. Accessed July 28, 2013. <http://www.airccse.org/journal/ijsea/papers/0410ijsea4.pdf>

This article provides an interesting and well-researched examination of the challenges to usability encountered in many OSS projects, along with suggestions resulting from the research findings for how such projects can increase non-technical user engagement and software use through a broadened focus on usability. Survey data from 78 contributors to 22 different OSS projects is collected and analyzed, with the survey resulting from an extensive literature review, leads the authors to conclude that considerations such as documentation, user feedback, design techniques, and usability assessments are all important factors in increasing the overall usability of a project, while considerations of usability at an architectural level are not as important – especially given that non-technical users want something that “just works” and do not need to understand the underlying architecture.

Almeida, Fernando, José Oliveira, and José Cruz. Open Standards and Open Source: Enabling Interoperability." *International Journal of Software Engineering & Applications* 2 no. 1 (January 2011): 1-11. DOI: 10.5121/ijsea.2011.2101. Accessed July 28, 2013. <http://airccse.org/journal/ijsea/papers/0111ijsea01.pdf>

More of a position paper, concept introduction, and case study than a research paper, this article focuses on the importance of Open Standards for interoperability, and argues that open source software that embraces and enables open standards is the best way to achieve true interoperability. Open standards are defined, their main characteristics outlined, and the advantages of employing them are discussed in reference to a broad range of literature review sources. Open source is similarly defined and explored, and the connection between the two concepts is established while their distinctions are also clarified. A brief section focuses specifically on “Open Standards in the European Context,” with a discussion of directives and guidelines such as the European Interoperability Framework (EIF). A good introduction to both topics and how each can support the aims of the other.

Wilson, Michael L., and Vakhtang Tchantchaleishvili. "The Importance of Free and Open Source Software and Open Standards in Modern Scientific Publishing." *Publications* 1, no. 2 (2013): 49-55. DOI: 10.3390/publications1020049. Accessed July 28, 2013. <http://www.mdpi.com/2304-6775/1/2/49>

While the scientific community has been one of the first to embrace OA, both the data collection and analysis methods as well as the publication procedures for many OA science journals, still rely on proprietary programs and formats: “The most commonly used formats by journals in the peer-review, editorial and publication processes are DOC/DOCX for written text and XLS/XLSX for graphs and tables. PPT/PPTX files are sometimes requested for graphs or embedded images. These formats have a number of issues associated with them which ultimately make science less open, less transparent and the

scientific authorship process less accessible.” Unlike the article above by Raza and Capretz, the authors here also make the important point that storing scientific data in proprietary formats constitutes a major risk to its long-term preservation and accessibility. They go on to outline the definition and features of an open format and open standards, before providing a breakdown of several open source alternatives, in the hopes of encouraging academic publishing and the scientific research community to embrace these more sustainable alternatives as the de facto standard.

Emanuel, Andi Wahyu Rahardjo, Retantyo Wardoyo, Jazi Eko Istiyanto, and Khabib Mustofa. “Success Rules of OSS Projects using Datamining 3-Itemset Association Rule.” *International Journal of Computer Science Issues* 7 no. 6 (November 2010): 71-80. Accessed July 28, 2013. <http://www.ijcsi.org/papers/7-6-71-80.pdf>

Using a highly technical approach, these researchers manage to examine over 130,000 OSS projects hosted on SourceForge and by developing a framework by which to quantify the project’s success, manage to derive their results into 9 “success rules” for open source projects using SourceForge (or by extension, any similar open code repository). The researchers look at 27 different parameters for their analysis (focusing their comparison on 17) to try to determine a pattern among the most successful projects. From this, after presenting the results in a series of technical tables, they present a clear and distilled version of their conclusions in 9 rules, including elements such as “Project should target for common users as audience” (ie not just developers and highly-skilled technical users), “Project should select a single type of license, preferable GPL license” (instead of licensing different libraries and parts under different licenses), and “Project should have Desktop-based User Interface” (instead of making the end user employ command-line tools to operate the software). An engaging read that uses a sophisticated approach to confirm common-sense applications of project management for OSS.

Fleet, Christopher, and Petr Pridal. “Open Source Technologies for Delivering Historical Maps Online – Case Studies at the National Library of Scotland.” *Liber Quarterly* 22 no. 3 (2012). Accessed July 28, 2013. <http://liber.library.uu.nl/index.php/lq/article/view/URN%3ANBN%3ANL%3AUI%3A10-1-113942/8565>

Fleet and Pridal offer a candid case study of their institutions move away from proprietary GIS software, their investigation of available OSS alternatives, and an account of the NLS’s development of its own open source solution. They are frank about challenges encountered, noting that in many institutional environments, “there is a need to use both open-source and proprietary software, and different balances and combinations of them both often work well.” They provide a useful list of references to both related academic articles, and websites and projects referred to in the article, which includes beautiful color images of the solutions they have developed.

Yunker, Jonathan, and Tim Ribaric. “Beyond Open Source Software: Solving Common Library Problems Using the Open Source Hardware Arduino Platform.” *Partnership* 8 no. 1 (2013). Accessed July 28, 2013. <https://journal.lib.uoguelph.ca/index.php/perj/article/view/2497/2873>

The authors, working out of the James A. Gibson Library at Brock University, outline their experience using open hardware and software to develop a “production portable barcode-scanning utility for in-house use statistics collection as well as a prototype for a service desk statistics tabulation program’s hardware interface.” They discuss the concept of open hardware by describing the backstory of Arduino, a “a low-cost, easy-to-use, single-board microcontroller” that is relatively easy for users of all skill levels to get started using, as well as exploring why anyone might want to apply such a technology to the library environment. They proceed outline the development of the “Barcodinator” from initial request to development and implementation, despite being at best “hobbyist-level” developers with limited time to deliver production-ready proof of concept. They also outline the Tabulatron, another Arduino device developed to record patron interactions. The article is non-technical, relatable, and highly readable, and comes with a resource list at its end; the authors are frank about the challenges encountered, and their enthusiasm about their successes is evident and endearing.

Khan, Nadim Akhtar. "Open Source Tools for Varied Professions." *Trends in Information Management* 7 no. 2 (2011): 104-115. Accessed July 28, 2013 <http://ojs.uok.edu.in/ojs/index.php/crd/article/view/15>

Khan's article serves as an introduction to twelve different OSS projects and tools for business management and healthcare. Feeling that these two fields have been somewhat slower to broadly embrace open source alternatives, he provides an overview of six existing sophisticated projects for each field. After beginning with a general overview of open source, Khan provides screenshots, functionality summaries, and other personalized notes about each project, along with URLs. The software discussed is not really criticized or evaluated in any systematic way, but the article nevertheless provides a useful overview of open source initiatives that will scale up to the demands of large business, hospitals, and the like.

## OS Software for creating OA Journals

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### Open Journal Systems

<http://pkp.sfu.ca/?q=ojs>

Developed by the Public Knowledge Project (itself a collaboration between SFU, UBC, and several other universities), OJS is a journal management and publishing platform that "assists with every stage of the refereed publishing process, from submissions through to online publication and indexing. Through its management systems, its finely grained indexing of research, and the context it provides for research, OJS seeks to improve both the scholarly and public quality of refereed research." Designed primarily for use on a UNIX-based platform using a LAMP architecture, the current 2.4.2 release became available on March 4<sup>th</sup>, 2013. The documentation has fallen a bit behind the current releases, but remains relevant, and is extensive and well-organized. While primarily used for OA Journal management, the site administrators acknowledge (and encourage) that application "is also used, on occasion, for reports, monographs, learning management systems, graduate and undergraduate student journals, and a variety of other experiments and innovations in online publishing and knowledge sharing."

### Ambra

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

Ambra, formerly known as TOPAZ, is an "innovative Open Source platform for publishing Open Access research articles," currently under active development led by the Public Library of Science. Built in Java for a Unix-based hosts using a MySQL database, Ambra version 2.7.2 has just been released on July 23, 2013. The Release Notes page shows steady progress since 0.6 Beta was first made available to the public in April 2007, with most updated releases arriving within a few months – the 1.0 version of the software was officially released on June 2, 2010, and the project has continued to forge ahead steadily since then. With a wide and ever-growing array of features and steady support from the PLOS community, Ambra is a promising open-source solution for OA journal management. The application comes with a basic set of features designed for easy integration into PLOS; however, clear instructions are provided for those interested in downloading and setting up a more "generic" version of the application for their own use. No demo site is available, but the site points to PLOS One (<http://www.plosone.org/>) as an example of Ambra in action – and the results are convincing, as the site is clean, responsive, easy to navigate, and feature-rich.

## EPrints

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

Currently in version 3.3, EPrints was developed by the University of Southampton in 2000 to allow the creation of web-based repositories. The software is “is often used as an open archive for research papers, and the default configuration reflects this, but it is also used for other things such as images, research data, audio archives - anything that can be stored digitally. They have an online sandbox available for testing the application’s functionality (<http://demoprints3.eprints.org/>), and the software will run on all 3 major platforms (Linux/Unix, Mac OSX, Windows). The project is still under active development, and the most recent stable version (3.3.12) was released on July 24, 2013. EPrints also maintains a page dedicated to Open Access, including an introduction to the concept and a list of key resources. EPrints also offers additional services such as hosting, custom development, configuration and theming, and training. The documentation is at times incomplete and/or confusing to navigate, but the project has wide support and implementation overall.

## ePublishing Toolkit

<https://dev.livingreviews.org/projects/epubtk/wiki>

Developed by the Max Planck Gesellschaft, the ePublishing Toolkit is “software package providing tools to help in publishing scientific content on the web.” Built using Python, the software is divided into a series of interacting components, such as the *pubBuilder* component, which allows for functionality to create publications; the *ref/db* component, which manages sophisticated queries to a supporting database; and the *webApp* component, which allows for content to be presented and accessed through the web. Documentation is limited, but the project shows active development on numerous branches, showing promise for the future.

## DPubs

<http://dpubs.org/>

DPubs was originally designed at Cornell University, to be “an open-source software system designed to enable the organization, presentation, and delivery of scholarly journals, monographs, conference proceedings, and other common and evolving means of academic discourse.” The software was designed to be flexible, extensible, and with the ability to integrate with existing repository solutions such as Fedora. Written in Perl and built to work with a MySQL database on the backend, the user interface is accessible via web browser. Unfortunately, the project has been inactive since the 2.3 release in October of 2008, though the source code remains available via SourceForge, [here](#).

## Drupal E-Journal Extension

<https://drupal.org/project/ejournal>

Inspired by the success of the PKP’s Open Journal Systems (described above), the Drupal community has created an extension to its open source content management system specifically to support e-journal management, that “allows you to create and control your own electronic (and possibly printed) journals in Drupal - you can set up as many journals as you want, add authors and editors.” Unfortunately, the extension has not seen active development since 2011 (two release candidates from 2011 are still listed as development releases), so the extension may require work to be compatible with the newest releases of Drupal.

# OS Software for Creating OA Repositories

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## DSpace

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

Developed at MIT, DSPACE has quickly grown to be one of the most popular open source repository solutions. Intended to provide users with a turn-key, “out of the box” solution, DSpace “preserves and enables easy and open access to all types of digital content including text, images, moving images, mpegs and data sets.” Claiming to have over 1,000 institutional users and a total of 41 code contributors on its latest release (version 3.2), the project’s GitHub repository shows active development and no signs of slowing down, with draft documentation already in the works for a 4.0 release. Further, the documentation is clean and extensive. The software can be installed on all major platforms. The project is now maintained by DuraSpace.

## Fedora

<http://www.fedora-commons.org/>

Begun in 1997 and first released in 1998 by researchers at Cornell University, Fedora (Flexible Extensible Digital Object Repository Architecture). Employing a set of abstractions to express digital objects, relationships, services, and more, Fedora is “an architecture for storing, managing, and accessing digital content in the form of digital objects.” Originally developed with funding from DARPA and the National Science Foundation, the project is now under the stewardship of DuraSpace. The Fedora Commons Registry lists over 300 institutions currently using the open source software, and the site provides a free sandbox for users to experiment with the application before downloading (<http://testdrive.fedora-commons.org/>). The latest release (3.6.2) became available in November 2012. Built using Java, the application seems best suited for installation on Apache / Unix-based servers, though a variety of SQL databases are supported.

## Islandora

<http://islandora.ca/>

Built on a base of Fedora and Drupal, and using the Solr search index library, Islandora is a recent addition to the open source repository community, that describes itself as “an open-source software framework designed to help institutions and organizations and their audiences collaboratively manage, and discover digital assets using a best-practices framework.” Developed by the University of Prince Edward Island’s Robertson Library, interest in the project has grown quickly, largely thanks to the developers’ active participation in conferences such as the Open Repositories conference, which the University of Prince Edward Island help to host this year. With a quicker release cycle, the software is preparing for the release of version 7.x-1.2, with a sandbox for users to test out the software available as well (<http://sandbox.islandora.ca/drupal7/>).

## Archimède

<http://www.bibl.ulaval.ca/archimede/index.en.html>

When the Laval University Library was looking for an institutional repository solution, it evaluated existing open source options available at the time (such as EPrints and DSpace) and felt like these did not quite meet its needs. Consequently,

Laval University Library staff decided to develop their own open source solution. Currently preparing for their 2.0 release, the Archimède project is designed primarily for “e-prints, pre-prints, post-prints and other research publications from faculty members and research communities,” but its architecture is flexible enough to be readily adaptable, and it installs on all major platforms. Unfortunately, the majority of the documentation is currently only available in French – though the team is clearly working to change this and encourage adoption and development.

### Invenio

<http://invenio-software.org/>

Invenio is “a free software suite enabling you to run your own digital library or document repository on the web. The technology offered by the software covers all aspects of digital library management from document ingestion through classification, indexing, and curation to dissemination.” Released under an AGPL-3 license, the current 1.1 version of the software was released in December 2012, and two two different branches (a 1.2 release and a 2.0 release) are currently under development. First developed as the CERN Integrated Digital Library System, it is used currently as the CERN document server, managing over 800,000 bibliographic records and 350,000 fulltext documents, organized in more than 500 collections. Despite its relatively poor end-user documentation at the moment, it has widespread use, mostly (but not exclusively) in the scientific community. The 2.0 release, viewable in one of its two demo sites, is clearly a huge leap forward in usability for the project, and looks promising (<http://invenio-demo-next.cern.ch/>), while both this and its 1.1 demo site (<http://invenio-demo.cern.ch/>) are wittily set up as the “Atlantis Institute of Fictive Science.”

## Other OSS Projects that can support OA Journals and Repositories

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### Omeka

<http://omeka.org/>

Omeka is one of the most polished projects on this list, though it is not exclusively a repository or journal application – rather, the project describes itself as “a free, flexible, and open source web-publishing platform for the display of library, museum, archives, and scholarly collections and exhibitions.” Its clean interface and the robust collection of plugins, themes, and extensions make it perfectly adaptable for use as an OA journal management system, however, or even as the access front-end to an OA Repository. Developed at the Roy Rosenzweig Center for History and New Media at George Mason University in 2007, its first release was made available in 2009, and its current version (2.0.4) was released on June 27, 2013; with the 2.0.3 release having become available in April 2013, the project shows consistent growth and active development. The website is well-designed and easy to navigate, and the documentation is robust. Intended for use with a LAMP architecture (Linux Apache, MySQL, PHP).

### Greenstone

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

Like Omeka, Greenstone has not been created with repository creation or journal management in mind, though it could easily be adapted to serve such a purpose. Created by the New Zealand Digital Library Project at the University of Waikato, Greenstone is “a suite of software for building and distributing digital library collections,” released under a GNU General

Public license. First established in 2000 with support from UNESCO, the current (2.8.5) version is available for all major platforms – additionally, a Greenstone3 release, which is “a complete redesign and reimplementation of the original Greenstone digital library software (Greenstone2)” intended to increase the software’s flexibility and extensibility, is available in version 3.05. The list of global implementations on its example page is impressive despite the software’s dated look – a situation vastly improved in the 3.x iteration currently available. Its blog has not been updated since 2012, though, and the issue tracker shows no activity since early 2013, so its current development activity is uncertain – although there remains a broad global user community.

## MOAI

<http://moai.infrae.com/>

MOAI is a “platform for aggregating content from different sources, and publishing it through the Open Archive Initiatives protocol for metadata harvesting” that has been built “for academic institutional repositories dealing with relational metadata and asset files.” Designed for implementation either with an existing repository solution (such as DSpace, Fedora, etc.) or as a simple stand-alone system linked to a SQL database. Developed by Erasmus University in 2003 for implementation with the [RePub](#) OA publication site from Erasmus, it was then extended to be able to act as a standalone system, and then further abstracted to be able to integrate with existing repositories. It is difficult to determine, via the documentation, if much development has taken place since 2008, but the Subversion code repository remains accessible for download.

## OpenACS

<http://openacs.org/>

Open Architecture Community System, or OpenACS, is intended as a backbone platform for establishing interactive, community-based websites, which “provides functionality for discussions, content management, personalization and other mechanisms for users to communicate.” The project, first launched in 1998, has not been actively developed since 2011 when it released version 5.7.0, but it continues to be maintained, forked, and used as the basis of many other projects. One of the most significant of these is .LRN, described below. Useful for creating a forum for sharing OA content, and discussing it.

## .LRN

<http://www.dotlrn.org>

.LRN (pronounced “Dot Learn”) describes itself as “a full-featured application for rapidly developing web-based learning communities,” delivering online learning environments including posting curricula and syllabi, sharing reading lists, course or community user forums, submitting learning assignments, grading, expense tracking, administering surveys, and much more. Developed by MIT, .LRN was built by branching OpenACS (Open Architecture Community System). It could be used to build courses, community learning and discussion groups, and other educational initiatives around OA materials.

# OSS for Digital Preservation

For an OA journal or a repository to be forward-thinking and sustainable, it is imperative that administrators consider what long-term digital preservation measures they will take to support continued access over time. Given the rapid pace of technological change, the realities of bit rot and other challenges to the long-term stability of digital objects, and the best practices and standards emerging from leaders in the digital curation field, the establishment of an OA repository or journal cannot be considered complete without planning for preservation as well. Below are a few open source tools that are emerging to support this important task.

## Archivematica

[https://www.archivematica.org/wiki/Main\\_Page](https://www.archivematica.org/wiki/Main_Page)

Archivematica, developed by the New Westminster-based Artefactual Systems, is “a free and open-source digital preservation system that is designed to maintain standards-based, long-term access to collections of digital objects.” Modeled on an implementation of the OAIS Reference Model, and following digital preservation best practices, it offers users a web-based dashboard for managing a series of micro-services to ingest, normalize, checksum, and store digital objects and related metadata as an Archival Information Package. Currently still in 0.10 beta release, the 1.0 release, scheduled for September 2013, will include integration with DSpace, CONTENTdm, and a number of other archival description application, while the 1.1 release will include integration with Islandora, LOCKSS, Fedora, and Hydra, and the ability to push OAI updates to AIPs back to applications such as DSpace, CONTENTdm, and AtoM. Used as a backbone for preservation before moving objects into a repository, it is one of the most robust digital preservation solutions available, open source or otherwise, and is under active development.

## Roda

<http://roda-community.org/>

RODA, or the *Repository of Authentic Digital Objects*, is another standards-based implementation of digital preservation best-practices, through a web-based user interface. Maintained by the Portugal-based KEEP Solutions and written primarily in Java, RODA describes itself as “a complete digital repository that delivers functionality for all the main units of the OAIS reference model,” and it implements recognized preservation standards such as PREMIS, METS, and EAD. The project is relatively new but has clearly developed with sophistication, and includes a robust reporting and visualization model.

## Curator's Workbench

<https://github.com/UNC-Libraries/Curators-Workbench>

Curator's Workbench is an “extensible digital collection and appraisal tool for the desktop. It is designed to acquire and process batch data efficiently while giving the user control over work flow.” Developed at the University of North Carolina at Chapel Hill, it is intended to support preservation activities such as packaging and description prior to ingest in a digital repository, and offers tools to support staging, checksumming, metadata conversion and extraction, visual crosswalking between captured metadata and data dictionaries, and the like. Built in Java, the project is now in version 4.1.4. It does not seem to have its own dedicated website with more information, but the gitHub page has some information, and it provides a link to the original 2010 [release announcement](#); additionally, a research poster about Curator's Workbench is available here ([PDF](#)).