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This month I'm pleased to introduce our first guest editor, Kevin Goheen. The strength of Kevin's network of contacts from academia, research, and industry is evident in the quality of the submissions he invited for this issue. You'll find plenty of thought provoking content around the editorial theme of education. These include the vertical markets of high performance computing and integrated library systems to the broad topics of open educational resources and predictive management theory.

This issue also marks a milestone for the OSBR as we enter our second year of publication. When we launched OSBR.ca we knew that there was a need for it. What pleasantly surprised us in our first year of operations was the large number of high quality contributions received, the diversity of experienced authors, and OSBR.ca's extensive adoption worldwide.

Thanks to the grant from the Ontario Research Commercialization Program of the Ministry of Research and Innovation, Ontario has become a significant contributor to the pool of knowledge on open source that is relevant to technology companies, educational institutions, and open source foundations and projects worldwide.

We thank our readers, authors and sponsors for their support. Happy first birthday OSBR.ca!

Dru Lavigne

Editor-in-Chief

Dru Lavigne is a technical writer and IT consultant who has been active with open source communities since the mid-1990s. She writes regularly for O'Reilly and DNSStuff.com and is author of the books BSD Hacks and The Best of FreeBSD Basics.

The August issue of the OSBR is focused on "education." The relationship between open source software (OSS) and education is extremely broad and also very important. One could argue that OSS creation and adoption has been driven by faculty and research leaders, with eventual buy-in from the commercial sphere. This should not be a surprise; university research labs are populated with individuals possessing an abundance of creativity, a need to work with platforms for innovation, and a shortage of funding. My own lab's experience with clever graduate students and finite funding sources forced us to collaborate with the National Research Council of Canada on open source helicopters.

Another driver of the OSS education market is philosophical. This issue's first author, Justin Davidson of Datamonitor, pointed in another forum to dissatisfaction expressed by some schools with Blackboard, a major provider of enterprise educational software and services. In 2005, Blackboard bought WebCT, another educational software company. Blackboard's share of the market has grown to approximately 75% and concerns remain within schools over the dominance of one company in the market. Blackboard's subsequent patent dispute with the small Canadian firm Desire2Learn has galvanized the educational technology community and has arguably driven market acceptance of the major open source alternatives in the Course Management System (CMS) space, Moodle (<http://moodle.org/>) and Sakai (<http://sakaiproject.org/>).

Despite the mistrust of commercial software companies potentially driving OSS adoption, one survey (<http://www.ahec.org/media/files/A-HEC%20open%20source%20hed%20030106.pdf>) found that larger institutions adopt OSS infrastructure and applications at a much higher rate than smaller institutions because of the lack of support. The smaller schools expressed a great interest in commercial support of OSS. In addition, Data-monitor predicts a compound annual growth rate of 14% until 2012 on OSS, based on their survey in 14 countries of primary, secondary and tertiary educational institutes. They also predict only 3-6% of information technology spending by those institutes, so education will represent a great market for commercial entities. In this issue, Justin writes about spending trends in the educational OSS market and why only some institutions should adopt OSS.

Open educational resources (OER) promise to lower the costs for students in the developed world (http://www.springwise.com/education/open_source_approach_to_textbo/). Muegge, et al of Carleton University and Jan Hylén of OECD both argue that the implications are far broader. The first article focuses on the democratization of education in developing countries while the OECD paper describes quality control and sustainability of the OER movement.

We next examine the important tertiary educational application of High Performance (Scientific) Computing (HPC). David Rich of Interactive Supercomputing describes how both open source and commercial components are being combined to provide the optimal scientific computing environment and how OSS is gradually being accepted by commercial users of HPC.

This issue concludes with two articles which describe the use of OSS in libraries. In the early 1990s, I was part of a Task Force on the future of Technologically Mediated Education at Carleton University. As part of our survey, we found that many thought leaders on campuses came from the ranks of the librarians. Carl Grant of CARE Associates provides a checklist for librarians considering OSS Integrated Library Systems (ILSs) and Art Rhyno of the University of Windsor describes Project Conifer, a collaborative effort of three Ontario universities to provide a mission critical OSS ILS.

Space and resource restrictions prevented us from publishing articles on many important OSS education issues, including Moodle and Sakai, the application R, which is quickly becoming the de facto standard in statistics, and the scientific applications SciPy and Octave. We hope to revisit the OSS impact on the education sector in a future issue.

Kevin Goheen

Guest Editor

Kevin Goheen is an Adjunct Professor in the Department of Mechanical and Aerospace Engineering at Carleton University, Ottawa, Canada, teaching in the areas of control and dynamic systems. He also is Director of Scientific Research and Experimental Development Tax Credits with McLarty & Co LLP, a leading accounting firm in Ottawa.

OSS SPENDING TRENDS IN EDUCATION

"Man perfected by society is the best of all animals; he is the most terrible of all when he lives without law, and without justice."

Aristotle

Open source software (OSS) is becoming more prominent within the education market as more educational institutions turn towards open source as a solution that meets their needs. However, open source is not appropriate for all, and institutions should be cautious about implementing OSS. When adopting open source, institutions should ensure it is a strategic decision and not just a philosophical one.

At Datamonitor (<http://www.datamonitor.com>), a provider of online data, analytic and forecasting platforms for key vertical sectors, we believe that the role of OSS will become increasingly important in education. The solutions available are becoming more sophisticated and stable. Currently, 56% of education institutions are using OSS and open source is clearly making headway into the education market. Furthermore, there are a number of varying factors driving institutions towards OSS and not all institutions are implementing OSS for the same reason.

OSS offers an alternative method through which an institution can implement a technological solution, along with its own variety of benefits and pitfalls. However, the increased popularity of OSS will not prevent proprietary software solutions from having an important role to play in education. Instead, OSS and proprietary solutions are going to become even more entwined together and the line between open source and proprietary solutions will blur. **[Editor's note:** A report detailing the forecasted spending on open source initiatives in education is available for purchase from Datamonitor.]

Suitability of OSS

It is easy to get carried away with enthusiasm for OSS and to believe that it is always of benefit. However, not all OSS applications will prove suitable or popular for education. For example, enterprise resource planning (ERP) software has yet to make significant inroads into the open source arena. It is likely to take a number of years before it does, if ever, because of the complexity of ERP applications.

Certain applications used by educational organizations are particularly suited to open source. Specifically, these are learning management systems (LMS) and operating systems. LMS fit well with OSS because these solutions have education at their heart, making it even more important that institutions have key input. From a business perspective, it makes more sense for companies offering services to concentrate on these two areas.

Open source alternatives for operating systems have become accessible and easy to use, with Linux being the most well known. Open source operating systems will prove successful in education because they provide viable, sophisticated alternatives to current proprietary solutions that dominate the market. Furthermore, the cost of Microsoft Windows can prove beyond the means of many institutions, especially in K-12 (kindergarten to grade 12) and emerging markets.

Some institutions believe that they get a higher return on investment (ROI) from OSS. Many institutions understand that OSS is not actually free as there are many other associated costs with implementing OSS. However, they still feel that the value of their investment is not being fully achieved from proprietary software.

OSS SPENDING TRENDS IN EDUCATION

Institutions consider that an undue percentage of the cost for proprietary software licenses is lining shareholder's pockets and funding expensive marketing campaigns. While this may be an incorrect perception, it is helping to drive institutions towards OSS. Institutions feel that nearly all investment that goes into OSS is going into the development of the product. Thus, they achieve a higher ROI and end up with a superior product over which they have some control compared to that which a traditional proprietary vendor could have provided.

Motivations for OSS Adoption

A number of governments have adopted policies that compel education institutions to implement OSS as they believe it will benefit their country over using proprietary solutions. They are also implementing policies that will force institutions to move towards OSS in order to save money. While governments are in a position to save money with OSS when implementing operating systems, the financial savings will prove much harder to achieve with other applications.

Some of the motivation for adopting open source is a matter of exerting independence away from a certain amount of American dominance, coupled with a feeling that OSS will enable the government to achieve more control over the products in their schools. Central to this concept is a desire to exert further independence from Microsoft.

For example, France is showing a propensity towards open source: they moved all of their servers in their local education authorities to Linux at the behest of the Ministry of Education. Such factors are helping to drive the OSS market forward.

In addition, some developing countries are looking towards adopting open source initiatives. For example, the State of Kerala in India is now advocating that all departments, including schools, move to desktop Linux and other OSS. While cost savings may prove a motivating factor, it is moving away from American dominance of the software market that is helping to push them towards OSS. Furthermore, the emerging markets of Brazil, Russia, India and China (BRIC) wish to establish themselves as independent, strong economies. Not having to depend on software is a part of this. While they may use US developed OSS, they have their own input into any solution.

OSS Considerations

Implementing OSS is not an undertaking that any institution should take lightly. Implementing OSS, specifically one that is not an operating system, is unlikely to be more cost effective than a proprietary solution. Furthermore, an institution needs to employ or have access to experienced personnel who are able to implement and maintain OSS. While OSS often has a community that exists to offer support, it is dependent on the good will and time of others and there is no guarantee that any glitch will be solved in a certain amount of time. Many institutions, especially those in K-12 and smaller institutions, do not have this expertise. We believe that these factors will hold back OSS from becoming as widespread as some open source proponents believe. Datamonitor's survey of 150 information technology (IT) decision makers in higher education reveals that the smaller an institution's IT budget, the more hesitant they are about adopting OSS. Smaller institutions do not have deep pockets and may find that implementing OSS costs more than a proprietary solution.

OSS SPENDING TRENDS IN EDUCATION

Institutions should carefully consider the benefits of implementing OSS. Benefits are not universal and OSS is not suitable for all institutions. Benefits can include: i) increased control over the product; ii) better interoperability with other solutions; and iii) reduced cost.

By implementing OSS, institutions are able to increase their control over software. With OSS, end users are free to customize the software to meet their specific needs. A good example is Moodle, an open source LMS (<http://moodle.org/>). Furthermore, as part of this increased control, the risks associated with vendor lock-in are diminished. With proprietary software, an institution will have software upgrades forced upon them. With OSS, institutions are free to develop and upgrade the software when they see fit.

When implementing any solution, institutions must grapple with the challenge of ensuring that it integrates with other software solutions already in place. OSS is often easier to integrate with other solutions as OSS code can be customized to allow disparate systems to interoperate more easily. Interoperability is important because it can bring together both an institution's learning data and CRM application, thus giving an institution real depth and analysis into their students' activities.

In the increasingly competitive environment for students in today's society, institutions need to ensure that they choose the best and most suitable technology solutions for their institution. Institutions should conduct the necessary due diligence to ensure that they are selecting an appropriate solution, be it open source or proprietary. The areas of cost, quality of product, support from software provider, and internal resources to support software should be evaluated.

Conclusion

OSS is not always right for an institution and certain applications and types of institution are more suited to open source than others. While institutions should always carefully evaluate OSS on its merits, there are certain cases when open source is going to prove a viable alternative and certain cases when it would prove a risky endeavour. Operating systems are likely to provide the most value for K-12 institutions, open source LMS fit well with institutions wishing to have increased control, and institutions entering into an ERP open source solution should proceed with caution.

When assisting and advising institutions, vendors should consider OSS on its merits to that institution. In no case should OSS be adopted for any reason other than strategic. In addition, not all applications are suitable for all institutions and vendors should ensure that they only recommend accordingly. Clearly, open source is going to play an increasingly significant role within education, and this will continue to create opportunities for vendors that are able to offer services.

Justin Davidson is an Associate Analyst at Datamonitor. He writes on global issues and looks at how technology companies can make the most of opportunities within the Education Market, while bringing value to their clients. Datamonitor is a premium business information company specializing in industry analysis that helps its clients, 5000 of the world's leading companies, to address complex strategic issues.

*"I have engaged in literary license in titling this book *The World is Flat* to draw attention to this flattening and its quickening pace because I think it is the single most important trend in the world today [but]... there are hundreds of millions of people on this planet who have been left behind."*

Thomas Friedman

[http://en.wikipedia.org/wiki/
The_World_is_Flat](http://en.wikipedia.org/wiki/The_World_is_Flat)

Open educational resources (OER) apply the principles of openness – particularly the freedoms of use, modification and redistribution – to digital materials for teaching, learning, and research. In many regards, OER resemble open source software (OSS), open data, and open access scientific journals. OER can take several different forms, including learning content (such as courses, content modules, and learning objects), tools (for development, distribution, and delivery), and implementation resources (such as communities of practice and open licenses for intellectual property). Some prominent OER initiatives include MIT OpenCourseWare (<http://ocw.mit.edu>), the Carnegie Mellon Open Learning Initiative (<http://www.cmu.edu/oli>), and Rice University Connexions (<http://cnx.org>). As part of its codified knowledge and knowledge transfer initiative, the Talent First Network (<http://www.talentfirstnetwork.org>), publisher of the OSBR, is working to develop and distribute OER about open source technology and competing in open environments.

OER can potentially touch all areas of education - from elementary schools to higher education to professional development all over the world - but we are particularly excited about the potential to expand access to education in developing countries. That is the focus of our research and the topic of this article.

The OSBR has previously covered OER in September 2007 (<http://www.osbr.ca/ojs/index.php/osbr/article/view/380/341>) and November 2007 (<http://www.osbr.ca/ojs/index.php/osbr/article/view/406/367>). Both articles describe many examples of OER and their successful application in various settings. This article is an update and extension of that work.

The World is Flat – or Is It?

In *The World is Flat*, first published in 2005 and currently at Release 3.0, New York Times Foreign Affairs columnist Thomas Friedman argues that a convergence of flattening forces has leveled the competitive playing field. According to Friedman, "Flattening forces are empowering more and more individuals today to reach farther, faster, deeper, and cheaper than ever before, and that is equalizing power – and equalizing opportunity, by giving so many more people the tools and ability to connect, compete, and collaborate." Entrepreneurs, companies, and individual knowledge workers in the urban centres of India and China can compete successfully with their counterparts in North America and Europe.

In a chapter titled "The Unflat World", Friedman admits that his analysis applies to about half the world today, but large parts, particularly Africa, rural India, rural China, and parts of Latin America, remain detached from the level playing field and largely untouched by flattening forces. For developing countries to create the right environment for companies and entrepreneurs to thrive and participate in the level playing field of the flat world, Friedman recommends getting four basic things right: i) infrastructure to connect people; ii) education to enable innovation and collaboration; iii) governance; and iv) preserving the environment. OER directly involves the first two points of infrastructure and education.

What About the Unflat World?

Low-cost computer infrastructure - including laptop computers, mobile phones and handheld devices, open source operating systems and software, and Internet connectivity - are widely available in industrialized countries but remain scarce in much of the developing world. Various philanthropic programs and commercial offerings have recently emerged to address the availability of computers. The rugged XO-1 laptop computer of the One Laptop per Child (OLPC, <http://laptop.org>) association focuses on durability, low power consumption, and network connectivity, with an initial target price of US \$100. Its announcement was soon followed by commercial competition from Intel's Classmate PC (<http://www.classmatepc.com>). Other low-cost computing programs and companies include InkMedia (<http://ink-media.com>), the VIA pc-1 Initiative (<http://via.com.tw/en/initiatives/empowered>), Sinomantic (<http://www.sinomantic.com>) in mainland China, as well as Elonex ONE (<http://elonexone.co.uk>) and the National Laptop Initiative (<http://nli-uk.org>) in the UK.

As C.K. Prahalad explains in *The Fortune at the Bottom of the Pyramid* (http://en.wikipedia.org/wiki/Bottom_of_the_pyramid), addressing emerging markets is good business. For-profit businesses are increasingly looking towards bottom-of-the-pyramid markets in developing countries with enormous upside potential for future consumption of products and services.

Much of Sub-Saharan Africa and other parts of the developing world lack the wireline access networks common in industrialized countries. Satellite access service to remote areas is expensive, so Internet access points are scarce and often shared.

Network connectivity is being addressed, in part, by rapidly expanding deployment of mobile telephony services in countries such as Nigeria. Novel networking technologies, such as mobile ad-hoc networks (MANET) that establish peer-to-peer connections with nearby computers in a mesh network (http://wiki.laptop.org/go/Mesh_Network_Details) can share and expand the reach of scarce Internet access points. Off-line collections such as the eGranary Digital Library (<http://widernet.org/digitallibrary>) can provide local access to a critical subset of Internet resources where Internet access is unreliable or over-subscribed.

OER complement enabling infrastructure technologies to create new opportunities for innovation. The combination of OER and information communication technology (ICT) can potentially provide children everywhere with opportunities for primary learning that approach those of Western nations, and provide adults with knowledge and skills that would otherwise be unavailable. Equally important, OER open up a previously closed commercial value chain system in ways that empower learners and teachers. The bottlenecks and cost structure of conventional publishing and distribution channels are removed, and previously passive consumers become authors, active collaborators, and content creators. This convergence of technology enables what Clay Shirky (<http://shirky.com>) calls mass amateurization, where capabilities once exclusive to professionals become widely available to many.

Peering Through the Lens of Management Theory

Theories of management, strategy, and technological innovation can help us understand and make sense of the challenges and opportunities surrounding OER in developing countries.

OER IN DEVELOPING COUNTRIES

Education serves many different social functions, but it is also a business, and it is useful to analyze it as a commercial system.

In the 1980s, Michael Porter of the Harvard Business School defined a value chain as a sequence of activities through which a product passes in order to create value and competitive advantage. Goods and services in a value chain flow from left to right, starting from raw materials, passing through value-adding intermediaries, and ending at end-customer consumers. The figure below provides one possible way to depict the established value chain of formal education in developing countries. Naturally, there will be important differences between different countries and regions of the world, but this provides a useful starting framework.

In the traditional value chain prior to the availability of OER and its enabling technologies, educational materials were typically textbooks and other professionally published resources. Knowledge creation for these materials is a professional activity restricted to select authors with access to scarce resources: the capability and contacts to publish a book. Developing countries often adapt books developed elsewhere, many of which are written in English, to local language and culture.

This localization step is expensive but also important. Research shows that the learning effectiveness of localized material is much higher than that of unlocalized material.

Publishing books is traditionally a high cost-structure business protected by high barriers to entry and limited by economic forces to a small number of large companies. In some areas, non-governmental organizations (NGOs) such as World Vision (<http://worldvision.org>), Save the Children (<http://www.savethechildren.org/>), Oxfam (<http://oxfam.org>), Book Aid International (<http://bookaid.org>), and the African Book Collective program (<http://africanbookcollective.com>) play important roles in local distribution. However, high costs built into the first three stages on the value chain - knowledge creation, publishing, and local distribution - limit the selection, number of books distributed, and the timeliness of updates.

Schools, in various forms, and teachers disseminate knowledge locally. All too often, government funding for schools and community centres does not cover all costs. NGOs can help this situation by providing funds, importing education resources, and employing foreign teachers. Teachers Without Borders (<http://teachwithoutborders.org>) is an example of an NGO which places teacher leaders from different cultures within specific countries. However, without the necessary learning resources, these efforts cannot reach their full potential.

Technological innovations and social change are reshaping this value chain to the benefit of students and teachers in the developing world.

Figure 1: Value Chain in Developing Countries



We first consider how the combination of OER and ICT can impact each stage of the traditional value chain, and then examine the impact on the relationships between stages and the reshaping of the overall structure of the value chain system.

What Lies Ahead?

The global digital divide refers to the gap between those with access to technology (hardware, software, and connectivity) and the abilities to use them, and those without (http://en.wikipedia.org/wiki/Digital_divide). It is the antithesis of Friedman's flat world. OER are inherently digital materials, thus an ICT infrastructure of networked computing devices and software is a prerequisite to adoption. Some of the recent efforts to bridge the global digital divide with low-cost computing infrastructure were described in the previous sections.

The increasing availability, accessibility, and capability of software tools to create, manage and distribute OER enables new opportunities for knowledge creation. Some tools for OER creation and editing are co-opted from other tasks, such as document creation, photograph and image editing, video and audio editing, web development, and other forms of creative expression. Other tools are unique to OER. For example, the eGranary Digital Library (http://widernet.org/digital_library) is an ICT access tool for digital educational resources that garners permissions, copies web sites, and delivers assets to partner institutions in developing countries. Much OER knowledge creation has thus far been at the level of higher education in industrialized countries. For example, the Open University (<http://open.ac.uk>) in the UK offers an open inventory of more than 200 undergraduate courses.

However, the number of initiatives local to developing countries is also growing. The China Open Resources for Education (CORE) consortium (<http://www.core.org.cn>) shares 750 courses by 222 university members. Although most OER available today are in English and based on Western culture, the tools for new OER creation also enable adapting, remixing, and recombining OER to fit local regional conditions, culture, interests, and languages. Localization can happen by individual teachers and learners, or through organized projects such as Youth-Managed Resource Centers (YMRC) in Nepal (<http://ymrc-nepal.org>) and the Vietnam OpenCourseWare project (<http://vocw.vef.gov>).

Internet technologies such as YouTube (<http://youtube.com>), Flickr (<http://flickr.com>), and Blogger (<http://blogger.com>) enable anyone with a computer and an Internet connection to be a publisher of video, photographs, and text. Equivalent user-networks for OER distribution are already emerging, pressuring publishers to find new ways of creating value.

Two examples from the Fourth Annual Open Education Conference (<http://cosl.usu.edu/events/opened2007>) suggest how the publishing business model might evolve to create value that the end-user is willing to pay for on top of free content. The National Repository of Online Courses (NROC, <http://montereyinstitute.org/nroc>) is a financially self-sustaining non-profit organization built around OER with multiple streams of revenue. Within their free online courses, they serve up advertisements from companies interested in targeting their audience of 15-21 year-old students, and they also collect license fees for use of content by commercial vendors and textbook publishers.

Flatworld Knowledge (<http://flatworldknowledge.com>) is a new venture that publishes college textbooks under free and open licenses. Books are available in digital form through a web-based platform in which students and users can read, edit, comment and provide feedback on the content. Content is available for free on-line “as is” or available for purchase in other formats for a fee, and institutional customers pay for customized packages of content that are suited for their specific teaching needs. The full commercial launch is planned for January 2009.

Freed from supply dependence on traditional publishers and empowered by new technical capability, the role of NGOs shifts from passive distribution of books to localization of OER and creation of new learning resources. Today, many established NGOs lack expertise and experience in these areas, but new NGOs have emerged to help other NGOs master this new role. Tactical Technologies Collective (TTC, <http://tacticaltech.org>) is a new NGO building a network for other NGOs to learn about and apply OSS. Aspiration (<http://aspirationtech.org>) rewrites software to better localize educational content created as OER.

Schools and other educational institutions can access knowledge repositories directly at no cost and adapt content to their needs. Perhaps more importantly, new ways of interconnecting people extend the geographical reach of schools outside their physical buildings and enable alternatives to traditional formal academic institutions and classroom teaching. OER can complement other open learning technologies, such as learning management systems for course management and video conferencing services for distance education. Interconnectivity through modular interfaces and open standards creates more value and capability.

Teachers can obtain free and high-quality educational resources and gain the capability to localize and redistribute those resources according to the needs of the communities they attend. They can improve OER based on their own experiences in the classroom and create new OER for previously unaddressed areas. Confident that students have access to educational resources, teachers have greater flexibility to develop challenging assignments and independent projects. Teachers can also become students by accessing self-study OER for professional teacher training. Teacher Education in Sub-Saharan Africa (TESSA, <http://tessaprogramme.org>) is an international consortium that creates open content multimedia resources and course design guidance for teachers and teacher educators.

Ultimately, it is students who are most empowered in the evolved value chain system. No longer limited to the education resources provided by their teachers and institutions, students can utilize ICT to access OER on their own – both to complement formal studies and for independent learning – and also modify and redistribute what they find on-line and create new unique content.

Enabling Entrepreneurship

Muhammad Yunus received the 2006 Nobel Peace Prize (http://nobelprize.org/nobel_prizes/peace/laureates/2006/yunus-lecture-en.html) for "efforts to create economic and social development from below" by providing tiny microcredit loans to aspiring entrepreneurs in Bangladesh who were too poor to qualify for conventional bank loans. Yunus believed that if given the opportunity, poor borrowers would use the money wisely and would repay loans, even without collateral at risk.

Between 1976 and June 2008, the Grameen Bank (<http://grameen-info.org>) that Yunus founded issued US \$7.12B in loans to 7.53 million borrowers, with a loan recovery rate of 98.11 per cent. In his 2008 book, *Creating a World Without Poverty* (<http://www.amazon.com/Creating-World-Without-Poverty-Capitalism/dp/1586484931>), Yunus argues that enabling entrepreneurship – particularly social businesses – provides the poor with the means to raise themselves out of poverty. OER can play at least two roles in Yunus' vision of enabling local entrepreneurship. First, OER can provide learners with knowledge and skills to do things that they could not do before. Second, just as innovative entrepreneurs have discovered novel ways to profit from other open innovations, OER may enable innovative social entrepreneurs to earn a sustainable living in the new and increasingly open education value chain.

From a Chain to a Network

A final insight concerns the evolving structure of the commercial system for education. The traditional value chain for books and printed material was linear with well-defined roles. Particular organizations and individuals typically identified with one stage or with a small number of adjacent stages in the value chain. Thus, the structure of interactions between organizations and individuals was linear and sequential, moving left to right in an orderly progression from production of resources to consumption by students. In the evolved commercial system enabled by ICT and OER, organizations and individuals empowered by technology and mass amateurization can easily and simultaneously occupy many roles. Formerly passive consumers can move up the value chain to actively shape OER at early stages by creating new resources, modifying existing resources, re-mixing resources, and sharing the results with others.

Students can become active learners. Teachers and schools have greater choice and flexibility. Entrepreneurs can unlock tremendous value by creating products and tools for better collaboration and interaction. The structure of interactions between organizations and individuals is no longer a sequential chain, but rather an interactive network. Each user, on approximately equal footing, is only one step removed from the Internet, ICT infrastructure, and OER tools for collaboration at the centre of the hub. In other words, the network is flat.

Conclusions

OER, in combination with enabling infrastructure technologies such as low-cost computing and Internet connectivity, have the potential to reshape the education systems in developing countries. This combination allows development of high quality open content that is localized and compatible with existing infrastructure. It is the end-users – learners and teachers in developing countries – who will directly benefit most from these changes. The systematic application of theories of management, strategy, and technological innovation has been useful for better understanding the impact of these changes.

The old education value chain in developing countries was anchored around textbooks and other published material. It was sequential with clear distinctions between stages. Technological, social, and market forces are now motivating some participants to change their roles, allowing others to shorten distances and bypass barriers, and enabling new participants. Novel business models enabled by OER and ICT provide a sustainable means for local entrepreneurs and foreign social entrepreneurs to affect positive social change.

OER IN DEVELOPING COUNTRIES

New opportunities are available for profit-seeking companies to create and capture value by servicing previously inaccessible markets. The emerging networked system of individuals and organizations will be less sequential than the linear chain it replaces, and the distinctions between roles will be less sharp. Individuals and organizations can simultaneously be knowledge creators, publishers, teachers, and students of OER, with the Internet and enabling infrastructure technologies providing distribution and access.

Returning to Thomas Friedman's flat world analogy, the powerful combination of OER and emerging ICT capability is a flattening force for the unflat world – the developing countries on the other side of the global digital divide who today remain detached from the level playing field of the flat world platform. It is an enabler of opportunities for entrepreneurship, sustainability, and empowerment in parts of the world where fewer opportunities exist today.

This article summarizes key findings from research presented by the authors at the 2007 Open Education Conference (<http://cosl.usu.edu/events/opened2007>) and the 2008 IEEE International Symposium of Technology and Society (<http://istas08.ca>).

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"At the moment the OER movement is taking its first steps beyond a culture focused around "my site" towards a culture that is focused around "our commons." Most people who create OER sites have a sense of who they expect their users to be and what needs those users have. This is all to the good, if it is not to the exclusion of those users whose needs—or innovations—we have totally failed to imagine."

Towards a Global Learning Commons
<http://learn.creativecommons.org/wp-content/uploads/2008/03/bissellboyleedtecarticle.pdf>

Recommended Resources

A Review of the Open Educational Resources (OER) Movement: Achievements, Challenges, and New Opportunities

http://www.hewlett.org/NR/rdonlyres/5D2E3386-3974-4314-8F67-5C2F22EC4F9B/0/AReviewoftheOpenEducationalResourcesOERMovement_BlogLink.pdf

Here Comes Everybody: The Power of Organizing without Organizations

<http://isbn.nu/978-1594201530>

Seeing What's Next: Using Theory to Predict Industry Change

http://harvardbusinessonline.hbsp.harvard.edu/b01/en/common/item_detail.jhtml;jsessionid=RQUOKDKCIDD T0AKRGWDR5VQBKE0YIISW?id=1857&_requestid=102224

Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns

<http://www.mhprofessional.com/product.php?isbn=0071592067>

The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits

<http://www.amazon.com/Fortune-Bottom-Pyramid-Eradicating-Poverty/dp/0131467506>

An apparently extraordinary trend is emerging. Although learning resources are often considered as key intellectual property in a competitive higher education world, more institutions and individuals are sharing digital learning resources openly and without cost, as open educational resources (OER). The issues of why this is happening, who is involved, and the important implications were addressed in a 2006 study carried out by the OECD Centre for Educational Research and Innovation with the support of the Hewlett Foundation (<http://www.oecd.org/dataoecd/35/7/38654317.pdf>). The main conclusions are summarised here, together with some insights from a follow-up, and not yet published, study from spring 2008.

Higher education is facing a number of challenges: globalisation, an aging society, growing competition between higher educational institutions both nationally and internationally, and rapid technological development. OER is itself one of these challenges, but may also be a sound strategy for individual institutions to meet them. The trend towards sharing software programmes through open source software and research outcomes through open access publishing is already so strong that it is generally thought of as a movement.

It is now complemented by the trend towards sharing learning resources: the OER movement.

OER are a fascinating technological development and, potentially, a major educational tool. They accelerate the blurring of formal and informal learning, and of educational and broader cultural activities. They raise basic philosophical issues dealing with the nature of ownership, the validation of knowledge, and concepts such as altruism and collective goods. They reach into issues of property and its distribution across the globe. They offer the prospect of a radically new approach to the sharing of knowledge, at a time when effective use of knowledge is seen as the key to economic success, for both individuals and nations.

OER projects can expand access to learning for everyone, but most of all, for non-traditional groups of students. They thus widen participation in higher education. They can be an efficient way of promoting lifelong learning, both for individuals and for government, and can bridge the gap between non-formal, informal, and formal learning.

What are OER?

OER are digitised materials offered freely and openly for educators, students and self-learners to use and re-use for teaching, learning and research. They include: i) learning content; ii) software tools to develop, use and distribute content; and iii) implementation resources such as open licences. The learning content is open courseware such as educational material organised as courses and typically distributed as PDF files, as well as smaller chunks of learning, often referred to as learning objects. The content may involve websites, simulations, text files, images, audio or videos in digital format. Content may be for use only or also open for adaptation and reuse.

Who is Using and Producing OER?

Although no definite statistics are available, there is a rapid expansion in the number of OER projects, the number of people involved, and the number of resources available. In 2006, the OECD identified over 3,000 open courseware courses available from over 300 universities worldwide. When recontacted during the first half of 2008, six major OER initiatives reported an increase in the number of resources available as between 35 and 300%. There are hundreds of thousands of pieces of content representing thousands of learning hours which are freely available in repositories all over the world. The same six OER initiatives also reported that their visitors grew by 50 to 150% since 2006. Translation of resources combined with a growing number of non-English OER projects provide increased language diversity and global use. The potential number of users is enormous.

While the majority of producers of resources and OER projects are located in English-speaking countries in the developed world, promising initiatives like OER Africa (<http://www.oerafrica.org>) cater for a global development. The OER movement grows both top-down and bottom-up; new projects are started at the institutional level while individual teachers and researchers also use and produce OER. The institutions involved so far seem to be well-reputed internationally or in their own countries, rather than institutions that are unknown or have low status.

In exchange for an accurate estimation of the number of ongoing OER initiatives, we can offer a preliminary typology of different repositories. There are both large-scale operations and small-scale activities. Furthermore, there are different types of providers: institution-based programmes and more community-based bottom-up activities.

In both cases, there are all kinds of in-between models, as shown in Figure 1.

In the upper left corner of the figure, large-scale and institution-based or supported initiatives are found. Good examples are the MIT OCW programme (<http://ocw.mit.edu/>) and LearningSpace (<http://openlearn.open.ac.uk/>) from the Open University in the United Kingdom. Both are large in terms of the financial funding provided and are entirely institution-based in the sense that all materials originate from own staff. LearningSpace does have a sister site called LabSpace (<http://labspace.open.ac.uk/>), which is an experimental zone for downloading, remixing and sharing.

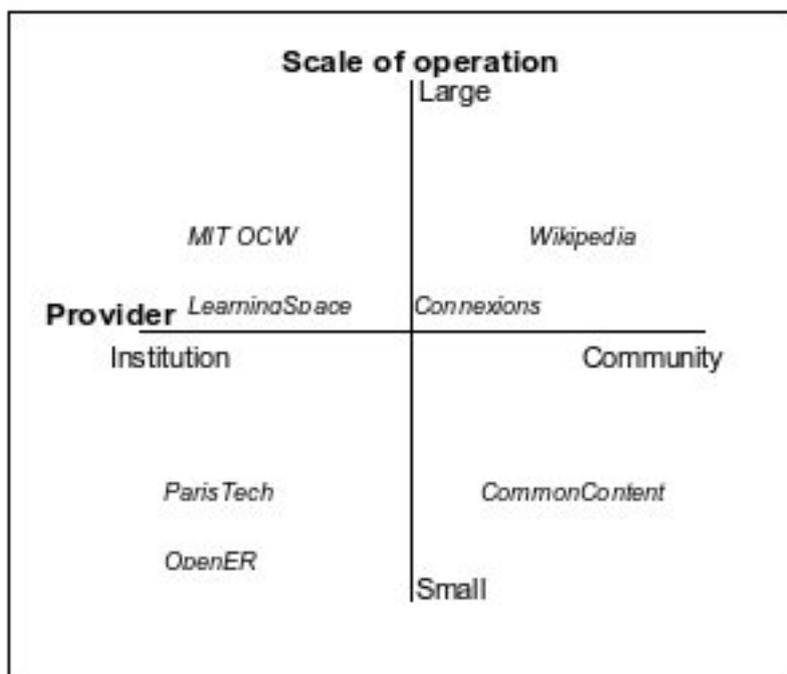
In the upper right corner of Figure 1, large-scale, non-institution-based operations are placed. The best example is probably Wikipedia, one of the Internet's real success stories and a good example of a large-scale community-based operation.

Other examples would be MERLOT (<http://www.merlot.org>), Connexions (<http://cnx.org/>), and ARIADNE (<http://www.ariadne-eu.org/>). In the bottom left corner of the figure, examples of small-scale institution-based initiatives are listed. Finally, in the bottom right corner are examples of small-scale community-based initiatives.

Why are People Sharing for Free?

There are technological, economic, social and legal drivers behind this dramatic expansion. Educators and researchers relish the chance to exploit new broadband capabilities, improved technologies for creating and distributing content, and greater interactivity. The costs of these technologies are dropping. Sometimes the driver is the need to compete with other universities; institutions use OER initiatives to attract new students and to improve their public relations.

Figure 1: Categories of OER Providers



THE CASE FOR OER

There is a strong sense in different parts of the community that OER offers a major opportunity to sustain or restore altruistic notions of sharing for the common good.

The drivers and motivations for producing and sharing OER are summarised in Table 1.

Independently of whether institutions are engaged in OER projects or not, OER can be expected to affect curriculum, pedagogy and assessment. With thousands of opencourseware courses from internationally reputed higher education institutions available for free, teachers will need to consider that students compare their curriculum with others.

Table 1: Motives for Producing and Sharing OER

Governments	Institutions	Individuals
Widening participation in higher education	Altruistic reasons	Altruistic or community supportive reasons
Bridge the gap between non-formal, informal and formal learning	Leverage on taxpayers' money by allowing free sharing and reuse between institutions	Personal non-monetary gain
Promote lifelong learning	"What you give, you receive back improved"	Commercial reasons
	Good public relations and showcase to attract new students	It is not worth the effort to keep the resource closed
	Growing competition – new cost recovery models are needed	
	Stimulate internal improvement, innovation and reuse	
Underlying drivers		Underlying inhibitors
<i>Technical:</i> Increased broadband availability; increased hard drive capacity and processing speed; new and improved technologies to create, distribute and share content; simpler software for creating, editing and remixing.		<i>Technical:</i> Lack of broadband and other technical innovations
<i>Economic:</i> Lower costs for broadband, hardware and software; new economic models built around free content for recovering costs.		<i>Economic:</i> Lack of resources to invest in broadband hardware and software. Difficulties to cover costs for developing OER or sustaining an OER project in the long run.
<i>Social:</i> Increased use of broadband, the desire for interactivity, increased skills and willingness to share, contribute and create online communities.		<i>Social:</i> Absence of technical skills, unwillingness to share or use resources produced by someone else.
<i>Legal:</i> New licensing regimes facilitating sharing of free content		<i>Legal:</i> Prohibition to use copyrighted materials without consent.

Since the teacher's role as supplier of reading lists and teaching materials is diminishing, OER is likely to accelerate changes in the traditional teaching role and the evolution of more independent learners. An increase in non-formal and informal learning can be expected to enhance the demand for assessment and recognition of competences gained outside formal learning settings.

Copyright and Open Licences

While information technology makes it possible to multiply and distribute content worldwide and almost at no cost, legal restrictions on the reuse of copyright material hamper progress. Frustrated by this obstacle, academics worldwide have started to use open licences to create a space in the Internet world – a creative commons – where people can share and reuse copyright material without fear of being sued. To do this, copyright owners have to agree or give permission for their material to be shared through a generic licence that gives permission in advance. The Creative Commons (<http://creativecommons.org/>) is by far the best-known licence for content. Its use is growing exponentially, although low awareness on intellectual property rights (IPR) issues among the academic community was regarded in both studies as a challenge to the OER movement.

How can OER Projects be Sustained?

The actual costs of an OER project vary considerably. Some initiatives have institutional backing involving professional staff, others build on communities of practitioners and rely on their voluntary work. There are all sorts of in-between models as well. Repositories can be organised as a place to share and exchange resources, meaning that people are either users or producers, or they can promote the collaborative production of common resources.

The first model is called the user-producer model and the second the co-production model, with many models in between. The first model is more likely to be centralised than the latter.

Although real costs can be met with resources other than money, most initiatives need to raise some capital. To this end, a number of models for cost recovery are identified in the report. These include: i) the replacement model, in which open content replaces other uses and benefits from cost savings; ii) the foundation, donation or endowment model in which funding for the project is provided by an external actor; iii) the segmentation model, in which the provider offers value-added services to user segments and charges for these services; iv) the conversion model, in which “you give something away for free and then convert the consumer to a paying customer”; and v) the voluntary support model or membership model, which is based on fundraising campaigns or paying members. The follow-up study in 2008 shows that long term sustainability is currently regarded as the most important challenge to most OER initiatives.

Policy Implications and Recommendations

OER represents a further blurring of the borders between formal and informal learning, and governments should study how OER can be efficiently used to meet some of the demand for increased lifelong learning. OER can make an important contribution to a diversified supply of learning resources. A plethora of digital learning resources supports methodological diversity, which again is a prerequisite for promoting individualisation of the learning process. Governments are advised to take a holistic approach towards digital learning resources, of which OER is but one part.

Governments should also review the existing copyright regime in order to promote further use of information technology in education and consider actions to create at least a neutral policy regarding commercial actors and OER. Funds should be made available for openly publishing education materials developed within publicly funded institutions, and governments should open up national digital archives and museum collections to the education sector.

The rapid pace of development of the OER movement means that it will soon have an impact on all higher education institutions. University managers need to consider the risk of doing nothing. Higher education institutions are advised to have an information technology strategy which includes the opportunities and threats posed by the OER movement. It should also comprise training offers and create incentives for faculty members to participate.

These are exciting prospects. But three important challenges for the OER movement identified in 2006 still seem to be the key issues for the future. These issues are:

1. Quality control: who will ensure that the material is relevant and accurate?
2. IPR: in a context where laws cannot follow the pace of growth of OER. Will governments be willing to adapt copyright regimes to facilitate the use of digital resources for learning?
3. Transformation: of grass-roots initiatives into sustainable models at the institutional or even national level. Will there be funding available or cost recovery models that make it possible for OER projects to sustain when the initial hype is over?

The future for the OER movement will to a large extent depend on how these challenges can be met.

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Recommended Resources

Centre for Educational Research and Innovation, OER
<http://www.oecd.org/edu/oer>

The Future of Delft Open Courseware:
How to Build a Sustainable Environment
for Open Educational Resources
<http://www.scribd.com/doc/2891064/Hennis-TA-The-Future-of-Delft-OCW-MScThesis>

British Columbia BCcampus OER
Initiative
<http://www.bccampus.ca>

webcast.berkeley, University of California
<http://webcast.berkeley.edu/>

OER Introduction Booklet
http://openeducation.developmentgateway.org/uploads/media/oer_public/OER_Introduction_Booklet.pdf

HYBRID SOFTWARE BOOSTS HPC PRODUCTIVITY

"...while HPC has been primarily limited to large enterprises, R&D firms, and academic institutions in the past, there is now also a broad swath of mid-market companies adopting HPC due to the availability of affordable and open solutions, supplanting the costly and proprietary solutions of the past. All of these factors are contributing to a logical progression: HPC is maturing from high performance to high productivity."

Novell

<http://www.novell.com/products/server/hpc.html>

Users of high performance computing (HPC, http://en.wikipedia.org/wiki/High-performance_computing) have long enjoyed the availability of both commercial and open source software (OSS). But they typically resided in separate worlds. Open source was favored by the academic and government research communities while commercial independent software vendors (ISVs) served the HPC needs of specific industries, such as aerospace or energy. This article examines how the wall between these two software worlds is crumbling as industry increasingly adopts more open source tools.

HPC Enters the Mainstream

The ubiquity of Linux for HPC servers is the obvious beach head for the trend in increased usage of OSS in HPC environments. But many more open source tools have become de rigeur in commercial HPC labs, such as MPICH2 (<http://www.mcs.anl.gov/mpi/mpich/>), an open source implementation of the Message-Passing Interface (MPI, http://en.wikipedia.org/wiki/Message_Passing_Interface) standard for distributed-memory applications used in parallel computing.

The software stacks from the OpenFabrics Alliance (<http://openfabrics.org/>) are designed to support server and storage clustering and grid connectivity using InfiniBand (<http://en.wikipedia.org/wiki/Infiniband>) and iWARP (<http://en.wikipedia.org/wiki/IWarp>) fabrics.

At the same time, businesses increasingly need to model larger, more complex problems through simulation to stay competitive, while the cost of HPC hardware continues to plummet thanks to the availability of commodity multi-core chips. The result: demand for HPC is exploding across all industries.

And with this change comes a massive influx of new users who lack the computer science and programming expertise required for parallel computing. For example, few engineers or scientists are skilled in the low-level programming methods of MPI that are needed to achieve top computational performance. Consequently, the future of HPC applications will neither be the sole domain of OSS nor commercial applications, but rather a graceful integration of both, according to Nancy Wilkins-Diehr of the San Diego Supercomputing Center (SDSC).

She should know. Wilkins-Diehr helps thousands of users from U.S. business, government and academia take advantage of SDSC's vast HPC resources every year. As one of a small number of National Science Foundation (NSF)-funded supercomputing centers, the facility provides HPC systems, tools and support at no cost to academic users. "We're seeing a lot of blending of open source and commercial software across the scientific and engineering community," she said.

HYBRID SOFTWARE BOOSTS HPC PRODUCTIVITY

“Many new users coming to us worked on PCs using popular commercial tools; others preferred open source tools. But the common problem across all users is that they’ve run out of computational steam on their desktops. Our goal is to let them tap into our HPC resources while continuing to work in their familiar development environments, extending their codes’ reach to parallel systems using a variety of open source and commercial tools.” [Editor’s note: The quote is from a conversation with the author and is used with permission.]

Hybrid HPC Software

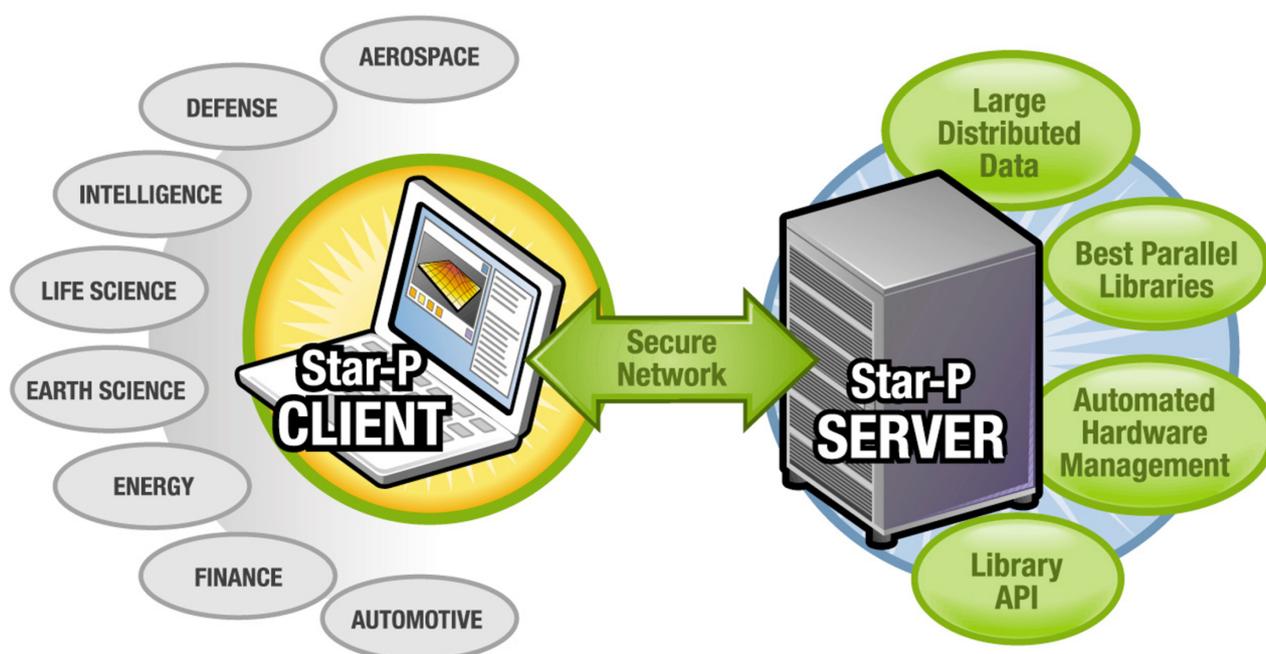
To this end, SDSC and many other research centers have deployed the Star-P (<http://www.interactivesupercomputing.com/products/>) interactive supercomputing platform. Star-P is an open commercial software package designed from the ground up for easy integration with a wide range of open source mathematical libraries, solvers, schedulers and other tools favoured by technical computing users.

As seen in Figure 1, Star-P is suitable for use in many diverse types of industries and provides the interface to large sets of data, parallel libraries, and the management of the underlying hardware.

While the notoriously complex programming requirements of parallel systems are beyond the capabilities of the average scientist, engineer and analyst, Star-P enables them to transparently work with parallel HPC clusters and servers using familiar desktop tools. Users can code models and algorithms using either popular commercial technical computing applications or open source programming tools. Either way, users can then run their applications instantly and interactively on HPCs. It eliminates the need to re-program the code to run on parallel systems, which typically takes months to complete for large, data-intensive problems.

Star-P is client/server software that connects a Windows or Linux desktop client to a Linux-based Star-P server running on either a locally networked HPC resource, or in cases like SDSC’s lab, remotely over the Internet.

Figure 1: Star-P Architecture



HYBRID SOFTWARE BOOSTS HPC PRODUCTIVITY

Linux as Star-P's server operating system is a natural fit since most of today's HPC clusters and multi-core servers are based on Linux. Much of this migration to open source HPCs has been driven by the ability of standards-based commodity multi-core processors from Intel and AMD to deliver significant performance at low cost. An HPC Linux cluster can provide better performance than a traditional proprietary supercomputer at a fraction of the cost. Linux-based HPC offers an unbeatable mix of scalability, flexibility and an ever growing ecosystem of HPC hardware and software vendors to provide support.

On the front end, Star-P gives the user a choice of proprietary MATLAB (<http://www.mathworks.com/>) or open source Python (<http://www.python.org>) development environments. When using MATLAB, Star-P provides users of the popular very high level language (VHLL) with easy access to many open source libraries and supporting tools. Conversely, Python users can take advantage of commercial third-party add-on modules for Star-P. The workflow between proprietary and open source tools is seamless.

Support for the Python language is apropos given Star-P's goal of making users more productive. Python is an object-oriented, high-level programming language with a simple, easy to learn syntax. It requires no compilation step, and debugging Python applications is fast and easy. Consequently, programmers appreciate the increased productivity it provides.

A key benefit of using Python in HPC environments is the wide array of Python modules for technical computing. For example, users can leverage any of Python's hundreds of functions in a task parallel computation.

They can also take advantage of Python-specific numerical libraries and functions, including NumPy (<http://numpy.scipy.org/>) and SciPy (<http://www.scipy.org/>), the Python programming extensions that add support for large, multi-dimensional arrays and matrices. These, as well as many other modules from the Python open source community, can be run as parallel tasks to speed up tasks that can be executed independently. The Star-P Python client works in a way that feels comfortable to users of NumPy, the de facto Python package for numeric and scientific computing, as the syntax for creating and operating on distributed arrays in the Star-P Python client resembles NumPY. In fact, users can run their code on a parallel HPC with only a couple of trivial syntax changes.

This integration of open source and commercial software enables users to write a Python program handling very large matrices and array objects on their desktop PCs. During the coding they can take advantage of Python's intrinsic interactivity, as well as any of the convenient Integrated Development Environments (IDEs) available for working in Python, such as Komodo (http://www.activestate.com/Products/komodo_ide/), BlackAdder (<http://www.thekompany.com/products/blackadder/>) or PyScripter (<http://code.google.com/p/pyscripter/>). When processing extremely large datasets, they can export their calculation to an HPC running the Star-P server while still controlling their computation from the interactive session running on the desktop PC.

Python support is particularly useful for image processing applications in life sciences, defense and other industries thanks to the wide variety of open source modules available for them.

HYBRID SOFTWARE BOOSTS HPC PRODUCTIVITY

The combination of Python's programming speed and ease of use combined with Star-P's interactive parallelization capabilities means that Python modules can now be automatically parallelized, yielding significant productivity gains for users.

OpenConnect

Python-specific libraries and modules are just one of many kinds of open source tools that can interoperate seamlessly with Star-P. Scores of open source libraries, solvers and algorithms are available to the technical computing community. To facilitate integration, Star-P includes an enhanced application programming interface (API) called OpenConnect that enables users to easily plug in open source tools to boost productivity. Since most of these open source tools were written in low level languages like C or FORTRAN, users can plug them in into Star-P, work on them with their preferred desktop tool, and execute the code in task- or data-parallel modes with little re-programming effort. This easy integration also enables users to utilize some powerful open source numerical libraries which may have previously been beyond their technological reach.

For example, using Star-P OpenConnect, users can plug in a variety of solvers from Sandia National Labs' Trilinos library. Trilinos uses application development building blocks called packages for computing tasks such as creating dense matrices, graphs and vectors. In a real world example, NASA scientists are combining Star-P with OSS they developed called Optical Systems Characterization and Analysis Research (OSCAR) to improve next generation space telescopes and other stellar imaging applications. OSCAR is modeling software used to design and analyze large space-based imaging systems.

The software was instrumental in solving the highly publicized optical flaws of the Hubble Space Telescope. Because systems of this type require large, high-fidelity optical modeling, NASA runs OSCAR on open source-based Beowulf (<http://www.beowulf.org/>) parallel clusters to handle the huge datasets and meet the large memory requirements.

The research project is enabling scientists in NASA's Stellar Vision Mission to boost productivity by reusing existing serial and parallel OSCAR code, without having to master OSCAR's complex programming requirements. To facilitate parallel computing, OSCAR is written entirely in C with MPI handling the computations across many processor nodes. With Star-P, scientists can re-use and extend the functionality of existing code by linking it to easy-to-use desktop tools such as Python or MATLAB. Star-P then automatically transforms the programs to run interactively on the Beowulf clusters.

Star-P is also aiding in the development of new OSS. Biomedical engineers at the University of Virginia School of Engineering and Applied Science have developed a new imaging tool that hopes to dramatically improve medical ultrasounds, potentially leading to more accurate and timely diagnoses of breast cancer and other life threatening conditions. Using Star-P, the University's biomedical engineering research team created an open source beamforming algorithm, called the Time-domain Optimized Near-field Estimator (TONE, <http://www.ncbi.nlm.nih.gov/pubmed/18270066?dopt=Abstract>), which significantly improves the contrast and resolution of ultrasound images.

A small sampling of other open source tools that work with Star-P include:

- ScaLAPACK (<http://www.netlib.org/scalapack/>), a linear algebra library for parallel computers
- FFTW (<http://www.fftw.org/>), a C subroutine library for computing Fast Fourier Transforms
- MUltifrontal Massively Parallel Solver (MUMPS, <http://graal.ens-lyon.fr/MUMPS/>), a tool for solving systems of linear equations
- Torque (<http://www.clusterresources.com/pages/products/torque-resource-manager.php>), an open source resource manager providing control over batch jobs and distributed compute nodes
- HDF5 (<http://hdf.ncsa.uiuc.edu/HDF5/>), a suite of database tools for managing extremely large and complex data collections.

Conclusion

In HPC, a blending of commercial and OSS can be mutually beneficial, enhancing the strengths and functionality of each. HPC is quickly going mainstream and is no longer a rare and exotic resource limited to computer science labs. With this shift comes a huge influx of new users unfamiliar with the complexities of parallel computing. The ease of use provided by commercial software combined with the vast and rich offering of open source tools can work together to make HPC more accessible and users more productive.

David Rich is Vice President of Marketing at Interactive Supercomputing Inc. He has more than 23 years of HPC and networking experience in both large and entrepreneurial high tech companies. At AMD, he directed the company's entry into the HPC cluster market and secured large wins such as the Red Storm system at Sandia National Laboratories and the Dawning 4000A at the Shanghai Supercomputer Center. While at AMD, he served as president of the HyperTransport Consortium, a standards organization for high-speed interconnect technology. David's earlier experience includes being the founding manager of the TotalView product line, which has become the de facto standard for parallel and distributed debugging. He served as vice president of Fujitsu System Technologies, which developed high-speed networking technology that was a precursor to InfiniBand. His parallel processing experience started at BBN Technologies where he worked on the Butterfly series of computers. David received a bachelor's degree in computer science from Brown University.

Recommended Resources

HPC Community
<http://www.hpccommunity.org/>

Linux HPC
<http://www.linuxhpc.org/>

IS OPEN SOURCE RIGHT FOR YOUR LIBRARY?

"The principles and practices of open source software are very similar to the principles and practices of modern librarianship. Both value free and equal access to data, information, and knowledge. Both value the peer review process. Both advocate open standards. Both strive to promote human understand and to make our lives better. Both make efforts to improve society as a whole assuming the sum is greater than the parts."

Eric Lease Morgan

<http://infomotions.com/musings/biblioacid/>

We all know that feeling in our gut, that moment when it's time to sign the order for a new software program for your library. It's accompanied by a host of nagging questions: "Is it the right decision?" "Have we overlooked anything?" "Will this work?" "Have we considered all the options?" The decision to acquire or upgrade a library automation package is never an easy one and every director, when faced with this decision, wants to choose the best package at the best value that most fully meets the needs of users. Today, that decision is complicated by a new option, that of open source.

This article will examine when and why open source software (OSS) might be appropriate for your library. It also discusses why so many libraries are moving towards OSS and some of the disadvantages to be aware of when deciding to move in that direction.

Why are Libraries Moving Towards OSS?

Libraries are moving towards open source for a variety of reasons, but many find that their reasons share a lot of commonality such as:

Commodity/Infrastructure technology. Open source makes sense when a software product reaches commodity or infrastructure status. That status allows users "to obtain components (or even complete systems) on the open market and leverage economies of scale" (<http://ieeexplore.ieee.org/Xplore/login.jsp?url=/iel5/5992/30430/01401797.pdf>). In libraries, it could be argued that integrated library systems (ILSs) have reached that status.

Consolidation. Libraries have seen a great deal of consolidation in the last few years among ILS vendors and federated search applications. As vendors consolidate, it raises concern among current and potential users of a product. While not always the case, there have been examples of software businesses that are more focused on short-term profitability and resale than meeting the longer term interests of their customers. The end result is staff downsizing, product lines being terminated or consolidated, and customers being stranded on a product without support options and being forced to migrate to a new product. Administrators, as a result of this experience, are looking for alternative options and for continuously evolving software that allows them to control the speed and direction of their library migrations. That's one promise of OSS.

Equivalent functionality. Many open source products are still fairly young and don't have the same level of functionality as proprietary library products that have been in the market for many years. However, because of the way open source development leverages large communities of developers, a committed effort can rapidly replace key missing functionality. While it will depend on the needs and capability of a library, many find this a satisfactory solution for missing functionality.

IS OPEN SOURCE RIGHT FOR YOUR LIBRARY?

Ease of procurement. Procurement processes are frustrating for both libraries and vendors. Libraries are burdened with purchasing office and legal conditions, as well as tedious and costly document preparation. Open source offers the potential for a more streamlined procurement process as many libraries download the OSS application, install it and test it against their needs. In the proprietary world, this option may not exist, or may be a limited-functionality or a time limited version. If you want commercial support for the software and/or custom developments, then you can issue a request for proposal (RFP) for service on the product. Because this is a much more focused procurement, the document will be smaller and more manageable than the document for proprietary vendor products. With OSS, libraries are finding a better way to examine the product at a lower cost.

More reliable products. One of the advantages of OSS is that the associated community of users and developers can be larger than for some proprietary solutions. When that is the case, there is likely to be a greater level of peer review, not only for the specifications for new features, but also for the code that is written to implement those new features. The result is a more reliable product.

No vendor lock-in. When a library adopts an open source product, they have access to the source code. This means that the vendor can't lock them into their proprietary customer base and the library is once again in control of their future. With open source, if their service provider/vendor were to be bought, sold, or consolidated or they wish to terminate service or support, they can move to a new vendor that will continue to enhance, support and maintain the product. The library remains in control of the decision of when to upgrade or migrate.

Support options. In the early days of OSS, you either had to be a programmer or have one on your staff to use OSS. Many libraries didn't meet that requirement and left the OSS option aside. However, commercial entities have since been created to provide commercial support options at a reasonable cost. These companies handle data conversion, installation, training, support, maintenance, ongoing development, customization and all the other services you've come to expect with proprietary software. If libraries don't like their current support or costs, they can move to another OSS vendor. For libraries stuck with proprietary vendors that are more focused on profit than customer satisfaction, this is proving to be a refreshing change.

Development options. Libraries have grown frustrated with slow and costly developments from some proprietary vendors. Often, what gets delivered is not what was requested or needed. Most companies build walls between users and their programming teams, and only the most savvy of analysts can describe exactly what a library wants to a programmer in a way that ensures delivery of the right software. In addition, many developments get caught behind new contracts or return on investment (ROI) calculations that make the company move slowly. Open source models alleviate these frustrations. Furthermore, if the library doesn't like the quote or timeline from their vendor, they can hire or outsource their own programmer. They also have direct access to the programmer through email or instant messaging. The end result is that libraries get what they want, much closer to when they want it. Features can be implemented in days and weeks instead of years and decades. And, once any library has exactly the open system it wants, it can share that system with other libraries around the world.

IS OPEN SOURCE RIGHT FOR YOUR LIBRARY?

More efficient use of financial resources. Moving to open source doesn't mean that everything is free. You remove one huge cost in licensing and create a competitive market surrounding other costs. The financial model changes, in favor of the library.

What are the Concerns about OSS?

We've identified numerous reasons why open source is under consideration at many libraries today. However, there is no perfect solution and everything has pluses and minuses. If you announce you're moving towards open source, you'll hear many arguments such as those which follow.

"Is there legal protection from lawsuits if you use OSS?" Clearly this is a complicated topic and even a library that uses proprietary software is not totally protected. Software developers are always exposed in that they trust the contributors to not copy or steal product code. In the OSS world, as in the proprietary world, if a violation happens, you'll need to have new code written and substituted that avoids the legal claim. The good news with OSS is that you have more helping hands than you might have inside of a proprietary company facing this claim.

"How do we know the software won't branch?" Branching usually happens when the community grows so large that the code can't accommodate everyone's needs. However, the use of an open service oriented architecture means code components can more readily be re-used and/or interfaced with other software, thus allowing customized implementations to be more readily achieved.

"OSS lacks maturity." New products often face this concern. But, just because the idea is new does not mean it is immature. Most vendors of proprietary products want you to forget that there are often more people at work on an OSS product than there are on their proprietary product(s). In the proprietary model, the development process tends to be tightly controlled and limited by the vendor. OSS vendors join forces with their customers in a community effort to develop the product. The result is faster development and a product where users get exactly what they want.

"Open source companies have no product road map." This is not true, as the road map followed by open source vendors doesn't belong to a company but to the users of the software. You have a major say in where an open source product goes, what roadmap is followed, when updates get applied to your systems, and what costs you decide to take on to use those updates and new features. OSS represents a true collaborative approach. Librarians are in control – not the company.

"What will it cost to add functionality to open source products?" Those who raise this question don't understand one of the major benefits of OSS. Open source development is more cost effective, allowing more functionality for the expenditure. Why? Because your library is not paying the vendor to maintain a research and development (R&D) environment. In the open source development model, every library that uses the software can (but doesn't have to) be an R&D environment. Because there are libraries that will join together to contribute code, the cost of adding functionality can be lower, and the results tend to be far more comprehensive and have higher quality when released.

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“Is open source really open?” If you can get the source code, if it uses an open source license, and if you’re free to modify it, support it yourself or purchase support from other companies, it is open.

“Is OSS really free?” What is “free” in OSS is freedom. Freedom from having the future of your automation product dictated or terminated by your vendor. Freedom to obtain service where you want at a price you want. Freedom from licensing and license upgrade charges.

“Is OSS viable over the long road and will support be available for the long-term?” This question can and should be asked of every software product, whether it is open source or proprietary. The answer does not depend on whether the software is proprietary or open source. It depends on a combination of the quality of the product and the stability of the company. If a proprietary software product has reached the end of its development road and/or the company is sold, current users may find themselves saddled with a product whose future is in doubt or even terminated. This scenario is less likely to happen with OSS, because from early on the software is understood, improved and supported by many parties, any one of which can extend their services to other libraries. OSS also provides several layers of insurance against product termination. With OSS: i) you have the source code for the product without going to court or pressing for a release of escrow; ii) you can obtain support from numerous sources including your own IT staff, commercial vendors, or hired consultants; and iii) the products are developed through community, not company product managers, meaning you’ll see products that stay more current with technology trends and thus remain viable.

“Being open is more important than just open source.” Being open is far more than just using OSS. It’s about an approach to customer needs with regard to costs and to the future direction of products. When you’re open, the community directs the future, not the company.

“Customers can have a co-existence strategy with open source.” Those that advocate either pure proprietary or pure open source solutions are not being realistic. Both solutions will co-exist well into the future.

“There are a myriad of licenses”. This is true, as each license meets a different need. When adopting OSS, the license should be examined for suitability for your library. Just because a product says it is open source, that does not mean you can do anything you want with it. Licenses impose obligations and because there are different types of open source licenses, there are different types of obligations to be observed and met. For instance, many open source licenses have no imposed fees as long as the library using it is a non-for-profit or educational library. However, if you’re a for-profit business, fees could be involved. As with any software product, read the license and know what you’re agreeing to before you start using the product.

What Can Go Wrong with Open Source?

In our work, we’ve seen the following major problem areas with OSS implementations. These are, in part, because people try to apply their experiences with proprietary software without understanding that open source is different.

IS OPEN SOURCE RIGHT FOR YOUR LIBRARY?

1. Support is important. One of the keys to a successful open source implementation is to understand that maintenance is needed and that your staff may or may not be able to do this by themselves. You can hire outside firms that specialize in supporting open source and the number of firms supporting library applications is growing. If, however, you wish to get support from the community of users that developed and support the software, you need to remember: i) that they do this as their time permits; and ii) to broaden the likelihood of prompt support, do not use a unique platform configuration.

2. Not contributing back. Open source succeeds when users contribute back to the product. This can be through contributing code, contributing money, writing documentation, hiring service/support companies to support your use and have them contribute back your changes, and talking about the application and how you use it at conferences.

3. Not doing full evaluations or suitability analyses. Since open source is easily downloaded and used, it is possible to select the easiest application to load and start using it. This action skips the critically important analysis to ensure the functionality will meet user needs and that the product will scale to meet future needs. Do not skip doing a full total cost of ownership analysis on an application before you begin implementing it.

4. Not staffing properly to support the application. We frequently see libraries add more applications to their information technology department's list of things to do, without providing the staff and resources to properly support the applications. This is short sighted and will ultimately lead everyone involved to think open source is not suitable, when in fact it is, if properly planned, supported and implemented.

Conclusion

We started this article with the question "is open source right for your library?" We've examined a wide variety of reasons why many libraries have and are moving in the direction of OSS. Those reasons focus on stretching budgets, regaining control and aligning end user needs and development agendas. As shown, there are many valid reasons for considering OSS.

We investigated some of the concerns you'll face should you decide to move your library in this direction. OSS isn't a perfect solution, but answers have been offered for the concerns. Finally, we've listed a few of the common mistakes we've seen libraries make in using OSS. Ultimately, as with any choice, you'll have to match your library's needs with the features and benefits to see if open source is right for your library.

Parts of this article were first presented at the ILS Symposium by Lincoln Trail Libraries System in September 2007 and other portions are from the author's blog located at <http://www.care-affiliates.com/thoughts>.

Carl Grant is a librarian who has worked in libraries, or companies automating libraries, for many years. Recently he founded CARE Affiliates, a company specializing in open source solutions for libraries. Mr. Grant has a demonstrated commitment to libraries, librarianship, and industry standards having served on the Board of the National Information Standards library (NISO) as a Board Member, Treasurer, and Chair. He is also a member of ALA, LITA, ACRL and ERT. Library Journal has previously recognized him as an "Industry Notable". Mr. Grant holds a Master's in Information and Library Science from the University of Missouri at Columbia.

"As the open source vision and culture continue to mature, librarians would be remiss not to find our profession playing a major role in that culture. For all we have done so far, our online systems are not good enough yet. We can do better."

Dan Chudnov

<http://www.oss4lib.org/readings/oss4lib-getting-started.php>

Sharing resources lies at the heart of librarianship, and libraries have a long history of collaborative projects and initiatives. It comes as no surprise then to find that libraries have a natural synergy with open source software (OSS) and there have been some recent activities where open source solutions have been applied to large scale services. This article describes a project between several Ontario university libraries to work together on a mission critical OSS application for their campuses.

Integrated Library Systems

Project Conifer (<http://conifer.mcmaster.ca>) is a collaborative effort by McMaster University, the University of Windsor, and Laurentian/Algoma Universities to implement a common instance of an open source Integrated Library System (ILS, http://en.wikipedia.org/wiki/Integrated_library_system) called Evergreen. The ILS is the production system for a library's operations, providing inventory management and other mission critical functions. The ILS has also been considered one of the most problematic open source software (OSS) options for libraries due to its sheer complexity and requirements for large scale software engineering. The integrated aspect of the ILS has traditionally referred to the major functions or modules of a library being brought together in a way that they can talk to each other. These modules are usually identified as:

- acquisitions: module for ordering, payment tracking, and other activities associated with purchasing materials
- cataloguing/bibliographic control: module for describing resources and providing points of access
- circulation: the first library function to be automated, the circulation module tracks materials borrowed from the collection and typically supplies additional processing to support activities like automatic notification when materials are past a due date
- online public access system (OPAC): the public interface to the catalogue, one of the last functions to be automated, one of the first computer layers to be made available to the general public, and the subject of much discussion in library circles because of comparisons to systems like Amazon and Google

Most major ILS vendors support two additional functional layers that are sometimes identified as core modules:

- serials control: tracking publications that are issued at regular intervals such as periodicals, annual publications, proceedings, and transactions
- authority control: automating activities associated with the verification and collocation of headings in the catalogue

Libraries spend more on the ILS than any other type of software. Yet, the economies of scale do not produce a wide variety of options or favourable pricing models in the commercial world. There are fewer than a dozen ILS vendors for libraries with mid-sized to large collections (100,000+ titles).

This marketplace has become saturated, with vendors depending strongly on existing customers for a revenue stream, and the appearance of private equity firms as the owners of the largest ILS companies. (The trends in the ILS market are monitored by Marshall Breeding at <http://www.librarytechnology.org/>).

The Evergreen ILS Takes Root in Canada

In September, 2006, the most ambitious and sustained open source ILS initiative ever undertaken in the library world was unveiled with the deployment of Evergreen, a multi-year project of the PINES (Public Information Network for Electronic Services) Consortium, representing over 250 libraries in Georgia with the backing of full-time developers (<http://www.georgialibraries.org>). Evergreen was constructed from start to finish as an open source application, and one that needed to scale to a very high level of processing load. One in five residents of Georgia are serviced by a PINES library, and it represents one of the busiest library systems in North America.

Two months after Evergreen went into production, the University of Windsor hosted a one day symposium on the state of the ILS and invited representatives from PINES to present their experiences from adopting an OSS solution. There has been long standing interest in OSS solutions at the University of Windsor, and the Leddy Library at Windsor had been a participant in an international gathering of software developers, information access advocates and library representatives at the launching of the eIFL FOSS program in the Italian province of Ancona just one month after Evergreen made its debut (<http://www.eifl.net/cps/sections/services/eifl-foss>).

The PINES presentation, entitled "Evergreen: The ILS is Open and Everyone is Invited!", was a huge success. In December, the University of Windsor announced a partnership with PINES to work on acquisitions functions, one of the modules that was not required in the initial PINES implementation. The prospects for the viability of the ILS marketplace and the need for OSS solutions that were described in the symposium seemed prophetic when, in early March, 2007, a leading library software automation vendor, SirsiDynix, announced the cancellation of its long-awaited successor ILS (Horizon 8.x).

Among the organizations that had planned a migration to this product was the Public Library Services Branch (PLSB) in British Columbia (BC), which facilitates information sharing among BC public libraries and is charged with ILS support services. PLSB calculated that BC libraries currently pay ILS vendors a conservatively estimated \$700,000 annually for software maintenance, and was successful in achieving an endorsement to switch its migration path to Evergreen. The BC implementation, originally given the name of BC Pines, is now known as Project Sitka (<http://sitka.bclibraries.ca>). It reached a major milestone when Prince Rupert Public Library became the first BC public library system to go live with Evergreen in November, 2007. Others have followed and it is anticipated that 15 BC libraries will be using Evergreen in production by the end of 2008.

The View from Ontario

Interest in implementing Evergreen was not limited to BC. In July 2007, an informal meeting was held at the University of Guelph to discuss Evergreen in the context of sharing library resources in Ontario.

The participants in the meeting were representatives from the University of Guelph, McMaster, the University of Windsor, and Laurentian University. The ILS seemed to be a natural point of cooperation among these institutions. Consortial projects have had much success among Ontario libraries, and the academic libraries in the province have a well established project called Scholars Portal which represents one of the biggest collections of digital scholarly content in the world (<http://www.scholarsportal.info>).

Official decisions for major system installations often go through many hoops in universities, but at the Guelph meeting it was agreed that McMaster, Windsor and Laurentian would pursue a shared installation of Evergreen with the full backing of our respective administrations, and that this implementation would be hosted at the University of Guelph.

The existing contracts with commercial ILS vendors and associated timelines for the three sites involved in this deployment suggested that a rollout in 2008 or 2009 would be achievable. Further, the utilization of Guelph's network services in a shared installation would be a compelling testimony to the appropriateness of Evergreen as a networked solution to distributed campuses. Since that initial meeting, the group has adopted the name Conifer for the project, one of Laurentian's partners, Algoma, is receiving university standing, thus bumping up the number of university participants in the initial deployment, and the group has gained the official support of the administration of each participating university. A test environment is now in place at Guelph and initial loading of library data into a shared database is well underway.

It is very difficult to change ILS operations in production during the Fall/Winter semester on our campuses, and our target date for going live is May 2009. The University of Prince Edward Island (UPEI) has also given Project Conifer a boost in credibility by becoming the first academic library to go live with Evergreen in May, 2008 (<http://www.upei.ca/library/html/evergreen.html>). Many other academic libraries have expressed interest in Evergreen as a replacement for their commercial ILS applications.

A Flexible Path to Agility

Given the modest size of the library community, it is gratifying to note that Evergreen is not the only open source ILS, nor the only successful one. Koha (<http://www.koha.org>), an ILS that started in New Zealand, and NewGenLib (<http://www.newgenlib.com>), an ILS with roots in India, are well established in production settings. Arguably, ISIS (<http://www.unesco.org/isis>), the UNESCO library system, follows an open source model and represents the most deployed library application on the planet. Yet, Evergreen is of special interest not only for its scalability, but also for its architecture. Evergreen utilizes a jabber-based communications infrastructure and a custom messaging layer called OpenSRF (Open Scalable Request Framework, <http://open-ils.org/dokuwiki/doku.php?id=osrf-devel:primer>), pronounced "open surf". It provides a powerful message based system that allows for maximum utilization of network settings.

With OpenSRF, ILS functions can be abstracted and extended in a wide variety of development environments. OpenSRF has the potential to be to the ILS what HTTP was to the World Wide Web.

Although the ILS is sometimes characterized as being a legacy system without a lot of resonance to web trends like Web 2.0, the ILS is still the main engine for supplying state information about library objects. This manifests itself in activities like determining whether a book is signed out through to processing the invoice that controls whether a library's subscription to an electronic database is renewed. OpenSRF represents a strong conduit for bringing forward state information to arbitrary web spaces and allowing the ILS to support rather than sit on the sidelines for web interactions.

Evergreen also shares an essential trait with its open source ILS brethren in that it runs well on Intel-based Linux systems, and opens the door to using low-cost computing platforms. The Conifer server environment at Guelph consists of several Dell servers running Debian and represents a fraction of the specialized server costs, such as IBM/AIX, that were incurred at any of the partner sites for their existing commercial ILS applications.

An ILS for a Small Planet

One of the requirements for Laurentian is that Evergreen be fully bilingual, and Laurentian has led the way in making internationalization a strong component of Evergreen's offerings. Windsor and Lakehead University have contributed a Chinese version of Evergreen, and the Academy of Sciences in Armenia is currently working on an Armenian translation. The Academy of Sciences also hosted the first workshop for the eIFL FOSS program and Evergreen is poised for deployments in Nepal and Zimbabwe through eIFL's initiative.

The importance of a viable open source ILS to developing and transitional countries can not be understated. Resource poor libraries can have their budgets badly compromised by the costs of a commercial ILS, and information access, a vital part of energizing economies, is greatly improved when underpinned by efficient systems.

Next Steps

The participants in Conifer will continue to work through data issues arising from shared cataloguing records and will seek to define workflows that will encourage the sharing of both data and expertise between our institutions. Our process, like that of UPEI, is public, and we are hopeful that other libraries can benefit from our experiences. Conifer is one of the most exciting partnerships to go forward among Ontario university libraries and we are confident that we are positioning our systems to better meet the needs of our campus communities in the future by embarking on this project.

Art Rhyno is a Systems Librarian at the University of Windsor, Chair of the Technical Committee for Knowledge Ontario, and the co-owner of a community newspaper (The Essex Free Press). He has published articles and book chapters on topics ranging from technology to genealogy and quantum physics, and is author of Using Open Source Systems for Digital Libraries, published by Libraries Unlimited. Art is also a former president of the Ontario Library and Information Technology Association and was the recipient of the Ontario College and University Association's Librarian of the Year Award in 2004, and co-recipient of the OLITA 2008 Award for Technical Innovation.

Recommended Resources

Evergreen blog

<http://open-ils.org/blog/>

Evergreen documentation wiki

<http://open-ils.org/dokuwiki/doku.php>

"Open source is not exempt from the laws of gravity or economics."

Joel Spolsky

<http://www.joelonsoftware.com/articles/StrategyLetterV.html>

The TIM Lecture Series provides a forum that promotes the exchange of knowledge between university research and technology company executives and entrepreneurs. Readers outside the Ottawa area who are unable to attend the lectures in person are invited to view upcoming lectures in the series either through voice conferencing or webcast. Instructions for joining a lecture are available (http://www.talentfirstnetwork.org/wiki/index.php?title=Instructions_to_join_via_voice_conference_or_webcast).

On July 2, 2008, Steven Muegge from Carleton University delivered a presentation entitled "Theory, Evidence and the Pragmatic Manager". This section provides the key messages from the lecture. The scope of this lecture spanned several topics, including management decision making, forecasting and its limitations, the psychology of expertise, and the management of innovation. The slides from the presentation are available for download (http://www.talentfirstnetwork.org/wiki/images/e/ea/Theory%2C_evidence_and_the_pragmatic_manager_July_2.pdf).

Management Decision-Making

The first half of the lecture provided an overview of the rationale underlying management theory, surveyed findings from recent research in managerial decision making, and outlined the role that theory can play in reaching effective management decisions.

Scholars argue about the precise definition of theory, but for our purposes, we can define theory as a contingent statement of what causes what, and why. Good management theory has predictive power about things that managers care about, and it is circumstance-contingent: actions may be expected to produce different results under different categories of circumstances. Good management theory is useful for managers making sense of the present and for guiding decisions about the future. It is particularly useful when data is limited – the low information, high uncertainty environments that characterize innovation and entrepreneurship.

Whether managers realize it or not, they have mental models of cause and effect that include the deeply ingrained assumptions, generalizations, and images that influence how they understand the world and how they take action. Mental models are broad concepts that encompass many notions from cognitive psychology, including decision-making frames, scenarios, scripts, stories, images, and mental simulations. Good management theory can extend and sharpen a manager's mental models. Pragmatic managers can gain several benefits from using good management theory to help guide decisions. They can reduce the cost and time of formulating what to do, avoid making costly mistakes, and discover their own blind spots.

For group decisions, theory can provide a common framework for analysis and a language for discourse that can help pinpoint disagreements and help managers understand and appreciate other perspectives. It forces precision and clarity that can focus attention, elicit new insights, and promote individual and organizational learning.

Field research in decision making finds that seasoned experts employ a variety of techniques to reach decisions. In difficult tasks, experts blend different sources of power including intuition, mental simulations of future outcomes, story-telling to make sense of the present, analogous and metaphorical reasoning, drawing on the experience of others, and formal rational analysis. Viewed in this context, theory is another tool in an expert's cognitive toolkit; it complements other tools rather than substituting for them.

There is much debate in management writing regarding decisions from the gut. We have anecdotal accounts both of spectacular successes and of costly failures. Recent research has provided new insights into the once mysterious mechanisms of intuitive decision making. We now understand intuition as a pattern matching process that occurs rapidly, below the level of consciousness. It can improve through training and practice to acquire more and better patterns. Conditions favouring an intuitive decision making approach include time pressure, ill-defined goals, dynamic conditions, and experienced participants. Effective intuition produces an adequate solution quickly. Conditions favouring an analytic approach include computational complexity (where apparent patterns are often wrong), conflict resolution between multiple participants, optimization (where there is a genuine requirement to identify the best option), the need to justify the decision to others, and inexperienced participants.

Black swans (http://en.wikipedia.org/wiki/Black_swan_theory) are high impact, low probability events that occur outside our expectations. In technical terms, many real events are fat-tailed (http://en.wikipedia.org/wiki/Fat_tail), complex, and fractal, and this places an upper limit on our capability to accurately forecast the future. Although black swans may appear to make sense in retrospect, they are not foreseeable as events unfold. It is not yet clear whether technological innovation is fundamentally a black swan, or whether it will become more predictable as we better understand it through further research.

Theories that are useful to economists are not necessarily good management theories as defined here. Good management theory addresses things that managers most care about. For managers, knowing about opportunities, fostering innovation, delivering value to customers, creating and appropriating value in ecosystems, and growing businesses is likely to be more useful than knowing about the market-level aggregate factors, industry averages, and equilibria that are of interest to policy makers.

There are multiple ways to make any decision and no way is perfect. Learning how to match a method to a specific context is one aspect of expertise. Further, distinguishing a good decision from a bad decision may not be obvious. Classical decision theory argued that there was an optimal utility-maximizing solution; behavioral studies attempt to describe the actual processes followed, but provide no best outcome as a benchmark. It can be argued that "following one's gut" is applying theory – the theory embedded in a manager's tacit mental models acquired through experience. In this sense, managers use theories all the time, whether they realize it or not.

Most descriptive research on intuitive decision making has thus far examined emergency workers or military officers rather than entrepreneurs. We need more cognitive task analysis research on entrepreneurs and managers.

Reflecting on black swans and uncertainty, one audience member surmised that the only thing certain about the future is that it is uncertain.

Theory and Evidence & Theory-Based Prediction

The rest of the lecture described the theory-building process, the importance of good categories, some examples of good management theories of innovation, and examples of theory-based prediction within the TIM program (<http://www.carleton.ca/tim/>). It was noted that categorization is important and that superficial categories imply a lack of understanding of what is really happening. Theories improve, in part, through discovery and refinement of better categories.

Extrapolating the past may often be an adequate predictor of the near future, but when underlying circumstances change, a technology manager's experience and intuition can be unhelpful – possibly even misleading. Decision making grounded in good management theory is a possible way forward in an uncertain world.

Pragmatic managers can examine a situation through the lens of more than one theory, and gain insights from understanding the tensions and differences. They can avoid management fads by demanding evidence and cultivating a healthy scepticism towards categorical prescriptions.

Theory and evidence are best treated as complements to intuition and analysis, to be employed in combination with other decision making approaches and other tactics for managing uncertainty.

An expanded reading list for this talk is available at http://www.talentfirstnetwork.org/wiki/index.php?title=References#July_2.2C_2008:_Steven_Muegge.2C_Theory.2C_evidence_and_the_pragmatic_manager.

Recommended Resources

Maps of Bounded Rationality: A Perspective on Intuitive Judgment and Choice
http://nobelprize.org/nobel_prizes/economics/laureates/2002/kahnemann-lecture.pdf

The Society for Judgment and Decision Making
<http://www.sjdm.org/>

The Innovator's Solution: Creating and Sustaining Successful Growth
<http://www.theinnovatorssolution.com/gameplan.html>

Sources of Power: How People Make Decisions
<http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=5773>

The Power of Intuition: How to Use Your Gut Feelings to Make Better Decisions at Work
<http://www.amazon.com/Power-Intuition-Feelings-Better-Decisions/dp/0385502893>

The Fifth Discipline: The Art and Practice of the Learning Organization
http://en.wikipedia.org/wiki/The_Fifth_Discipline

The Hidden Role of Chance in Life and in the Markets
http://en.wikipedia.org/wiki/Fooled_by_Randomness

CALL FOR PROPOSALS

The goal of the Talent First Network Proof of Principle (TFN-POP) is to establish an ecosystem anchored around the commercialization of open source technology developed at academic institutions in Ontario.

The priority areas are the commercialization of open source in:

- Mapping and geospatial applications
- Simulation, modeling, games, and animation
- Conferencing
- Publishing and archiving
- Open educational resources
- Social innovation
- Business intelligence
- Ecosystem management
- Requirements management

Expected Results

The TFN-POP is expected to:

- Establish a healthy ecosystem anchored around the commercialization of open source assets
- Maximize the benefits of the investment in the Talent First Network by the Ministry of Research and Innovation
- Accelerate the growth of businesses in Ontario that use open source assets to compete

Eligibility to Receive Funds

Individuals eligible to receive funds are faculty, staff, and students of universities and colleges in Ontario.

Budget and Size of Grants

A total of \$300,000 is available. Applicants' requests should not exceed \$30,000.

The TFN-POP may provide up to 50 percent of total project costs.

Criteria

Proposals will be judged against the following five criteria:

- Strength and novelty of open source technology proposed
- Extent of market advantage due to open source
- Project deliverables, likelihood that the proposed activities will lead to deliverable completion on time, and effectiveness of the plan to manage the project
- Track record and potential of applicants
- Extent of support from private sector

Application

The electronic version of the application received by email at the following address: TFNCompetition@sce.carleton.ca will be accepted as the official application. The email must contain three documents: a letter of support, project's vitals, and a project proposal.

CALL FOR PROPOSALS

Letter of support: (maximum 2 pages) a letter, signed by the person responsible for the Technology Transfer Office or Applied Research Office of the academic institution that proposes to host the project and the faculty member or student who will lead the project, must be included. This letter should describe the nature of the support for the project from the academic institutions, companies and other external organizations.

Project's vitals: (maximum 1 page) The project's vitals must include:

- Person responsible for applied research or technology transfer at the college submitting the proposal: name, mailing address, telephone number, and email address
- Project leader: name, mailing address, telephone number, and email address
- Team members: names, mailing addresses, telephone numbers, and email addresses
- Budget: Total budget, with TFN's contribution and that of other organizations
- TFN investment: TFN contribution broken down by payments to students, payments to faculty, and payments to project awareness activities

Project proposal: (maximum 5 pages) Project proposal must include the following:

- Benefits: (maximum 1/2 page) Description of the benefits of the proposed project, and an overview of the context within which the project is positioned
- Advantage: (1/2 page) Market advantage provided by open source assets used in the project

- Information on applicants: (maximum 1.5 pages) Background information to help assess the track record and potential of the people who are key to the project and the college
- Project plan: (maximum 2.5 pages) Description of the deliverables (what will be delivered and when); key project activities; nature of the involvement from companies, and other external organizations; and plan to manage the project

Evaluation & Deadline

Proposals will undergo review by the Expert Panel established by the TFN-POP. The Chair of the Panel may contact the applicants if required. A final decision will be communicated to the applicants within 30 days after the email with the official application is received.

There is no deadline. Applications will be evaluated on a first-come basis until the \$300,000 available is committed.

Contacts

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About the Talent First Network

The Talent First Network (TFN) is an Ontario-wide, industry driven initiative launched in July 2006 with the support of the Ministry of Research and Innovation and Carleton University. The objective is to transfer to Ontario companies and Open source communities: (i) Open source technology, (ii) knowledge about competing in Open source environments and (iii) talented university and college students with the skills in the commercialization of Open source assets.

GeoBC Puts Province on the Map**July 18, Victoria, BC**

GeoBC (<http://www.geobc.gov.bc.ca/>) and the Province's recent partnership with Google ensure that information viewed using Google Earth takes advantage of the imagery sourced from the Province's geographic warehouse. The Province's partnership with Google is the first of its kind for any province or territory in Canada. It will allow the Province to better showcase its landscape and assets, and spur innovative new products and services from businesses and citizens alike. The Province's geographic database has grown into one which is relied upon by tens of thousands of people to support business and critical land-based decisions.

http://www2.news.gov.bc.ca/news_releases_2005-2009/2008AL0030-001113.htm

NRC Publications Archive Announced**July 23, Ottawa, ON**

The National Research Council's Canada Institute for Scientific and Technical Information (NRC-CISTI) is pleased to announce an initiative to create an NRC Publications Archive (NPArc). This searchable, web-based archive will provide access to NRC's record of science and demonstrate the many ways NRC researchers translate science and technology into value for Canada. As part of this initiative, NRC has established a policy making it mandatory, starting in January 2009, for NRC institutes to deposit copies of all peer-reviewed, NRC-authored publications and technical reports in NPArc.

http://cisti-icist.nrc-cnrc.gc.ca/media/press/nparc_e.html

Sangoma Launches Developer Network for the Open Source Community**August 5, Toronto, ON**

Sangoma Technologies Corporation announced that they have designed a Developer Network for the open source community. This online network will support the open source community by giving VoIP developers the opportunity to interact with the people and companies in need of their services. Sangoma's Developer Network will serve as a platform for open source developers, and provide the opportunity for them to showcase their talents and skill sets among potential clients and employers. Through the network, developers can share success stories about their applications and solutions.

http://www.sangoma.com/company/newsroom/news_releases/news/885943/Sangoma_Launches_Developer_Network_for_the_Open_Source_Community.html

UPCOMING EVENTS

September 22-26

Toronto Tech Week

Toronto, ON

The second annual TorontoTechWeek will raise national and international awareness of Toronto as one of the largest, most innovative and fastest growing Information & Communications Technology (ICT) markets in North America. A world-class series of events will bring Toronto's ICT community together to promote and foster partnerships, employment, investment, education and business opportunities.

<http://www.torontotechweek.com/>

September 24-25

How to Manage, Monitor and Measure Social Media Effectively in Your Organization

Calgary, AB (English)
Montreal, QC (French)

Get solutions to your most pressing social media challenges through practical examples and case studies presented by a select group of practitioners who have implemented social media at their organizations.

http://www.canadianinstitute.com/bus_corp_general/SocialMedia.htm?PageMode=Search (Calgary)

<https://www.institutcanadien.com/ventes/mediassociaux.htm> (Montreal)

September 25-27

Fall Institute in Digital Libraries & Humanities

Fredericton, NB

The Electronic Text Centre at UNB Libraries, University of New Brunswick, will feature sessions on digital imaging and data conversion, XML markup, Institutional Repositories (IRs), and the Open Journal System (OJS) for journal management. In addition, researchers from Atlantic Canada will present lectures on digital humanities research and projects.

<http://etc.hil.unb.ca/fidlh/>

September 29

2008 BCIC Awards Dinner

Vancouver, BC

The annual British Columbia Innovation Council Awards is the premier event showcasing the best and brightest innovators in the province who communicate science in creative ways, establish innovative technology companies and conduct groundbreaking research. The award winners are widely renowned for their outstanding accomplishments in research, science communication and commercialization.

<http://www.bcic.ca/recognition>

UPCOMING EVENTS

October 1-2

PST2008

Fredericton, NB

The annual Privacy, Security and Trust research conference is unique in its broad approach including examining the issues from both the research and practice perspectives, encouraging multidisciplinary research, and fostering collaboration between academe, the private sector and government. The theme for PST2008 is "privacy, security and trust - enabling innovation".

<http://www.unb.ca/pstnet/pst2008/>

October 1-4

Access 2008!

Hamilton, ON

Access is Canada's premier library technology conference that focuses on issues relating to technology planning, development, challenges and solutions. Hackfest is a day long event, taking place prior to the regular conference program on Wednesday, October 1st, 2008 at Hamilton Public Library.

<http://access2008.blog.lib.mcmaster.ca>

October 7-8

SecTor

Toronto, ON

SecTor brings the world's brightest (and darkest) minds together to identify, discuss, dissect and debate the latest digital threats facing corporations today. Unique to central Canada, SecTor provides an unmatched opportunity for IT Professionals to collaborate with their peers and learn from their mentors.

<http://www.sector.ca/default.htm>

October 7-9

Ottawa Venture & Technology Summit

Ottawa, ON

As the region's premier risk capital event, it provides an opportunity for selected companies to present directly to a large audience of local and foreign investors. This year participation is open to both early and mid-stage companies.

<http://www.ottawavts.com/2008/>

UPCOMING EVENTS

October 9-10

CLLAP 2008

Quebec City, QC

The conference on free software and public administrations offers the opportunity to meet administrators who have already adopted open source, to obtain answers to your questions, and to discover convincing experiments which have taken place in Quebec, the remainder of Canada or abroad.

<http://www.cllap.qc.ca/cllap-2008/accueil/>

October 23-24

FSOSS 08

Toronto, ON

Open source, open content, and open formats are changing the way we work, play, and learn. From software to the web to television and the media, the open source movement is spreading. Come see and hear the future in person from some of the most important thinkers in open technologies.

<http://fsoos.senecac.on.ca/2008/>

October 25

Ontario Linux Fest

Toronto, ON

Finally, a grass roots conference for Linux and Open Source right here in Ontario. The Ontario Linux Fest is a conference for all things Linux and Open Source.

<http://onlinux.ca/>

The goal of the Open Source Business Resource is to provide quality and insightful content regarding the issues relevant to the development and commercialization of open source assets. We believe the best way to achieve this goal is through the contributions and feedback from experts within the business and open source communities.

OSBR readers are looking for practical ideas they can apply within their own organizations. They also appreciate a thorough exploration of the issues and emerging trends surrounding the business of open source. If you are considering contributing an article, start by asking yourself:

1. Does my research or experience provide any new insights or perspectives?
2. Do I often find myself having to explain this topic when I meet people as they are unaware of its relevance?
3. Do I believe that I could have saved myself time, money, and frustration if someone had explained to me the issues surrounding this topic?
4. Am I constantly correcting misconceptions regarding this topic?
5. Am I considered to be an expert in this field? For example, do I present my research or experience at conferences?

If your answer is "yes" to any of these questions, your topic is probably of interest to OSBR readers.

When writing your article, keep the following points in mind:

1. Thoroughly examine the topic; don't leave the reader wishing for more.
2. Know your central theme and stick to it.
3. Demonstrate your depth of understanding for the topic, and that you have considered its benefits, possible outcomes, and applicability.
4. Write in third-person formal style.

These guidelines should assist in the process of translating your expertise into a focused article which adds to the knowledgeable resources available through the OSBR.

Upcoming Editorial Themes

September 2008	Social Innovation
October 2008	Building Community
November 2008	Health and Life Sciences
December 2008	Enabling Innovation

Formatting Guidelines:

All contributions are to be submitted in .txt or .rtf format and match the following length guidelines. Formatting should be limited to bolded and italicized text. Formatting is optional and may be edited to match the rest of the publication. Include your email address and daytime phone number should the editor need to contact you regarding your submission. Indicate if your submission has been previously published elsewhere.

Articles: Do not submit articles shorter than 1500 words or longer than 3000 words. If this is your first article, include a 50-75 word biography introducing yourself. Articles should begin with a thought-provoking quotation that matches the spirit of the article. Research the source of your quotation in order to provide proper attribution.

Interviews: Interviews tend to be between 1-2 pages long or 500-1000 words. Include a 50-75 word biography for both the interviewer and each of the interviewee(s).

Newsbytes: Newsbytes should be short and pithy--providing enough information to gain the reader's interest as well as a reference to additional information such as a press release or website. 100-300 words is usually sufficient.

Events: Events should include the date, location, a short description, and the URL for further information. Due to the monthly publication schedule, events should be sent at least 6-8 weeks in advance.

Questions and Feedback: These can range anywhere between a one sentence question up to a 500 word letter to the editor style of feedback. Include a sentence or two introducing yourself.

Copyright:

You retain copyright to your work and grant the Talent First Network permission to publish your submission under a Creative Commons license. The Talent First Network owns the copyright to the collection of works comprising each edition of the OSBR. All content on the OSBR and Talent First Network websites is under the Creative Commons attribution (<http://creativecommons.org/licenses/by/3.0/>) license which allows for commercial and non-commercial redistribution as well as modifications of the work as long as the copyright holder is attributed.

The OSBR is searching for the right sponsors. We offer a targeted readership and hard-to-get content that is relevant to companies, open source foundations and educational institutions. You can become a gold sponsor (one year support) or a theme sponsor (one issue support). You can also place 1/4, 1/2 or full page ads.

For pricing details, contact the Editor dru@osbr.ca.



TheCodeFactory is a collaborative work space located in downtown Ottawa. TheCodeFactory is a clubhouse or water cooler for the Start-up community in Ottawa. Take the relaxed and informal feel of the coffee shop meeting and add a dash of the excitement and enthusiasm of democamp and you have TheCodeFactory. TheCodeFactory provides a relaxed informal environment to work, connect and collaborate.

Check out our upcoming events at

<http://www.thecodefactory.ca>



Universities are expanding their courses to include on-line students from around the world, but the ongoing costs of commercial web-conferencing systems are a barrier to growth. BigBlueButton is an open source web conferencing system that enables academic institutions to deliver their courses on-line, with high quality slides, voice, and video collaboration, at a fraction of the costs. To examine a demonstration of BigBlueButton in action, visit:

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



Vitesse Re-Skilling™ Canada is a non-profit organization which provides innovative, cost-effective and timely solutions to meet the dynamic skills requirements of the emerging and growth-oriented knowledge-based sectors by using existing educational, human and business resources.

The success of the Vitesse model lies in its ability to bring career-oriented professionals, educators, and industry partners together and collaboratively shape individualized training solutions - providing new and relevant skills for the knowledge-based economy. Vitesse is expanding across Ontario with the assistance of Ontario Government's Strategic Skills Investment Program.

<http://www.vitesse.ca>



Value Beyond Service

Software and IT Professionals: Did you perform SR&ED eligible work?

The Scientific Research & Experimental Development tax credit incentives reduce the after tax cost of performing SR&ED in Canada to one of the lowest in the world. More than 19,000 claims are made each year for over \$3 billion in tax credits. Small and medium companies submit 75% of these claims, generally for \$20,000 to \$2M in expenditures per claim. However, it is estimated that 1/3 to 1/2 of eligible costs are not claimed each year because management either under claims on projects or they do not believe that their companies are doing SR&ED eligible work at all. IT companies tend to fit into the former category. If you answer in the affirmative to a number of the questions in the list below, contact Kevin Goheen, Director of SR&ED Tax Services, 613.726.1010, x.227, kgoheen@mclartyco.ca, for a free consultation.

Did your software project involve:

- 
 - New architectures, algorithms or database techniques?
 - Performance increases (response time, speed, user or database scalability, reliability?)
 - Interoperability with other systems and between different technologies where none existed before and where there are compatibility issues?
 - Development of new in-house development tools?
- 
 Before you began the design, were you uncertain whether or not the design would succeed? If you were certain it would succeed, were you unsure which design would achieve the best results?
- 
 Were you unable to find an “off-the-shelf” solution to your problem?
- 
 Did you develop a prototype design which failed? Did you then change your design and try to build another prototype? Did you document your design iterations?
- 
 After deployment, did you have abnormally high warranty costs with the product or large numbers of non-trivial bug fixes?
- 
 Would you feel comfortable making a presentation to your industry peers on the methods and practices that you learned in your project?



The Talent First Network program is funded in part by the Government of Ontario.



The Technology Innovation Management (TIM) program is a master's program for experienced engineers. It is offered by Carleton University's Department of Systems and Computer Engineering. The TIM program offers both a thesis based degree (M.A.Sc.) and a project based degree (M.Eng.). The M.Eng is offered real-time worldwide. To apply, please go to: <http://www.carleton.ca/tim/sub/apply.html>.