Major Open Source ILS Products

At least four open source ILS products are available today: Koha, Evergreen, and OPALS. (see table 4). While there may be some additional products, these four have emerged as the most widely implemented and serve as good examples of the current state of the art of the open source ILS. While each of these products bears a great deal of similarity in approach, they also differ in features and functionality and in their appeal to different types of libraries This section provides detailed information regarding each of these systems.

History and Background

Koha

Koha claims the status of being the first open source library automation system. This product traces its roots to 1999 in New Zealand, where a group of three libraries, the Horowhenua Library Trust (HLT), needed a new automation system to replace their current library automation system, called Catalist, which was not compliant with the looming Y2K issue. Rather than purchase a commercial system, HLT contracted with a consulting company named Katipo Communications to develop a new Web-based system. They named this new system Koha, the Maori word for gift or donation, and released it as open source, allowing libraries anywhere to use and help develop and support the software. The HLT libraries began using Koha on January 1, 2000.

A fairly quiet period followed the initial release of Koha, with a few individuals and libraries picking up on the system. No groundswell of interest resulted right away. The initial version of Koha was quite adequate for three libraries of HLT that together served a community of about 30,000 residents with a collection of about 80,000 volumes. At that point, Koha did not have some of the features considered mandatory for most libraries—no support for MARC, Z39.50, SIP, or NCIP. It did not seem scalable to handle the load of very large libraries. Nevertheless, the number of libraries interested in Koha continued to increase. Around fall 2000, for example,

Product	Types of Libraries Adopting Product
Koha	Small to mid-sized public libraries, small to mid-sized academic libraries, museums, special libraries. Gradual penetration into libraries of increasing size and complexity.
Evergreen	Consortia of public libraries; individual libraries, especially through SaaS. Increasing interest by academic libraries; next version will address features needed by academic libraries.
OPALS	K–12 school districts, school district consortia, union catalogs, church and synagogue libraries. Primarily deployed as SaaS or large consortial implementations.
NewGenLib	Libraries in the developing world.

Table 4
Open source ILS products and current market profiles

the Coast Mountains School District in the province of British Columbia in Canada adopted Koha with technical assistance from Steve Tonneson, the district's network engineer.

Interest in Koha increased dramatically when it was adopted by the Nelsonville Public Library serving Athens County in Ohio. This library, including a central facility in Nelsonville and six other branches throughout the county, serves over 62,000 residents with a collection of about 250,000 volumes. In about 2001, the library began investigating options to replace its Spydus library management system provided by Civica. Nelsonville was one of only a handful of libraries running Spydus in the United States. With Civica's corporate headquarters in the United Kingdom and its main library operations based in Australia, local support options were limited. More important, the library had strong ambitions to use open source technology in creative ways in support of its mission to the community.

Nelsonville's director, Stephen Hedges, began exploring whether open source software could provide the kind of automation platform that would meet the library's needs and provide a suitable replacement for Spydus. The library focused on Koha, which was the only reasonably complete open source ILS available at that time.

The initial assessment of Koha revealed that it required further development before it could support a medium-sized public library such as Nelsonville. The library required support for MARC21 bibliographic records to stay within national standards and to have a path for migrating its database from Spydus. The library participated in statewide MORE resource sharing initiative, requiring support for Z39.50. The library also required SIP2 or NCIP for use with its self-check stations. Koha lacked these features at that time.[1]

Ohio Libraries Share: MORE Statewide Resource Sharing
www.library.ohio.gov/more

In order for Koha to be a viable system for Nelsonville, significant development was required. Rather than looking to a commercial system that might already have these features in place, the library decided to invest in enhancing Koha and issued requests for proposals for specific development tasks. The library estimated that the costs for extending Koha would fall under what it would otherwise have paid for a system from a commercial vendor.[2]

Koha advanced through this sponsored development model. HLT financed the initial development of Koha for its needs as a set of small libraries in New Zealand. Its automation needs were modest, served well by a system with a simple bibliographic database. When released as open source, Koha then became a starting point available to others to extend. Nelsonville sponsored the development of MARC21, advancing the software to the point where it could be viable for a much broader range of libraries. The Crawford County Library System sponsored the integration of the Zebra XML-based data storage and retrieval into Koha, allowing it to scale to even larger libraries.

Paul Poulain, already involved as a Koha developer in France, was awarded the contract for reworking Koha to support MARC21. Poulain has continued his involvement with Koha and has recently founded BibLibre as a company to provide Koha support and development services in France.

With development of the mandatory components complete, the Nelsonville Public Library began production use of Koha on August 26, 2002, establishing it as the first public library in the United States to rely on an open source ILS. The success of Koha at Nelsonville catalyzed further interest, leading to its adoption by many other libraries and to the formation of LibLime and other firms devoted to its promotion, development, and support.

Evergreen

Another major example of an open source ILS emerged from Georgia. The Georgia Public Library System (GPLS) provides automation support to public libraries throughout the state through a shared library automation environment, called the Public Information Network for Electronic Services, or PINES. Out of the 408 library facilities in the state, at least 266 participate in PINES. These libraries hold a combined collection of 7.7 million items. One of the key tenets of PINES is wide sharing of resources. A single library card entitles a patron of one library to use materials throughout the PINES consortium.[3]

The initial PINES implementation was based on the Unicorn ILS provided by Sirsi Corporation (now SirsiDynix). The initial selection of Unicorn for the PINES was made in 1999, representing one of Sirsi Corporation's largest contracts. The contract for Unicorn extended through June 2005. The PINES project under Unicorn was deployed in two phases, resulting in one of the largest shared automation platforms in the United States.[4]

All was not well, however, as GPLS was not entirely satisfied with the performance of the software and believed that it could develop a new system custom-built to its needs at a lower cost than the fees being paid to Sirsi Corporation. In an open letter dated June 5, 2004, State Librarian Lamar Veatch announced that GPLS had elected to commence the development of its own library automation system.[5] Its review of the options available at that time concluded that none of the products available from the commercial vendors would meet its expectations.

Beginning in June 2004, a team of programmers at GPLS began a two-year project to develop a new automation system for the PINES consortium. On September 5, 2006, the PINES consortium successfully completed the transition from Unicorn to Evergreen. In the two years since the migration to Evergreen, the consortium has increased its ranks to over 270 library facilities.[6]

As with Koha, the success of Evergreen sparked broader interest. Since Evergreen was built from the beginning to serve a large consortium, it became positioned as a scalable open source ILS. Since the initial launch of Evergreen for Georgia PINES, this open source ILS has continued to build momentum. A company called Equinox Software was formed to promote, develop, and support the product. A growing number of libraries have adopted Evergreen, as we will see below.

OPALS

The Open Source Library Automation System, or OPALS library automation system, was created primarily for the K–12 school library automation market and was open source from its inception. Media Flex, the company behind its development, had previously been involved in creating proprietary ILS products for this library sector. The OPALS software has been in development since about 2000.

The K–12 school library automation market has seen a major transition toward centralized automation at the district level using Web-based systems in the last few years. Having software installed for each individual library within a district, while often a necessity in earlier times, places a high burden on sparse IT resources. OPALS fits well into this model, providing automation at the district level and many larger scale implementations for school district consortia.

The state of New York provides a structure for the support of its nonmunicipal schools, organized into 37 Board of Cooperative Educational Services (BOCES). Of the 721 school districts in the state, all but those in New York City, Buffalo, Rochester, Yonkers, and Syracuse share resources and services through a BOCES. A number of the BOCES in New York have adopted OPALS to deliver library automation and union catalogs for their school libraries. In an even broader initiative, the SCOOLS union catalog was created in support of interlibrary loan services among its participants, based on OPALS software.[7]

The OPALS software emerged from a project in February 2002, where six of the New York BOCES school library systems wanted to collaborate to create a combined resource-sharing environment. This project involved 300 school libraries, 700,000 bibliographic records, and 1.7 million holdings. Initially, the project considered using Koha, but determined at that time that Koha could not scale to a system of this size. A new system was cre-

ated based on MySQL, Perl, and Zebra and was operational by August 2003. The OPALS decision to use Zebra in combination with MySQL predated the decision to use this combination of database technologies by Koha, which began in December 2005. Media Flex served as the contractor that partnered with the six New York school library systems.[8]

NewGenLib

Interest in open source ILS extends throughout the world. The developing world in particular stands to benefit from finding ways to implement library automation at a lower cost than might be possible through proprietary systems. One effort to create an ILS specifically for libraries in the developing world started in India through a collaboration between a nonprofit professional organization, the Kesavan Institute of Information and Knowledge Management, and a commercial software development firm, Versus Solutions. The development of the software began in about 2003 as proprietary software, but it was released as open source in January 2008.[9]

NewGenLib has not seen adoption in North America. We include it as an example of international interest. Other open source ILS projects in other parts of the world are likely to be underway. If the open source ILS movement in North America can demonstrate lower costs and sustainable support models, we can expect it to have a major impact in the developing world. Many of the library automation projects in the developing world rely on subsidies provided by governmental and nongovernmental agencies. The growth of open source ILS may depend on these agencies moving away from strategies based on proprietary software.

Trends in Open Source ILS Adoption

We're in the early phase of the open source ILS. While some individual libraries began their involvement with these automation systems beginning in about the year 2000, the impact on the overall library automation world has been almost negligible until the last two years. The pioneering efforts of early implementers have led to the creation of viable products and support structures available through commercial companies that make this approach accessible to a broader range of libraries (see table 5).

Companies offering proprietary ILS products have dominated the library automation industry for the last two decades. These products and companies continue to represent a very large proportion of new ILS implementations. When considering the overall installed base of ILSs throughout the world, only a tiny fraction use open source products. Yet, the rate of growth seen in this early

Product	License
Koha	Public libraries (small to mid-sized), small to mid-sized academic libraries, museums, other special libraries
Evergreen	Large-scale library consortia; individual libraries through SaaS
OPALS	School districts; BOCES; individual school, synagogue and church libraries through SaaS
NewGenLib	Libraries in the developing world

Table 5
Open source ILS market trends

phase, if sustained, stands ready to reshape the industry.

According to the most recent "Automation Systems Marketplace" report published in *Library Journal,* LibLime reported contracts for Koha services to 57 libraries in the 2007 calendar year, out a total of 607 for all public and academic libraries, or roughly 9.4 percent. Considering that this was the first year that open source ILS products represented a measurable portion of the market, this figure may represent the beginnings of a major trend.

Date	Library		Branches	Volumes	Population Served
Jan 2000	Horowhenua Library Trust	Catalyst	3	80,000	30,000
Fall 2000	Coast Mountains School District (BC)		8		
Aug 2002	Nelsonville Public Library	Spydus	6	250,000	65,000
Mar 2006	West Liberty Public Library (IA)	Athena	1	18,000	5,000
Dec 2006	Crawford County Federated Library System	Winnebago	10	250,000	88,696
Feb 2007	Hartland Public (ME)	local	1	18,000	6000
Feb 2007	Stow-Munroe Falls (OH)	Dynix	1	120,000	40,000
Aug 2007	INCOLSA	Unicorn	30		
Sep 2007	Central Kansas Library System	various	31		
Oct 2007	Howard County (MD)	Horizon	7	1,000,000	266,000
Jan 2008	Geauga County (OH)	Dynix	7	500,000	85,000
Jan 2008	WALDO Consortium	Voyager	15		
Feb 2008	MassCat Consortium		100		
Mar 2008	Santa Cruz Public	DRA Classic	11	575,000	200000
Mar 2008	Ashtabula consortium	Horizon	6	235,000	
Apr 2008	Northeast Kansas (NExpress)	Unicorn	116		
Jun 2008	Polytechnic University	Data Trek		187,000	
Jun 2008	Salinas Public (CA)	Dynix	3	225,000	150,000
Jul 2008	Highland Park Public (NJ)	Horizon	1	65,000	14,000
Jul 2008	Butte-Silver Bow Public (MT)	Winnebago	1	65,000	35,000
Jul 2008	Grand County Public (UT)	Follett	2	50,000	
Aug 2008	Southeast Kansas	various	11	354,000	
Aug 2008	New Durham Public (NJ)	none	1	12,000	2,500
Aug 2008	Blue Mountains Public (ON)	Winnebago	1		6,500

Table 6
Selected libraries moving to Koha in North America

Date	Library	System	Branches	Volumes	Population Served
Sep 2006	Georgia PINES	Unicorn	270	1,700,000	
Jan 2008	Kent County (MD)	Horizon	3	50,000	20,000
Apr 2008	SITKA Consortium (BC, Canada)	various	18+		
Apr 2008	Michigan Library Consortium	various	6+		
Jun 2008	Marshall Public Library (MO)	Unicorn	1	30,000	12,500
Aug 2008	Indiana Evergreen	various	19	132,000	12,000

Table 7
Selected libraries moving to Evergreen in North America

The announcements made through 2008 presage an even larger proportion. Both LibLime and Equinox Software have made announcements of library commitments to their open source products with greater frequency than seen by the companies offering proprietary systems.

Tables 6 and 7 describe some of the open source ILS projects that have been publicly announced. In some cases, such as SITKA and Evergreen Indiana, the announcement involves an initial phase expected to expand to a much larger scale.

Open source ILS has not yet significantly penetrated the realm of large libraries. In academic libraries, we observe that no ARL (Association of Research Libraries) member has selected an open source ILS. Large municipal libraries have not been moving toward open source products. The King County Library System, a very large library system in Washington, has publicly announced its interest in moving to an open source ILS, with an eye on Evergreen. The Delhi Public Library, a municipal system with 56 branches and a collection of 1.4 million items in India, recently migrated to Koha. It is still unclear the extent to which the Koha system is being used and how that use compares to municipal libraries in North America.[10]

Evergreen has proven itself as a system capable of supporting large library consortia. These consortia tend to be comprised of smaller libraries. PINES, for example, serves over 270 libraries in Georgia, but does not include the high population centers of Atlanta-Fulton County, Cobb County, and DeKalb County.[11]

In broad terms, we can expect the open source ILS products to steadily reach into ever larger library environments as the products mature and become better established. That has been the pattern to date—open source ILS products face the same challenges as proprietary systems in moving into the ranks of larger libraries. Large libraries are reluctant to adopt an ILS that has not already proven itself successful in organizations of similar size and complexity.

Some academic libraries have also begun to move to open source systems. Koha and Evergreen both emerged in the public library sector. Given the differences in automation requirements for public and academic libraries, the question of whether they can be served by the same ILS products is often asked. Koha has demonstrated some appeal to both library types, though its portion of academics remains small relative to publics. The Westchester Academic Library Directors Organization represents a commitment by a group of academic libraries. In Cyprus, the Near East University Library, with a collection of 1.5 million volumes implemented Koha in 2006.

Evergreen positions itself as scalable to large installations. Its lack of modules for academic reserves, acquisitions, and serials required by academic libraries has so far excluded it from adoption by large academic libraries. The Conifer Project, involving Laurentian University, the University of Windsor, and McMaster University in Canada, has been working on enhancing Evergreen for use in academic libraries, moving toward a target implementation date of May 2009.[12] The University of Prince Edward Island put Evergreen into production in June 2008, using alternate approaches for acquisitions, serials, and course reserves.[13]

Geographic Impact

Open source ILS has made the most significant impact in North America. The United States and Canada provide a more favorable climate for open source ILS than other regions, and the philosophical preference for open source software is stronger in this region. Conferences such as Code4Lib, Access, and the LITA Forums provide fertile venues for cultivating interest in this approach. While open source ILS has made strong inroads into library automation industry in the United States and Canada, its impact elsewhere has been less dramatic.

The United Kingdom, Europe, and Asia have not been so dramatically affected. In these regions, the procure-

ment processes is usually quite formalized. In the recent JISC SCONUL LMS Study report, open source ILS was not portrayed with strong interest:

> The procurement and implementation of an Open Source LMS is not workable for most institutions in the current climate, largely because of the staff capacity and support overheads, but also because the mission criticality of library systems requires users and procurers to have confidence in a robust system. However, Open Source developments are a valuable catalyst for change in terms of exploring possibilities and pushing boundaries for the community.

In the developing world, UNESCO has been very active in distributing various flavors of the CDS/ISIS library automation software to libraries. While some are moving toward open source library automation systems, this is only a small portion of the overall automation efforts in developing countries. In comparison to the thousands of libraries using some variant of the CDS/ISIS software provided by UNESCO, the 122 libraries using NewGenLib is a tiny proportion.[14]

Licensing and Distribution

Each of the open source ILS products covered follows the GNU General Public License for software (see table 8). As we noted above, this is a full copyleft license that ensures strong freedoms in the way that the software is shared and modified. Convenient download sites are provided for Koha, Evergreen, and NewGenLib. Copies of OPALS are provided by Media Flex on request. Most users of OPALS have some kind of relationship with Media Flex, either through a SaaS arrangement or support arrangement.

Commercial Support Firms

Many commercial companies have emerged to promote, support, and develop each of the open source ILS products. While some libraries might venture to implement an open source ILS on their own, the majority seem to prefer working with a specialized vendor for some level of assistance. These companies work with a much different business model than those involved with proprietary ILS products. Their revenue streams are generated exclusively by services rather than by licensing fees (see table 9).

LibLime

The successful deployment of Koha at the Nelsonville Public Library led to interest by other libraries. The library itself could not necessarily commit itself to devote its own resources to assist other libraries with Koha. The individuals involved with the Koha initiative at this library decided to form a separate company devoted to Koha and other open source software for libraries.

LibLime formed in early 2005, with Joshua Ferraro, a former systems administrator at Nelsonville Public Library serving as its CEO. Ryan Higgins served as president for products, and Tina Burger as vice president for marketing.

Since its founding, LibLime has steadily increased its standing as the pivotal company involved with Koha. LibLime operates as a private company, owned by its founders. In 2006, it acquired some assets from Skemotah Solutions, a relatively small endeavor operated by Stephen Hedges, formerly the director of the Nelsonville Public Library. In February 2008 LibLime acquired the Koha-related activates from Katipo Communications, its original developer. LibLime operated this New Zealand operation for about a year until about February 2008 [15] Through these acquisitions LibLime gained control of key assets related to Koha, including copyrights, trademarks, and Internet domains, as well as additional customers. In July 2008, LibLime acquired the assets of CARE Affiliates, a firm co-founded by Carl Grant and Lou Leuzzi, specializing in open source software for libraries outside the ILS sphere.

Product	License	Source
Koha	GNU General Public License	www.koha.org/download Koha is written in Perl, so distribution of source code is automatic.
Evergreen	GNU General Public License	http://open-ils.org/downloads.php Includes binaries and source code for Evergreen and OpenSRF
OPALS	GNU General Public License	No download option available; copies of binaries and source code are available from Media Flex on request.
NewGenLib	GNU General Public License	http://sourceforge.net/project/platformdownload.php?group_id=210780

Table 8
Open source ILS license and distribution information

Product	Key Support Company	Brief Background
Koha	LibLime	Launched in early 2005 by individuals involved with the implementation of Koha at the Nelsonville Public Library.
Evergreen	Equinox Software, Inc.	Launched in Jan. 2007 by individuals involved with the creation of Evergreen at the Georgia Public Library System.
OPALS	Media Flex	Veteran company involved in school library automation. Had previously created the Mandarin library automation system. New effort to create a product for this market as open source.
NewGenLib	Kesavan Institute of Information and Knowledge Management / Verus Solutions Pvt. Limited	Developed initially as proprietary software. Made the transition to open source in Jan. 2008.

Table 9
Open source ILS products and companies

Although LibLime gained some assets through these acquisitions, it has primarily seen organic growth through a rapidly growing body of customers with a corresponding increase in staffing. LibLime has attracted a cadre of industry veterans, largely fleeing from other companies, particularly SirsiDynix, which is undergoing downsizing due to recent business consolidations. These have included Galen Charlton, now VP for research and development, formerly with Endeavor Information Systems; John Rose, VP for strategic markets, formerly with SirsiDynix; Marc Roberson, VP for library partners, formerly with SirsiDynix; Debra Denault, operations manager, formerly with VTLS and Ex Libris.[16]

Equinox Software

Development of the Evergreen software for Georgia PINES was done by a team of programmers employed by the Georgia Public Library System. Following the successful implementation of Evergreen for PINES, the team involved with its development broke away from GPLS and formed an independent company named Equinox Software, Inc. The relationship of these individuals relative to SPLS changed from being direct employees to being a private contractor with the state. The development team for Evergreen included Brad LaJeunesse, Jason Etheridge, Mike Rylander, and Bill Erickson, all of whom made the transition from GPLS employees to Equinox Software. LaJeunesse, system administrator for PINES, serves as president of Equinox. GPLS continues to own the majority of the copyrights on Evergreen.

Equinox Software has seen steady growth from its inception. The company has a growing base of customers looking to it to provide support for their use of Evergreen. While still a small company, it has expanded its workforce in tandem with its growing customer base. Industry veterans that have joined Equinox include Robert E. Molyneux, formerly with SirsiDynix; Karen Schneider, well-known writer and blogger; and Shae Tetterton, formerly with SirsiDynix.[17]

Media Flex

Media Flex has long been involved with proving automation products, supplies, and services to libraries. The company primarily focuses on the K–12 school, small college, and special libraries. According to their website, the company was founded in about 1985 by Harry Chan.

The company developed the DOS-based Mandarin library automation system in the mid-1980s. In June 1995, the Mandarin Library Automation System was acquired by SIRS, a publishing company that had previously been a distributor of the Mandarin software in the United States. The DOS-based Mandarin system was superseded by the Windows-based Mandarin M3 system, released in 1998. In 2001, SIRS separated its publishing activities from its library automation division, forming Mandarin Library Automation. At about this time, Chan exited the company and returned to Media Flex, a library supplies and services company that he had also founded. ProQuest acquired SIRS Publishing in July 2003. Mandarin Library Automation continues as an independent company.[18]

Media Flex reentered the library automation industry, developing a new automation system called Open Source Automated Library System, or OPALS, this time following the open source model. Media Flex began development of this system in 2002, targeting much the same type of libraries that used the company's original Mandarin product.

According to the web site, the company operates in the United States under the name Media Flex in Champlain, New York, and internationally from its offices in Montreal, Quebec, under the name Bibliofiche. The company also operates the CERFinfo homework helper site, providing access to over 400,000 Web sites selected for K–12 students and teachers.

Versus Solutions

Though fairly far removed from the North American open source library automation scene, we are seeing a somewhat similar scenario in India. The NewGenLib open source ILS was spearheaded by the Kesavan Institute of Information and Knowledge Management, contracting with Versus Solutions for development and support of the system. Important differences apply to NewGenLib, relative to the North American companies involved in open source ILS. Given the orientation of NewGenLib to libraries in the developing world, opportunities for revenue may not necessarily to sustain the overall venture as a for-profit endeavor.

The original development of NewGenLib followed the proprietary software model. The development of NewGenLib commenced in about 2003, with funding for the development of the system coming from a venture capital firm and from other private sources. The decision to transition the project to open source did not happen until January 2008.[19]

Index Data

Through not offering its own ILS product, no discussion of open source software for libraries would be complete without mentioning Index Data. This company, based in Copenhagen, Denmark, also maintains a presence in the United States and in the United Kingdom. According to their web site, Index Data was co-founded in 1994 by Sebastian Hammer and Adam Dickmeiss. David Dorman serves as the U.S. marketing manager. Sebastian Hammer serves as its president and leads its software development initiatives. Lynn Bailey was appointed as Index Data's CEO in December 2007, and works from Massachusetts. The company employs a total of 10 people.

Index Data has created infrastructure components very widely used in library automation products. Software components created by Index Data are used in the commercial products offered by Ex Libris, Talis, Fretwell-Downing, Infor, Isacsoft, Polaris, and others. Its YAZ toolkit for Z39.50 and SRU/W and server finds use in both proprietary and open source ILS products and is licensed under the Revised BSD license. The YAZ Proxy server, offered under GPL General Public License, can be used in a variety of Z39.50 environments to increase performance and deliver MARC data in XML. Zebra, an XML indexing and retrieval engine, finds broad use, including in Koha and OPALS. The company created a federated search engine it calls Pazpar2 and offers a hosted service

version called MasterKey. The open components created by Index Data can be used without cost. The company's business model is based on consulting services and support arrangements surrounding these products and on custom development projects.

Index Data stands as one of the pioneers in the commercial open source arena for library software. Since the company's products tend to be used by other developers, its name may not be as familiar. Still, its impact on the library automation industry cannot be overstated.

Technology Components

Each of the open source ILS products makes use of a number of underlying components. The availability of mature and reliable open source components provides a tremendous advantage available for both open source and proprietary development projects. The use of these components saves developers from reinventing many areas of underlying infrastructure and to focus on the business logic and architecture of their application.

Server Operating System

All of these open source ILS products were designed to run on some flavor of Linux for the server functions. While some might theoretically be able to run under Microsoft Windows Server, libraries interested in using an open source ILS are also likely interested in avoiding proprietary operating systems. But for libraries whose data center might prefer Windows Server, it should be possible to assemble implementations on that platform.

Web Server

The Apache Web is very well established as a Web server and is used in almost all open source Web-based applications and in a large percentage of proprietary products. Each of the open source ILS products uses Apache.

Database Engines

The systems make use of different database engines. MySQL, originally developed by MySQL AB and acquired by Sun Microsystems in January 2008 is well established as an open source relational database engine and has the reputation of handling even the largest-scale applications.[20] It offers very fast performance for applications using structured data under a heavy transaction load. Facebook, one of the busiest destinations on the Web,

relies on MySQL. Of the open source ILS products under consideration, Koha and OPALS make use of MySQL.

In the library domain, MARC records are notoriously difficult to handle by a standard relational database management systems such as MySQL. One of the issues with early versions of Koha involved concerns with its ability to scale to large-scale use based solely on MySQL. Index Data's Zebra technology offers a scalable data storage and retrieval engine well-suited for MARC and other bibliographic data. LibLime and Index Data collaborated to integrate the Zebra search engine into Koha. It is a standard feature beginning with Version 3.0 for handling the bibliographic database. MySQL continues to power the rest of the system, and for smaller libraries, the system can be configured to use it for the bibliographic database. OPALS follows a similar approach, making use of both MySQL and Zebra.

PostgreSQL is an open source database management environment positioned as the most advanced available, able to handle extremely large and complex data sets and high transaction loads. Evergreen and NewGenLib both rely on PostgreSQL for all data functions.

> *MySQL*
> www.mysql.com/
>
> *PostgreSQL*
> www.postgresql.org

Programming Environment

Koha, OPALS, and Evergreen rely on Perl as the programming environment on which their business logic resides. OPALS relies on technologies surrounding Java.

The NewGenLib staff client was created using Java Swing, a programming environment for creating full-featured graphical applications that operate on any platform offering the Java Runtime Environment. Reports and other system features needing text processing rely on Open Office, using the Apache POI libraries for reading and writing files compatible with Microsoft Office. The system makes use of Hibernate to perform mapping between the Java-based business logic and the PostgreSQL database.

> *Hibernate*
> www.hibernate.org
>
> *Diagram of NewGenLib technology components*
> www.verussolutions.biz/web/node/18

One of the interesting features of the technology underlying Evergreen involves the Open Scalable Request Framework, or OpenSRF, a communications layer that was created for the project based on the Jabber instant messaging protocol. Jabber implements the Extensible Messaging and Presence Protocol (XMPP), an open, stable and reliable standard. Because the system is based on a service-oriented architecture and designed to be clustered across multiple servers, a messaging layer is required for communications among program elements. What's unusual about Evergreen is that its developers chose to create their own messaging layer rather than use technologies more widely seen in service-oriented applications.

Client Environments

Koha and OPALS rely entirely on the Web for both their online catalog and for staff access to the system. This approach avoids the need to install any software on the computers used by library staff, but means that the software must operate within the limits of what can be accomplished using Web forms, JavaScript, Ajax, and the like. NewGenLib relies on a staff client created in the Java Swing environment, which offers a full graphical interface, but must be installed on staff workstations. The Evergreen staff client is built on XULRunner, an open source runtime environment for building desktop applications created by the Mozilla Foundation. Though based on common Internet technologies, the Evergreen staff client must still be download and installed, but it offers an more sophisticated interface than would be possible through a browser interface alone.

> *XULRunner*
> http://developer.mozilla.org/en/XULRunner

These observations on the technology components implemented for each of the systems give us a general impression of the underpinnings each product. All four systems make use of well regarded and widely used components (see table 10). Knowing the technology components involved gives only the most general impression of each system's internal architecture. The ability for each system to withstand the load imposed by a given library depends on a myriad of other factors including issues of systems design, quality of programming, tuning parameters, and the hardware platform selected.

Product	Underlying Components
Koha	**Operating systems supported:** Linux. Debian most common. Windows possible, but less tested **Database:** MySQL for operational data. Zebra from Index Data for bibliographic data. **Programming language:** Perl **Web server:** Apache
Evergreen	**Messaging environment:** OpenSRF (based on Jabber instant messaging protocol) **Database:** PostgreSQL **Programming environment:** Business logic in Perl, infrastructure components in C **Web server:** Apache **Clustering engine:** Slony-I / PGPool **Staff client:** based on XULRunner
OPALS	**Operating system:** Linux **Database:** MySQL, Zebra **Bibliographic search engine:** Zebra from Index Data **Z39.50 engine:** YAZ from Index Data **Web server:** Apache **Programming environment:** Perl
NewGenLib	**Server operating system:** Linux **Web server:** Apache **Database:** PostgreSQL **Java container environment:** Apache Tomcat **Messaging layer:** JDOM (XML-based) Java-based document object model for XML **Object-relational mapping layer:** Hibernate; Apache (formerly Jakarta) POI for reading/writing Microsoft Office files; Open Office **Staff clients:** Java Swing

Table 10
Open source ILS product technology components

Standards

A number of standards, both national and international, have been developed that apply directly to library automation products such as the ILS. The use of these standards ensures that the systems will be interoperable with other automation systems, both those within the organization and those that might be used externally. Standards protect a library's investment in its data, preventing loss of information should the library need to migrate to another system. Table 11 presents a checklist of the standards implemented in each of the open source systems.

Features and Functionality

In this section, we will take a look at the products themselves, looking at the modules offered and some of the general features available in each one. While we attempt to provide some information regarding the functionality of each product, this is not meant to be a definitive review. The observations made derive from live systems, demo sites, or documentation provided by the vendor. The fea-

tures available will vary according to individual implementations, the version of the software in use, configuration options selected, and the like. Given the nature of open source software to allow local modification, there may be even more local variability than with proprietary systems. While we aim for accuracy, libraries should perform their own assessments of the functionality of systems in which they have an interest.

One of the key differences between a proprietary and an open source ILS involves the accessibility of information about the features available. With proprietary systems, a library may issue an RFP, eliciting a response where the vendor describes the functionality available. With open source systems, libraries can much more easily see the software in action. If they are not able to obtain sufficient information from peer libraries that use the software or from demo systems, they can download and install a copy of the software and even load their own data.

Table 12 identifies the sources that were examined for information presented in this section on the functionality of each system. Tables 13–17 describe only the most basic categories of ILS functionality. They aim to provide only a general impression of the areas of functionality addressed, not necessarily to provide detailed analysis of how a specific function might be implemented and whether it might meet any given library's expectations.

Function	Koha	Evergreen	OPALS	NewGenLib
Unicode 3.0	☑	☑	☑	☑
Z39.50 client	☑	☑	☑	☑
Z39.50 server	☑	☑		⊘
SRU/W server	☑	☑		☑
SRU/W client	☑	☑		⊘
MARC21	☑	☑	☑	☑
ISO 2709 (MARC communications format)	☑	☑	☑	☑
Dublin Core	☑	☑		☑
MODS	☑	☑		☑
OAI-PMH	☑	☑		☑
Z39.71 (serials display)	☑	⊘		☑

Table 11
Standards supported

We do not attempt to compare the functionality of these open source products with the proprietary systems.

The Scope of the ILS

A fundamental trend in libraries is an increased investment in electronic content, especially in collections of electronic journals, aggregated databases of articles, and other packages of content. The ILS has a limited role in the management of this aspect of the library's collection. While the ILS may include bibliographic records for each journal title represented in its electronic collection, it generally does not attempt to provide information about each article within these collections. Libraries license these products from publishers, who usually provide an interface to search and view content from these collections. In its current form, the ILS specializes in the library's print collection.

Given the specialization of the ILS on library print collections, a number of other software products have emerged that deal with different aspects of electronic content. These include:

- **OpenURL link resolvers** for tracking individual holdings within e-journal collections and providing context-sensitive linking. These products maintain a detailed knowledge base of the specific holdings represented by the library's subscriptions to aggregated content packages, e-journals, and other electronic content products.
- **Federated search platforms** simultaneously search multiple resource collections, often including the library catalog and selected packages of electronic content.
- **Electronic resource management systems** specialize in automating the management of the electronic

Product	Sources Consulted
Koha	**Online catalog:** Athens County Public Libraries: http://search.athenscounty.lib.oh.us **Staff client:** http://academic-staff.demo.kohalibrary.com
Evergreen	**Online catalog:** Georgia PINES: http://gapines.org **Staff client:** Downloaded and installed staff client from: http://demo.gapines.org and used demo library login.
OPALS	**Online catalog:** http://opalsbtl.stier.org/bin/home **Staff client:** Documentation and screen images from http://www.opals-na.org
NewGenLib	**Online catalog:** Bangalore University: http://202.141.128.115:8080/newgenlibctxt/LibraryAction.do?college=Bangalore%20University%20Library **Staff functionality:** NewGenLib website: www.newgenlib.com

Table 12
Open source ILS products: sources of information on functionality

Open Source Integrated Library Systems **Marshall Breeding**

content product subscriptions, including aspects of procurement, license tracking, access rights, vendor contact data, usage reporting, and other information to help the library efficiently manage its electronic collections.

- **Discovery interfaces** provide an alternative to the online catalog module delivered with an ILS. This genre of products aims to provide access to a broader range of resources beyond that managed within the ILS, following interface techniques consistent with modern Web destinations such as faceted browsing, relevance-ranked results, visually enhanced displays, and advanced resource fulfillment services.

We are starting to see movement toward a more comprehensive approach to automation beyond these traditional limits. The Open Library Environment (OLE) project has recently launched as a multi-institutional effort. Led by Duke University with funding from the Andrew W. Mellon Foundation, this project is working toward the development a more expansive model of library automation based on the Service Oriented Architecture and vendor initiatives, such as Universal Resource Management system articulated by Ex Libris.

Please note that the open source ILS products considered in this report largely stay within the confines of the traditional scope as established by their proprietary counterparts.

Open Library Environment (OLE) project
http://oleproject.org

Support for Consortia

Libraries follow many different organizational models that have a major impact on the way that they implement their automation environment. Some libraries operate fairly independently and correspondingly want their own ILS to manage and provide access to its resources. It's extremely common, however, for libraries to be organized into consortia and to share an implementation of an ILS. A consortial implementation of an ILS allows the participating libraries to pool their resources to lower the costs associated with systems management. More important, by combining their collections they offer more materials for their users.

Providing support for a consortium introduces a number of challenges for the ILS. Creating an ILS for a single library involves support for a simpler organization structure. Consortia involve more complex organizations of participating libraries. A key challenge of an ILS used to automate a consortium involves balancing the needs for the individual libraries to maintain their identities and local automation preferences versus gaining efficiencies through sharing resources and policies across the consortium as a whole. ILS implementations for consortia must manage much larger collections and must stand up to very high transaction loads to accommodate the combined automation activities of each participating library.

Evergreen positions itself as an open source ILS designed to accommodate consortia. Its initial development for a large consortium of public libraries in Georgia reinforces this capability. The system allows each library the ability to define its individual policies and preferences for circulation while providing a high degree of resource sharing through a shared consortial catalog.

OPALS was also designed to provide a high level of resource sharing for school libraries through union catalogs, district-wide implementations, and consortia of school districts. The implementations of OPALS in several BOCES in New York demonstrate the system's ability to support the complexity and performance requirements of large consortial implementations.

Koha has also seen a number of consortial implementations, including the MassCat in Massachusetts, several regional library systems in Kansas, and the Indiana Shared Catalog. In addition to consortial implementations, many Koha implementations support single library organizations, many including multiple branches or facilities.

Online Catalog

The online catalog module, sometimes called the online public access catalog (OPAC) of the ILS, enables users to search the library's collections and take advantage of online services. Basic functionality of this module includes the ability for users to perform searches or browse through the collection and to view descriptive and status information on any given item. Most ILS online catalogs allow patrons to sign into a personal account, view lists of items that they have currently checked out, renew items, place requests for items, pay outstanding fines, and other similar services.

Traditionally this component of the system has focused on access to print collections; as libraries transition to managing increasing proportions of electronic content, the role of the online catalog has become more complex. Many libraries, for example, have implemented products from a new breed of discovery interfaces that aim to provide access to a broader universe of content beyond that managed by the ILS.

The interfaces expressed in Koha and Evergreen bear many similarities to the standalone discovery interface products. They look more modern, make use of faceted browsing, default to relevance sorting of results, and makes use of cover art to enhance the visual appeal of the user

Function	Koha	Evergreen	OPALS	NewGenLib
Basic search (single search box)	☑	☑	☑	☑
Advanced search (multiple field selections)	☑	☑	☑	☑
Brief display list	☑	☑	☑	☑
Full record display	☑	☑	☑	☑
MARC display	☑	☑	☑	⊘
Faceted browsing	☑	☑	⊘	☑
Relevancy sorting	☑	☑	⊘	☑
Book jacket display	☑	☑	☑	⊘
Download / save records	☑	☑	☑	☑
E-mail records	☑	⊘		☑
Place / cancel hold (or reservations)	☑	☑		☑
Shelf / call number browse	☑	☑		⊘
Browse collection (author, title, series)	⊘	☑	☑	☑
Patron login	☑	☑	☑	☑
Patron account—view item charged to me	☑	☑	☑	☑
Patron account—pay fines	⊘	☑		☑
RSS delivery of search results	☑	⊘	⊘	⊘
Integrated federated search	☑	⊘	☑	⊘

Table 13
Online catalog functionality checklist

interface. NewGenLib and OPALS offer online catalogs with much more traditional interface design (see table 13).

Circulation

The circulation module of the ILS addresses a need every library has—to automate the tasks involved in loaning materials to library patrons. This module must offer very simple and efficient ways to perform routine transactions like checkouts, renewals, and returns. The circulation module uses the databases that manage the items within the collection and registered library patrons and often includes the ability to create new records when records are not already present in the system. Many libraries impose fines when materials are not returned on schedule, requiring the circulation module to track fine accumulations, manage payments, produce notices, and perform related functions. Requirements for circulation features vary by library type. Academic libraries, for example, often need the ability to manage a collection of items placed on reserve for courses, imposing in-house or short-term loans during the term of a course. Public libraries must deal with much heavier volumes of circulation transactions.

Each of the open source ILS products has quite capable circulation features, especially for public library environments. Academic reserves are currently under development for Evergreen and Koha (see table 14).

Cataloging

Any ILS must provide users with the ability to create records for new additions to the collection. A common workflow involves retrieving records from external resources such as OCLC WorldCat, the Library of Congress, or other libraries when possible, using a utility based on the Z39.50 search and retrieval protocol. When no existing record can be found, the cataloging utility needs to support the creation of original records. The library profession has well-established standards such as MARC21 and AACR2 to ensure that bibliographic records can be exchanged among libraries and that each field within the record will be populated consistently. Professional-level cataloging also involves the use of authority files to ensure the consistent use of names and subject headings.

The cataloging module also addresses the physical processing of materials, such as the creation of spine labels or pocket labels (see table 15).

Function	Koha	Evergreen	OPALS	NewGenLib
Check item to patron	☑	☑	☑	☑
Check in item	☑	☑	☑	☑
Register new patrons	☑	☑	☑	☑
Renew Items	☑	☑	☑	☑
Assess fines for late return	☑	☑	☑	☑
Fine notices	☑	☑	☑	⊘
Place items on hold (reserve)	☑	☑	☑	☑
Tally in-house use	☑	☑	☑	☑
Circulation of noncataloged items	☑	☑	☑	⊘
Academic course reserves (short-term loans)	⊘	⊘	⊘	☑

Table 14
Circulation functionality checklist

Acquisitions

The acquisitions module provides support—mostly on the financial side—for the process of adding new items to library collections. This module usually involves a database from each of the vendors that the library uses to purchase new materials and a financial system for tracking and allocating funds according to various budget categories. There are specific tasks automated by the acquisitions module, including placing firm orders for a needed item, managing approval plans where vendors supply materials based on collection criteria, processing invoices for items received, and approving payments. Larger libraries may implement automated transfer of data with their large suppliers, using protocols such as EDI.

The acquisitions process is one of the most complex aspects of library automation. Large libraries tend to make extensive use of the acquisitions functionality, often involving complex interchange of data with other financial systems. Smaller libraries may not use this module at all, managing the procurement of items by using spreadsheets. Academic libraries, especially large ones, tend to rely heavily on the ILS for the financial management of their collections budgets.

Development of an acquisitions module is underway for Evergreen. The next major release, Evergreen Version 2, has been positioned as the academic release, including modules for academic reserves, acquisitions, and serials management (see table 16).

Function	Koha	Evergreen	OPALS	NewGenLib
Create bibliographic / title-level record	☑	☑	☑	☑
Simple template for record creation	☑	☑	☑	☑
Support for MARC 21	☑	☑	☑	☑
Import MARC records with Z39.50	☑	☑	☑	☑
Add volumes / holdings / items	☑	☑	☑	☑
Harvest records with OAI-PMH	⊘	⊘	⊘	☑
Authority control	☑	☑	☑	☑
Produce spine labels	☑	☑	☑	☑
Produce pocket labels	☑	☑	☑	⊘
Export MARC records	☑	☑	☑	☑
MARC record validation	☑	☑	☑	⊘
Built-in documentation for MARC	☑	☑	☑	☑

Table 15
Cataloging functionality checklist

Function	Koha	Evergreen	OPALS	NewGenLib
Fund management	☑	⊘	⊘	☑
Vendor file	☑	⊘	⊘	☑
Place firm orders	☑	⊘	⊘	☑
Receive orders	☑	⊘	⊘	☑
Invoice processing (manual)	☑	⊘	⊘	☑
Invoice processing (EDI)	⊘	⊘	⊘	⊘
Approve / process payments	☑	⊘	⊘	☑
Claim items not received on time	☑	⊘	⊘	☑
Patron-initiated requests	☑	⊘	⊘	☑
Staff approval of patron requests	☑	⊘	⊘	☑
Gifts processing	☑	⊘	⊘	☑

Table 16
Acquisitions functionality checklist

Serials Control

The management of books seems simple compared to of the process of managing periodicals and other serials. Dealing with these materials involves both an initial establishment of a subscription and ongoing tasks related to incoming issues or volumes. The subscription record needs to reflect the expected schedule of the delivery of issues, the length of the subscription term, and other details. Given the great variability in the publication of serials, tracking them can get quite complex. Some of the tasks associated with the serials module include checking in issues as they arrive, generating claims for issues expected but not received and creating summarized holdings as issues are bound into volumes. The serials module manages the process of renewing the library's roster of subscriptions, often handled in bulk in conjunction with a serials subscription agent. Given the complexity of the materials involved, serials modules involve specialized and nuanced functionality.

One of the major issues in recent times, as libraries increasingly shift from print to electronic serials, involves the overlap between the serials module, the OpenURL link resolver, and an electronic resources management system. In the context of this trend toward electronic content, the need for the serials module of the ILS diminishes as the demand for an electronic resource management system increases.

The development of acquisitions and serials modules typically follows the basic modules like cataloging, circulation, and the online catalog. Some types of libraries, such as those in schools, tend not to use these modules, and even the fully mature ILS products geared toward them may not incorporate these modules (see table 17).

In broad terms, the functionality of the open source ILS products has matured at a fast pace. As more libraries adopt the software and choose to sponsor specific development projects, any lapses in functionality seem to be closing rapidly. Nevertheless, any library considering

Function	Koha	Evergreen	OPALS	NewGenLib
Create subscription record	☑	⊘	⊘	☑
Modify subscription	☑	⊘	⊘	☑
Checkin issues	☑	⊘	⊘	☑
Generate claims for missing / late issues	☑	⊘	⊘	☑
Binding management	⊘	⊘	⊘	☑
Support for MARC-21 format for holdings	⊘	⊘	⊘	☑

Table 17
Serials control functionality checklist

adopting an open source ILS needs to carefully review the features and functionality currently available and measure those against its current and anticipated needs.

It would be unrealistic, however, to suggest that the current open source ILS products can match the needs of the world's largest and most complex libraries. Many large academic libraries that express a high degree of motivation to move to an open source ILS have yet to migrate to one of these systems. It seems almost inevitable that the level of functionality will continually increase, broadening the universe of libraries for which an open source ILS will be a viable option.

Note

1. Many of the details of the implementation of Koha have been chronicled in "A koha Dairy: implementing Koha at the Nelsonville Public Library" by Stephen Hedges. http://www.kohadocs.org/koha_diary.html.

2. Based on personal correspondence with library director Stephen Hedges.

3. See the Georgia Public Library Service PINES Web site: http://www.georgialibraries.org/public/pines.php

4. Sirsi Corporation press relsease: http://www.librarytechnology.org/ltg-displaytext.pl?RC=8908

5. Text of the letter is available: http://www.librarytechnology.org/ltg-displaytext.pl?RC=10943

6. Breeding, Marshall. "PINES sets precedent for open source ILS" Smart Libraries Newsletter. ALA TechSource October 2006. p. 1

7. See: http://eboces.wnyric.org/wps/portal/BOCESofNYS

8. Pushpinder, K. Gill. "The State of Open Source Software in North Carolina School Media Centers" A master's paper for the M.S. in Library Science degree. July 2004. p. 23

9. Breeding, Marshall. "NewGenLib: An open source ILS for Libraries." Smart Libraries Newsletter. ALA TechSource. March 2008. p. 3.

10. See http://dbl.gov.in

11. Data from lib-web-cats http://www.librarytechnology.org

12. See: http://conifer.mcmaster.ca/

13. See Equinox Software press release: http://www.librarytechnology.org/ltg-displaytext.pl?RC=13302; Breeding, Marshall. "Evergreen Expands into Academic" Smart Libraries Newsletter. ALA TechSource. July 2008. p. 1-3.

14. See: http://www.verussolutions.biz/web/node/24

15. Based on personal correspondence with LibLime officials.

16. See LibLime press release "LibLime to Acquire CARE Affiliates" July 28, 2008. http://www.librarytechnology.org/ltg-displaytext.pl?RC=13424

17. Based on Equinox Software press releases

18. See Breeding, Marshall. "Partial management buyout at Mandarin." Smart Libraries Newsletter. ALA TechSource. October 2007.

19. See http://www.kiikm.org/. Also based on personal correspondence with L. J. Haravu.

20. See MySQL press release: http://www.mysql.com/news-and-events/sun-to-acquire-mysql.html

21. Veronica Adamson et al., *JISC & SCONUL Library Management Systems Study,* March 2008, 9. www.jisc.ac.uk/media/documents/programmes/resourcediscovery/lmsstudy.pdf (accessed Sept. 23, 2008)