

Smart Libraries Newsletter

News and Analysis in Library Technology Developments



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Smarter Libraries through Technology

The Growing Trend for Shared Technology Infrastructure

By Marshall Breeding

One of the most prevalent trends in the current phase of the library technology industry has been increased movement toward shared technology platforms to help libraries increase the impact of their collections through cooperation. Budget constraints prevent libraries from acquiring all the print and digital electronic resources to fulfill the interests and research needs of their communities. Libraries therefore seek out technologies that enable them to expand their offerings, often through partnerships and cooperative services with peer institutions.

Many different models of resource sharing support this need for libraries to offer materials beyond their immediate collections. Interlibrary loan, union catalogs, consortial borrowing, and expedited document delivery services are some examples. Each of these models helps libraries using different automation systems exchange materials.

Another model of resource sharing involves groups of libraries implementing a shared resource management and discovery system. Integrated library system (ILS) implementations serving multiple libraries in a consortium have been part of the library automation industry from the beginning. Large multi-branch ILS implementations are likewise commonplace.

This trend for libraries to cooperate through shared

technology infrastructure has risen to new levels in recent years, fueled by the ability of distributed cloud infrastructure to support ever larger numbers of institutions with massive aggregate collections and high volumes of transaction activity. The new genre of library services platforms designed for large-scale implementations has also eroded some of the limits seen in the previous generation of ILSs.

The number of libraries participating in shared systems has risen considerably in the last decade. There has been a steady movement of libraries previously automated independently to some type of shared system. In addition to new implementations of systems to be shared by a consortium, many libraries are also moving from their longstanding standalone systems to join an existing consortium. While standalone implementations of ILSs will likely persist indefinitely, their numbers will decline as libraries increasingly favor shared systems.

Sharing technical infrastructure removes many barriers that inhibit cooperation. Shared systems expand the universe of materials available to users and reduce the complexity of fulfilling requests across the participating institutions. Cooperative collection development can be more easily realized through a unified bibliographic database compared to multiple independent ILS implementations. Shared systems can also enable new options for processing materials, such as centralizing all or parts of technical services.

This issue features the Joint Library System in Denmark, which ranks as the largest implementation of shared technical infrastructure for a library consortium globally. I have not been able to identify any other system larger than the 2,428 public and school libraries participating in the Danish Joint Library System. This impressive initiative includes the development of Cicero, a new library management system, and the migration of all the public and school libraries from their incumbent systems to a new shared bibliographic and technical infrastructure. With this move, Denmark has realized a major milestone in its national infrastructure for its libraries, providing library management, bibliographic services, and resource sharing for all of its public and school libraries.

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Cicero: A New System Designed for Shared Library Management

Recent months have seen the completion of one of the most ambitious library automation projects globally. The Danish Joint Library System (Fælles Bibliotekssystem), based on the Cicero product developed by Systematic, has been put into production by 97 of the 98 municipalities to support their public and school libraries. In terms of libraries served, this project ranks as one of the largest consorcially shared library management systems, serving 2,428 library facilities. Other measures of the scale of the project are likewise impressive. The cumulative inventory of items managed within the consortium totals over 62 million items with an annual lending volume of 50 million transactions; the libraries serve a population of 4.2 million.

A new library management platform developed by Systematic, branded as Cicero, serves as the core of the Joint Library System. This software was developed anew beginning in 2013 according to the specifications of the Danish library community. The software was designed to provide new and efficient workflows to support the operations and administrative work of the libraries and was not based on any existing product. It was designed as an integral part of the Danish national library infrastructure along with existing components created and managed by the Danish Digital Library (DDB) and Dansk BiblioteksCenter (DBC).

The Joint Library System was born out of a desire for the Danish libraries to save operational costs and to work more efficiently. From an IT perspective, moving to a shared system obviates the need for each municipality to install and administer its own system and rely instead on a centrally administered infrastructure. The Joint Library System enables libraries to significantly lower their operating costs and increase efficiencies and cooperation. The municipalities anticipate at least a 30 percent cost savings as a result of this shift in technical support. The new product was also designed to provide better interoperability with the accounting systems of each local government and with the vendors that supply materials to the libraries. The software was also designed to provide more efficient workflows for library staff members, organizing related tasks into groups

that can be instantly accessed via function keys. Even small savings in time can make a substantial difference when multiplied by the 11,000 personnel working in the participating libraries.

Prior to the deployment of the Joint Library System, each of the municipalities in Denmark had implemented their own separate ILSs. By moving to a shared system, the public libraries across the country have closer relationships and the ability to exchange resources and their knowledge about optimizing workflows more easily. The libraries in the schools within each municipality were operated separately from the public libraries and used their own automation systems. The participation of the school libraries, or education centers, in the Joint Library System,

has engendered new opportunities for students and teachers to gain access to a broader body of information resources.

Cicero has displaced a variety of incumbent systems in the libraries in Denmark. Prior to this initiative, Axiell was the dominant vendor for software for the public libraries in the country. About 75 percent of the libraries used either DDElibra or Book-IT systems from Axiell. A smaller number used the Integra library management system from DBC; one was using Ex Libris Aleph. The school libraries mostly used the BiblioMatik system from

Dantek. The Joint Library System has entirely disrupted the vendor landscape in Denmark, illustrating the winner-take-all impact of the recent trend toward widely-shared resource management platforms. Although the counts of libraries represented in the libraries.org database do not align exactly with those reported by Systematic, Figure 1 illustrates the impact of the migration to Cicero among the Danish libraries.

While Cicero serves as the core to the Joint Library System, it also involves other major components. The overall infrastructure includes the backend Cicero server platform, a centralized bibliographic and holdings database, and multiple staff-facing and patron-facing interfaces.

The Joint Library System relies on a shared bibliographic data model. Systematic and the libraries work closely with DBC, a non-profit organization jointly owned by the Danish national government and Local Government Denmark. DCB

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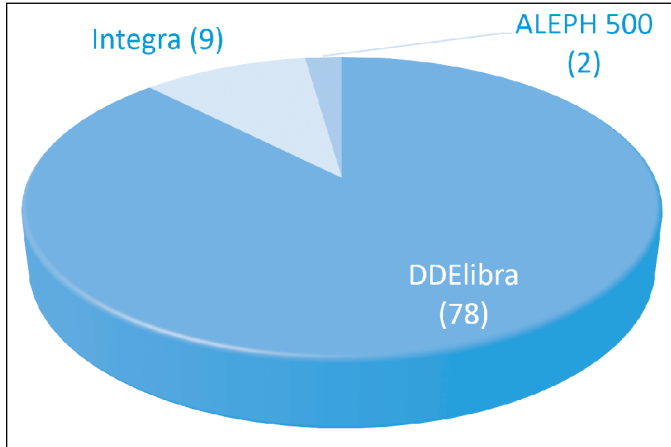


Figure 1. Previous systems used by the 93 libraries migrating to Cicero (counting number of institutions)

operates the national bibliographic network, maintaining the Danish national bibliography, and providing a cataloging system for Danish libraries. DBC plays a major role in the Joint Library System, providing the centralized data infrastructure and organizing data for the management of each participating library's inventory. DBC also created the Integra library management system, which was used by some of the Danish libraries prior to migrating to Cicero.

The Joint Library System also includes multiple patron interface options. The public libraries use a discovery interface provided by DDB (<https://www.danskernesdigitalebibliotek.dk/english/>). The school libraries use the Cicero Web interface specifically designed for the needs of students, teachers, and parents. Cicero also interfaces with self-service kiosks in the libraries via the SIP2 protocol.

The Joint Library System represents a key component of the Danish National Library Infrastructure, which also includes a union catalog and interlibrary loan services. All public libraries in Denmark make their materials available for interlibrary loan requests by patrons of other libraries. Patrons can place requests directly through the union catalog (<https://bibliotek.dk/>) for delivery to their home library.

Largest Shared Infrastructure Implementation for Libraries

In terms of libraries supported, the Joint Library System is the largest implementation of a resource management system shared by a consortium of libraries globally. It dwarfs the Illinois Heartland Library System, the largest consortium in the United States, which supports 467 public and school libraries sharing a Polaris ILS. The shared Evergreen implementation

for Georgia PINES supports 288 libraries. All 171 public libraries in Ireland participate in a shared Sierra ILS. All of the 1,112 public libraries in Turkey have implemented Koha, following a distributed server model and not a fully shared infrastructure. The Kōtui project in New Zealand currently includes 119 libraries sharing a SirsiDynix Symphony ILS.

Project Timeline

The Joint Library System emerged out of interest in building on earlier initiatives for shared data repositories among the libraries in Denmark. The project was officially launched in March 2013 when KOMBIT, the non-profit organization that manages IT projects for government agencies in Denmark, issued a tender for a new library management system able to serve all the public libraries in the country. The strength of support for the project was reflected by the commitment of the majority of the municipalities to participate in the system. 88 of the municipalities committed to the project at its onset, with others joining during the implementation phase. Currently, all the public library systems in Denmark except one have fully implemented the system. The libraries in Hjørring announced in April 2018 that they would also participate in the Joint Library System, and implementation is planned for June 2018. With this recent addition, the Joint Library System includes all of the public libraries in Denmark.

The tender invited proposals for the creation of a new custom-developed system to be operated on a large scale and delivered within an aggressive schedule. KOMBIT selected the Danish library software company Dantek for the project in June 2013. Dantek, founded in 1987, had developed the BiblioMatik system widely used in Scandinavian school libraries. This selection was contested by Axiell, the incumbent provider of library management software to the majority of the public libraries, asserting that Dantek did not meet some of the required business metrics. The award was affirmed and Dantek was authorized to begin development of the new system in November 2013.

The overall value of the contract to develop and deploy the Joint Library System is estimated at \$21 million with an annual operating cost of \$1 million.¹

Dantek was acquired by the Danish software firm

1. Brøchner-Mortensen, Martin, "Access to a World of Content with the Joint National Library Solution for Public Libraries and School Libraries in Denmark," conference paper, accessed May 14, 2018, https://webcache.googleusercontent.com/search?q=cache:wWj7XCt2oecJ:https://systematic.com/media/1360020/conference-paper_systematic.pdf+&cd=1&hl=en&ct=clnk&gl=us.

Systematic in August 2014. Systematic is a well-established IT services and software development company, creating systems for defense, police, hospitals, and other public-sector organizations. The company is based in Aarhus, Denmark, operates multiple subsidiaries globally, and employs over 900 personnel. Following its acquisition, Dantek became the Library and Learning division of Systematic. The BiblioMatik software for school libraries developed by Dantek will not be further developed but will be superseded by Cicero.

As a major software development firm, Systematic was well positioned to fulfill the development of the software for the Danish libraries. The personnel of Dantek continued to work on the project following the acquisition by Systematic, contributing their knowledge of the library domain. Systematic was able to bring their expertise to bear in the development of large-scale enterprise software for public and private sector organizations, culminating in completion of the initial version of the product now branded as Cicero.

The implementation phase of the project began with an initial set of pilot libraries receiving the software for testing in November 2014. The libraries in Horsens were the first to work with Cicero. Following a period of additional development, the phase of production implementation began in April 2016. The implementation phase saw about two libraries added to the Joint Library System each week. The implementation phase will conclude in June 2018 with the migration of the last municipal library system in Hjørring.

The implementation of the Joint Library System was a massive undertaking. The project included the migration of bibliographic and operational data from all 2,428 libraries coming from six different incumbent ILS products.

Systematic Library and Learning has also developed additional products to complement Cicero. Cicero Move is a mobile app for library staff members, delivering lists of materials that need to be retrieved to fulfill requests by patrons. Cicero Move is available for iOS and Android-based devices. The MoMo learning management system provides support to teachers and students for the support of courses and to provide statistical data for school administrators.

Development of the Cicero software and related components continues. Systematic deploys new versions of the software every two weeks with incremental improvements and fixes. The libraries continue to advise KOMBIT and Systematic regarding new enhancements desired for the product.

Cicero Technical Design

The Joint Library System has been deployed as a single platform to support the public and school libraries, as well as other organizations with local collections. The Cicero software provides the core component of its technical infrastructure.

Systematic developed Cicero as an entirely new codebase, not based on any existing product using Agile software development methodologies. Cicero was designed to be deployed on a multi-tenant platform based on open standards and components. The software was developed on Oracle's Java Enterprise Edition version 8. The database layer of the application is based on Microsoft SQL Server. The Cicero technical infrastructure also includes open source components. The system makes use of Apache SOLR for indexing. Cicero operates within the Red Hat WildFly application server (previously JBoss).

Cicero includes client software for library staff members to perform their work. The staff client requires the Java Runtime Edition (JRE). This client software can be installed via the Java Web Start or through the Windows Installer.

Once installed, the staff client is automatically updated as new versions are released. The staff client communicates with the Cicero server using REST APIs formatted in JSON.

One of the key design elements of Cicero relates to interoperability with external systems. Cicero communicates with the financial systems of each municipality to avoid redundant data entry for payments and fees. It also streamlines acquisitions of library materials through programmatic interfaces with supplier platforms.

As a fully hosted solution, Cicero depends entirely on the library's internet connectivity. The Cicero staff client includes a backup mode that can enable the library to continue to work in the event of a failure of its internet connection. The library can continue to lend items and process returns and then synchronize the transactions once connectivity has been restored.

For more information, see "National Automation System for Public and School Libraries in Denmark," in *Smart Libraries Newsletter* XXXIV, no. 1 (January 2014): 3–4.

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Cicero Expands Beyond the Denmark Joint Library System

With the Joint Library System largely fulfilled, Systematic plans to also position the Cicero library management system for use in other organizations within Denmark and internationally.

Timeline

- March 2013: Tender for Danish joint library system is issued by KOMBIT.
- June 2013: Dantek is awarded the project.
- November 2013: Dantek is authorized to begin development of the new system.
- August 2014: Dantek is acquired by Systematic. It now operates as the Library and Learning division.
- November 2014: First pilot deployment of Cicero for testing occurs in Horsens.
- April 2016: Production implementations of Cicero commence.
- November 2017: Final library implements Cicero in Holbæk and Copenhagen.
- April 2018: Sønderborg joins Joint Library System.
- June 2018: Hjørring is scheduled for implementation.

Cicero has already been implemented by the libraries in the Southern Schleswig region of Germany, an area adjacent to Denmark. Work is currently underway to implement Cicero in a group of 200 private schools and special libraries in Denmark and 22 colleges. Later in 2018, implementation will begin for a consortium of 500 private schools in Sweden.

Cicero has also been implemented by the National Library of Greenland, and migration is underway at the public library in Tórshavn, Faroe Island and in ten school libraries.

Systematic seems well positioned to continue to expand the use of Cicero in other regions. It has been designed especially for the needs of libraries in Scandinavia but may also find resonance with other libraries interested in taking advantage of its strengths in leveraging shared infrastructure and interoperability. In the global library technology industry, Systematic will be an interesting company to watch as it further develops Cicero and looks to a broader market for the products of its library and learning division.

Smart Libraries Q&A

Each issue, Marshall Breeding responds to questions submitted by readers. Have a question that you want answered? Email it to Samantha Imburgia, Associate Editor for ALA TechSource, at simburgia@ala.org.

What can we do to ensure we're evolving to meet the needs of our mobile users?

As smartphones become increasingly ubiquitous in society, it is essential for libraries to optimize their virtual services for these devices. Mobile devices now represent the majority of internet traffic. Google reports that over half of searches come from mobile devices. Statista, a company aggregating market and consumer data, indicates that mobile traffic has grown from 31 percent of overall website traffic to 52 percent in 2017. The proportions of mobile traffic on any given site will vary. Since libraries rely so heavily on their websites to deliver access to their content resources and services to their users, it is essential to pay attention to the dominance of mobile devices.

Libraries need to develop strategies on how to best accommodate mobile users. This issue isn't necessarily new or recent, and many libraries have already redesigned their public-facing web interfaces to nicely accommodate mobile devices. Some, however, continue to struggle with making the transition to a fully mobile-friendly environment. Mobile usability is one of the many areas of technology where I see substantial disparities between well-resourced libraries and those with limited financial and technical capacity.

Mobile support ranks as one of the top issues that must be considered in the support of existing patron interfaces and when launching new services. The need to develop and deploy technologies well suited to the trend of ever increasing mobile use must take place at several levels. At the local level, libraries need to continually assess the degree to which their web resources accommodate mobile devices and remediate any problems. More broadly, libraries as a whole must ensure that the products they acquire from vendors meet the highest standards of mobile usability. As libraries purchase new products, they need to stipulate this requirement in their contracts or

procurement documents. Suppliers of content or technology products designed for use by library users need to implement appropriate mobile usability standards and techniques in both their current and legacy products.

Mobile usability applies to the entirety of a library's public-facing, web-based services. The scope of concern includes the library's main website, its catalog or discovery service, as well as all the information resources and services directed to the library's users. The locus of control may vary for the different components that comprise a library's web presence. The library may have the ability to make any needed adjustments to its own website while it depends on vendors to address problems with purchased or licensed products. While libraries may be able to quickly rectify issues on their local website, they may have to wait much longer for fixes or enhancements to externally supplied products.

I'm not necessarily keen on the term "mobile users." Rather, it's likely that most library users work with multiple devices. Some activities such as gathering citations and resources for a research project require a laptop or desktop computer, or a tablet with a keyboard. Libraries would expect a higher percentage of mobile access for activities such as checking opening hours or other information about the library, searching the catalog, downloading e-books, or asking reference questions.

To quantify the areas of concern, libraries need to implement analytics to measure what portion of use takes place from mobile devices. A recent look at the analytics of my Library Technology Guides site revealed 73 percent of traffic comes from desktops, 18 percent from mobile, and 9 percent from tablets. Analytics can also indicate the proportions of mobile use for each section of the website. This information can help set priorities regarding which components to optimize.

Libraries need to continually assess mobile usability throughout their public-facing interfaces and then correct any problems identified. The process of optimizing a library's environment for mobile use involves ongoing iterations of assessing and taking any needed corrective action for each component. Assessment can take the form of a systematic survey of all the pages, resources, and services that comprise the library's web presence.

For websites with a relatively small number of pages and components, it would not be difficult to work through the

site with smartphones of different types to assess their usability. All text should display in easily read font and flow within the screen. If you have to manually adjust the size of the text or pan it into view, the page isn't mobile-friendly. Search boxes should also be tested as well as the display of results. Most desktop web browsers also include the ability to emulate mobile devices when viewing a page. Google's Chrome browser, for example, includes a device toolbar within its "developer tools" with options to set the display according to the most popular smartphones and tablets.

Complex sites with a large number of pages and resources will be difficult to assess manually. Many different tools are available that can identify specific problems. The Google Search Console, formerly Webmaster Tools, includes a section on Mobile Usability. This section includes reports on any pages with potential problems, such as content wider than a mobile screen, small fonts, unconfigured viewport, or touch elements placed too closely. Any pages that fail any of these categories will be flagged as not mobile friendly and will be penalized in search results.

Identifying problems with mobile usability can be relatively straightforward compared to resolving them. The techniques for addressing these issues will depend on whether the resource in question is generated through a coding implemented by the library itself or if it is a vendor-supplied product. In most cases, making a site friendlier to mobile devices includes both technical and design modifications.

Libraries using content management systems, such as WordPress or Drupal, can redeploy their sites based on more mobile-friendly themes, which might also come with new navigation and presentation styles that would need to be thoroughly reviewed and tested. In some cases, it might be possible to make relatively minor changes in coding to resolve basic problems with mobile use without having to redesign the site.

Components of the library's web presence based on vendor supplied products require a different tactic. The library will need to work with the vendor to determine if any problems in mobile use can be addressed through configuration issues or whether the issue will need to be resolved in a future release. Legacy products can be the most frustrating. A library may rely on an online catalog associated with their ILS that does not perform well from small devices and is no longer being enhanced. Resolving the issue may mean acquiring a

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new discovery interface or waiting until the library is ready to replace its ILS.

I do not have the same level of concern for the interfaces used by library staff members. Only a relatively small subset of tasks performed by library staff need to be specifically designed for mobile devices. These activities include working with lists of materials to be picked from library stacks, checking the inventory of selected ranges of the collection, and related work. Many vendors offer special mobile apps to assist library staff with these tasks. Most of the work performed by librarians and other personnel involves complex interfaces for

data management and other tasks that are not well suited to small screens without keyboards. A staff interface for complex tools such as an ILS or library services platform optimized for a mobile device would likely not be as efficient as when used on a desktop or laptop computer.

Providing an excellent experience to users when they use mobile devices cannot be seen as an optional feature. Rather, it is now an essential requirement of any patron-oriented interface and is part of the ever-expanding issues libraries must pay attention to as they strive to align their services with the ever-changing trends in business and consumer technologies.

Questions or suggestions
for topics in future issues?



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Marshall Breeding's expert coverage of the library automation industry.

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