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### 21st Century Library Systems

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## 21st Century Library Systems

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**ABSTRACT.** *Less than a decade into the 21st century, perhaps it is more fitting to describe library automation as approaching its 80th birthday, is a time to look back and carefully measure moving forward. Since the introduction of a punch card circulation system at the University of Texas in 1936, through the advent and perseverance of the MARC record, and following the ebb and flow of nearly 75 different library automation vendors, library automation has come a long way. For some, however, it has not come nearly far enough. If one were to stop the history of library automation in the mid-1990s and wish away the dominance of the Internet, libraries and patrons might have been quite content with the state-of-the-art as it existed 15 years ago. But wishing away the Internet is like envisioning a world without electricity and indoor plumbing; as such, that 1990s library automation summit is now a plateau from which many library technologists and futurists can see no launch pad to a next-generation of library software and services.*

**KEYWORDS** *Library Automation, cloud computing, OCLC, ILS, next-generation library system*

“If you wish to make an apple pie *truly* from scratch, you must first invent the universe.”—Carl Sagan

### A SLOW START

The irony of the current stagnant situation for library systems is that libraries likely offered the public its first glimpse of computer use and database interaction. Long before ATM machines and the Web, many of the first public

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keyboards could be found attached to dumb terminals in libraries. These terminals were, in turn, connected to mainframes, and libraries supported workflows that either relied on data supplied from a central hub, or created stand-alone systems for local inventory control.

Those local inventory systems, built upon ordering, acquisition, and circulation of physical materials grew into the robustly functional integrated library systems (ILS) with which most libraries are now familiar. Because back office workflows were governed by electronic records and computerized inventory, libraries were able to leap forward in providing public access to those records. The displays seem quaint by today's standards, but were designed to transition patrons from card catalogs to their new electronic equivalent.

Unfortunately, libraries and their vendors were not prepared for the exponentially rising expectations that the advent of the Web would usher in. Mired in transitioning character-based telnet systems to rapidly selling graphical user interface (GUI) systems, most vendors were ill-prepared to make another transition to the Web just a few short years later. First-generation Web-based online catalogs reflected the nascent state of Web development and lacked much of the functionality that had been available in online systems for over a decade. Faced with few alternatives, libraries suffered the pain of first generation GUI systems and took a wait-and-see approach to more sophisticated patron interfaces. Unfortunately, this strategy resulted in a wait-and-wait scenario for both end-user experience and back-office operations.

### PLUGGING THE GAPS

While libraries seemingly accepted the fate that the basic functions provided by an integrated library system would not change radically, the nature of their collections and associated workflow were themselves changing rapidly. Web-based content, licensed resources, born-digital documents, and institutionally significant digital collections emerged rapidly to overtake the effort required to maintain print collections, especially in academic libraries. Traditional integrated systems proved inadequate for managing these assets despite numerous noble efforts to fit square pegs into round holes—eSerials checkin, Cooperative Online Resource Cataloging (CORC), e-reserves scanning stations, etc.

The inadequacy of the ILS was compounded by a desire among vendors and libraries alike to build new solutions with new technologies. Electronic Resource Management (ERM), Digital Asset Management (DAM), and Institutional Repository (IR) systems would be built with 21st century technologies to aid in these new library workflows. Paradoxically, as industry expert Marhsall Breeding points out, “[The process of evaluating library workflow]

may be confounded by the fact that many libraries have adapted their workflows to match the limitations of their automation systems” (Breeding, 2007). This begs the question whether vendors have done a short-term service to libraries in the midst of a major sea-change, while doing a longer-term disservice to the efficiency of libraries.

Certainly, if automation experts were starting from scratch, they would endeavor to logically combine resource management in libraries under an umbrella of software that makes distinctions between resource format without unnecessarily bifurcating workflow into separate systems. A current list of essential products, of course, makes this challenge more daunting than it might seem at first glance. Many libraries might delineate a suite of services (in addition to the ILS) similar to the list provided by Mark Andrews (Andrews, 2007):

- OpenURL Link Resolver
- Federated search tool
- Digital archive, institutional repository, and portfolio products
- Electronic Resource Management (ERM)
- Compact and robotic storage systems for archived print materials
- Next-generation portal and discovery tools (for all of the above)
- A management interface (for all of the above) to determine usage and user satisfaction and allow for *ad hoc* reporting and statistical analysis

It’s difficult to picture a library workflow, let alone a single integrated product that can handle so much. Nevertheless, there are some technical strategies, discussed below, that might make the tactical deployment of solutions adequately functional, faster to deploy and upgrade, and less expensive for libraries.

## BUSINESS DISTRACTIONS

Before the demand for products capable of managing a new myriad of library content, vendors sought merely the state-of-the-art for managing print collections. “The hallmark of [first generation library] systems,” writes Andrews, “was the struggle for ‘functional completion’ in an ‘integrated library system’” (Andrews, 2007). By the late 1990s, the library software business had created several commodity-like applications. One vendor’s offerings had become less and less distinguished from another, leading one pundit to liken the choice between ILSes to a choice between cars on a rental lot (Pace, 2004). Nevertheless, this plateau of innovation had yet to cause considerable churn within the market. Concomitant with the market saturation for integrated systems was the firm establishment of strong and loyal relationships between libraries and their vendors. In fact, an apparent paucity of new product penetration

**TABLE 1** Mergers & Acquisitions, 2000–2008

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TLC acquires CARL (2000)
Auto-Graphics acquires Maxcess Library Systems (2001)
Sirsi acquires DRA (2001)
Scott Cheatham acquires EOS (2001)
Jerry Kline acquires remaining shares of Innovative Interfaces (2001)
OCLC acquires netLibrary (2001)
Geac acquires Extensity (2002)
ProQuest acquires Serials Solutions (2004)
ISACSOFT acquires Bibliomondo (2004)
Bowker acquires Syndetic Solutions (2004)
Sirsi acquires Docutek (2005)
Sirsi acquires Dynix (2005)
OCLC PICA acquires Fretwell-Downing (2005)
OCLC PICA acquires Sisis (2005)
Golden Gate Capital acquires Geac (2005)
OCLC acquires Openly Informatics (2006)
Follet acquires Sagebrush (2006)
Geac becomes Extensity (2006)
Francisco Partners acquires Ex Libris (2006)
Infor acquires Extensity (Geac) (2006)
Francisco Partners acquires Endeavor Information Systems (2006)
Cambridge Information Group acquires Proquest (2006)
OCLC acquires DiMeMa (CONTENTdm) (2006)
Vista Partners buys out SirsiDynix (2006)
Bowker acquires MediaLab (AquaBrowser) (2007)
Liblime acquires Katipo's Koha division (2007)
OCLC acquires remaining shares of OCLC Pica (2007)
Ronald Brisebois acquires ISACSoft (2008)
LibLime acquires Care Affiliates (2008)
Leeds Equity acquires Ex Libris (2008)

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made many vendors appear less like software companies and more like relationship management companies.

Customer relations and management would get a lot trickier in the early part of the 21st century. As indicated in Table 1, 2000–2008 activities in the library automation space have been largely driven by mergers and acquisitions, with over 30 major activities in less than 10 years. It's no wonder that a combination of business consolidation, stunted innovation, and rapid Web application development outside the library automation space would lead to disenchantment and restlessness among libraries.

## TURNING TIDES

It's also no coincidence that the first half of this decade in which blogs became so prevalent was marked more by a clamoring and complaining about the state of library automation than by the actual development of innovative software. Twenty-first century library system development is now

driven by restless customers, motivated not only by a few tireless advocates, but also by the publicly visible fruits of system development within libraries.

Open Source Software (OSS) efforts such as the Open Archive Initiative (OAI), DSpace, and Koha—just to name a few, as an exhaustive list would overwhelm the reader—challenged commercial proprietary systems, not only for market share but often in terms of sophistication and functionality. Experimentation with new so-called bolt-on catalog interfaces such as RLG's RedLightGreen and Casey Bisson's blog-powered WPOPAC led to production efforts from several individual libraries and vendors, including, North Carolina State University Libraries, OCLC, and AquaBrowser (Antelman, Lynema, & Pace, 2006).

Challenged by relative new-comers and outsiders of the library automation space—Endeca, MediaLab, WordPress, and FAST—vendors adroitly answered the call for improved public interfaces. In fact, it is fair for vendors to decry at least some of the impatient clamoring of library IT specialists, as many of the increasingly expensive incremental changes made to legacy ILS systems were demanded by the libraries paying relatively small maintenance fees. One might argue that vendors were squandering the money of their customers doing exactly what was asked of them.

### NEXT GENERATION AS A ZERO-SUM GAME

Despite the nimble reaction of many ILS vendors to fill some of the service gaps created by the inadequacy of the ILS to meet 21st century needs, the overall market for integrated library systems has not grown substantially over the last 5 years. With annual revenues estimated at \$570 million, sales of new ILSes dipped 15% in 2008. These losses were partly offset by new end-user product offerings, but do little to indicate incentives to radically change or improve underlying systems.

Several factors limited opportunities to sell traditional library automation systems this year. The higher-end market of public and academic libraries has saturated; fewer libraries have legacy systems in immediate need of replacement. Recent migrations from legacy systems have largely run to completion . . . [L]ibraries considering ILS replacements are holding off, hoping better options will emerge soon, especially on the open source front. Libraries feel a sense of urgency to acquire next-generation interfaces that will allow them to cast aside library catalogs that work more like the Web of 1998 than 2008 and gain tools to manage ever-growing collections of electronic content (Breeding, 2008)

It's clear that to counter the impact of a zero-sum future for the ILS, the next generation of functional offerings must be technically compelling while providing all the functionality with which libraries are accustomed.

## OPTIMISTIC FORECASTS

Two of the last three endeavors to create an ILS from scratch in the last decade have been business, if not also functional, failures. DRA's Taos system was killed after the company's acquisition by Sirsi, and Dynix's Horizon 8.0 was declared dead-on-almost-arrival after a merger with the same company. While some might tie these failed attempts at a next-generation management system to a common corporate ownership, some might have predicted lackluster outcomes of the somewhat overly optimistic picture created by the newly architected systems.

A more optimistic spin might say that the second mouse gets the cheese. The third (and thus far successful) venture alluded to above is the open source ILS venture, Evergreen, now supported by Equinox, Inc. By releasing their software as open source, the Evergreen team created a new compelling reason to consider switching systems. Though it combines the functionality sought after in a new patron front-end, the system actually falls short on the full functionality of other proprietary ILS systems. Nevertheless, it is the positioning of the open source code as something new, and embraced by forward-thinking customers, that has lured customers away from more traditional solutions.

Fortunately for libraries, the freshness of the open source solution is not the only 21st century innovation to look forward to; nor is it mutually exclusive of another burgeoning trend that is likely to have an impact on a next generation of service offerings.

## THE CLOUD GENERATION

Neil Howe and William Strauss are experts in evaluating the trends of generations. They write, "to anticipate what 40-year-olds will be like 20 years from now, don't look at today's 40-year-olds, look at today's 20-year olds" (Howe & Stauss, 2007). It is worthwhile, therefore, to evaluate the platforms on which younger generations are computing. This is not to suggest that Facebook, Flickr, and Wikipedia will form the basis for a next-generation library management system. It is these very services, however, that should serve as a model for 21st century data storage, software on demand, and cloud computing capabilities.

The cloud is a metaphor for the Internet (based on how it is depicted in computer network diagrams) and is an abstraction for the complex infrastructure it conceals. It is a style of computing where IT-related capabilities are provided “as a service,” allowing users to access technology-enabled services from the Internet (“in the cloud”) without knowledge of, expertise with, or control over the technology infrastructure that supports them (Wikipedia, 2008).

The Gartner Group predicts that massively scalable service solutions provided by cloud computing will be as influential as E-business (Gartner, 2008). Fast-paced improvement to IT infrastructure and the continued industrialization of IT services over the last decade has laid the groundwork for Web-based software services. Popular examples include Google-Docs, QuickenWeb, or Salesforce.com. According to Daryl Plummer, Managing Vice President and Gartner Fellow, “this is due, in part to the commoditization and standardization of technologies, in part to virtualization and the rise of service-oriented software architectures, and most importantly, to the dramatic growth in popularity of the Internet” (Gartner, 2008).

If one accepts the premise that the ILS has reached commodity status, it stands to reason that the services provided by locally installed and maintained software can and should be provided by a networked service. Of course, a higher level of trust and reliability must be achieved, and it remains to be seen whether existing vendors can put the same trust and reliability into software services that many online publishers have established with online scholarly and popular content.

Nevertheless, if this generation’s 20-year-olds are the next generation’s library administrators, it might be worth taking a look at the increased

**TABLE 2 Cloud Computing Activities by Different Age Cohorts** *Internet users in each age group who do the following online activities (%)*

	18–29	30–49	50–64	65+
Use webmail services such as Hotmail, Gmail, or Yahoo! mail	77%	58%	44%	27%
Store personal photos	50	34	26	19
Use online applications such as Google Documents or Adobe Photoshop Express	39	28	25	19
Store personal videos	14	6	5	2
Pay to store computer files online	9	4	5	3
Back up hard drive to an online site	7	5	5	4
Have done at least <u>one</u> activity	87%	71%	59%	46%
Have done at least <u>two</u> activities	59	39	31	21

*Source: Pew Internet & American Life Project April-May 2008 Survey. N = 1,553 Internet users. Margin of error is  $\pm 3\%$ .*



level of trust placed in cloud computing and data storage by younger generations. A look at usage levels according to age groups shows rising levels of trust for storing personal data on the Internet (Horrigan, 2008).

While the Pew study does not specifically address business data storage, it is easy to make extrapolations about the level of trust in those areas, and several online businesses are banking on the future for cloud computing that Gartner, Pew, and others have predicted.

## WEB AS PLATFORM

One such company banking on software-as-a-service (SaaS) and cloud computing is Bungee Labs, creators of Bungee Connect, an end-to-end environment that allows developers to build desktop-like applications from multiple Web services and databases and then instantly deploy them on Bungee's multi-tenant grid infrastructure. Services of this type are either extensions of or have been emulated by much more recognizable companies like Amazon and Google.

If such platforms—Bungee's Dave Mitchell goes so far as to call the model Platform-as-a-Service (PaaS)—were extended to library software usage, libraries might foresee a day when large capital expenditures for hardware and software could be replaced by subscription-based services. Mitchell writes:

On the SaaS side of things, there have been some notable successes in the areas of [Customer Relationship Management] CRM-as-a-service, computing-as-a-service and storage-as-a-service. These are just a few examples of data, functionality and hardware as services over the network. These individual offerings represent the next logical evolution of software and computing in the cloud (Mitchell, 2008)

### Technical Advantages of the PaaS Model

- Develop, test, deploy, host, and maintain on the same integrated environment
- Dramatically reduce costs of development while supporting a robust software life cycle.
- User experience without compromise: avoiding downloads, plugins, and Internet hiccups
- Built-in scalability, reliability, and security
- Multi-tenancy—the ability for an application to automatically partition state and data to service an arbitrary number of users

- Must support Web-scale use
- Built-in integration with Web services and databases
- Deep application instrumentation—see exactly how and when users are using the application (Mitchell, 2008)

It's at least time that libraries and vendors turned some of their attention from richer end-user experiences to the back-office workflows that support them. As Breeding contends, "We can't let the current focus on front-end interfaces make us complacent about the software systems that we use to automate routine library functions" (Breeding, 2007). The timing seems right to make such an effort at the creation of next-generation systems with the cloud in mind. There could come a day very soon that libraries would simply plug into the wall to receive all the required power of software services, rather than running locally deployed systems like home generators with all the associated expense, cyclical upgrades, and hardware maintenance.

The economic advantages to a service-based future for library automation should not be under-estimated. Despite a surge of online content being available to patrons, libraries will continue back-office operations for all types of materials. The more these workflows are industrialized and served by network-level applications, the more time and effort libraries can assign to other intellectual endeavors. Far too much time is spent getting systems to work at the expense of more fruitful activity.

In varied lists of technical demands made of library automation vendors, the library is poised to become part of the Web 2.0 culture, acknowledging and even supporting many Web service models. Most punditry, however, still calls for hardware independence and access to proprietary APIs; demands fall short by merely asking that local systems avail themselves of other Web services rather than establishing themselves as services in their own right. Moreover, integration with other business process systems—course management, financial services, and human resource systems—will require new thinking on a next-generation of integration. Acknowledgement that library management system will never attain dominance as college, university, community, and corporate business process systems should encourage libraries to seek integration through Web-based services—a loftier goal than mere "interoperability"—so that library workflows can be managed in conjunction with other services.

## THE FUTURE IS INEVITABLE

When it comes to library automation, lamenting the past is nearly as easy as predicting the future is difficult. One thing seems fairly certain, however—that the library automation landscape requires dramatic change in

order to ensure its future. The landscape metaphor itself is too pessimistic, though, as shifting ground often leaves only destruction as its aftermath. Libraries require a sea-change—a dramatic departure from the status quo of library automation, solutions that will scale like typical Web solutions, technologies that will ensure our future. To date, the swelling seas of library automation have been caused by the rising tide of discontent in libraries. Going into the future, libraries, service providers, and technology experts have an unparalleled opportunity to create the swelling seas on which all boats will rise.

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