

Introduction and Concepts

This issue of *Library Technology Reports* covers a variety of issues related to the genre of library services platforms. These products represent the latest wave of automation systems for libraries that depart in many ways from those of the previous era and that also carry forward the essential functionality upon which libraries rely for their daily operations. The ensuing discussion and descriptions of library services platforms will reveal capabilities that have been present for decades as well as many characteristics that set them apart as a distinct product category.

This report aims to provide a general understanding of this new category of products and to provide libraries with additional data and perspective as they consider the options available in developing their technology strategies. Library services platforms have not replaced previously established categories wholesale and for all types of libraries. Integrated library systems continue to flourish as seen by ongoing use of existing installations and in new sales. Each type and size of library comes with its own concerns and requirements that it expects to be addressed by its technology products. While library services platforms may be appropriate for a growing set of libraries, any data that demonstrates the types of libraries using any given product can be helpful as libraries ponder their options.

This report does not attempt to make recommendations for the products it covers, but to treat each product in a neutral manner. Libraries making decisions about products should consult with a variety of sources as they work through their procurement process. The report provides general descriptions and presents empirical data related to the numbers and types of libraries that have implemented each product. Sources of data include previously published

statistics, figures provided by the vendors of the products, the libraries.org library directory, and the 2014 “Library Automation Perceptions Survey.” While general descriptions of the products are given, the report does not attempt to list or characterize the detailed functionality of the products covered. An understanding of the specific features of each product and its suitability to any given library can be gained only through a more in-depth process than could be captured in a report such as this one. Checklists of functionality can be misleading relative to the actual performance of any given system in its daily operation in a library. Consider the information in this report introductory and preliminary to a more thorough process that would need to be conducted as a library investigates the field of available products.

Libraries.org
www.librarytechnology.org/libraries

The scope of the report includes the major products with a significant presence in North America that embody most of the characteristics of a library services platform, as described in the following section. Products given specific treatment include OCLC WorldShare Management Services, Ex Libris Alma, Sierra from Innovative Interfaces, ProQuest Intota, and Quali OLE. SirsiDynix BLUEcloud Suite, a hybrid product, is mentioned but not given separate treatment in the product section. This report also does not cover Spydus 9 from Civica since it does not yet have a presence in the United States, but it is a product that warrants consideration in other international regions.

What Is a Library Services Platform?

The term library services platform describes a type of library resource management system with a set of characteristics that differ substantially from the long-standing genre of integrated library system. At this time, there was considerable concern about integrated library systems not necessarily meeting expectations, and it was helpful to consider the new generation of products as a new category that did not have the conceptual and functional baggage of the existing set of products. But the introduction of the term has also introduced some confusion, especially since many products fit some of its characteristics and not others. Above all, as we consider library services platforms, it must be noted that it describes a set of products that each embody a somewhat different set of conceptual, technical, and functional characteristics. While I continue to see library services platform as a helpful term to describe this set of products, the lines of distinction remain blurry.

We refer to any major product that a library uses to manage some set of its collection as a resource management system. This broad category includes library services platforms, integrated library systems, electronic resource management systems, and digital collections management systems, as well as those products that may be used for other categories of specialized materials.

I coined the term library services platform in 2011 to describe a new set of products that were being developed that promised to take a much different approach to library resource management than the incumbent integrated library systems.

I initially proposed the term in my August 2011 *Smarter Libraries through Technology* column in *Smart Libraries Newsletter*:

I'm gravitating toward the term "library services platform" for this new software genre. The products are library-specific, they enable the library to perform its services, internally and externally though their built-in functionality, as well as exposing a platform of Web services and other APIs for interoperability and custom development. In a time when long-standing terms like "integrated library system," or OPAC bring along considerable negative baggage, we need new terms when we talk about what comes next.¹

My September 2011 *Systems Librarian* column in *Computers in Libraries* further refined the concept:

This new generation of products—more appropriately called something like library services platforms rather than integrated library systems—addresses the fundamental changes that libraries have experienced over the course of the last decade or so toward more engagement with electronic and digital content. In their own distinctive ways, these

recently announced or delivered systems aim to break free of the models of automation centered mostly on print materials deeply embodied by the incumbent line of integrated library systems. To make up for functionality absent in their core integrated library systems, many libraries implemented a cluster of ancillary products, such as link resolvers, electronic resource management systems, digital asset management systems, and other repository platforms to manage all their different types of materials. The new products aim to simplify library operations through a more inclusive platform designed to handle all the different forms of content.²

The introduction of the term library services platform was also meant to provide a vendor-neutral product category. As each of these products was being introduced, each vendor posited its own name for its approach. Ex Libris used Unified Resource Management, and OCLC used Web-Scale Management Service. Vendors tend not to use each other's product categories for new products, so providing a neutral term was needed. The term has since been adopted in both the library and vendor communities.

Historic Perspective: Consolidation of Functionality

The general missions of libraries have remained fairly constant throughout the history of this institution. They develop collections of materials of interest to their communities and provide ways to make those materials available. The types and formats of materials that comprise their collections and how they have been stored, organized, and made available have changed with each era of publishing and content distribution. In each phase of the history of libraries, they have made use of the tools and technologies of the time to facilitate their work.

The history of library technology tracks alongside the prevailing technologies available in the general business and consumer sectors. Methods employed by libraries have constantly evolved. Though we don't aim to delve too deeply into the history of library automation, some of the tools employed prior to the age of computing include handwritten sequential catalogs, printed catalog volumes, and card catalogs. Computers allowed libraries to manage and provide access to their collections more easily. Early products included computer output microfilm. The early mainframe computers were also put to use to help libraries automate the circulation, cataloging, and acquisitions of their collections. Programs dedicated to individual areas of library operations eventually coalesced into integrated library systems that addressed multiple areas of functionality based on centralized databases.

Library-oriented applications have been developed and redeveloped through each of the generations of technology, from mainframes to client/server applications and more recently into those based on cloud computing and web-based technologies. The functionality addressed has likewise morphed over this period, with new products emerging to support the library involvement with electronic and digital materials and in providing ever more effective tools for their management and access.

One theme that has remained constant through the development of library automation systems can be seen in the gradual consolidation of programs and tools that each addresses a given area of the library's work into more integrated or unified platforms. Each phase of libraries brings new operational tasks that benefit from technology, leading to new products to meet those needs. In subsequent phases, new products emerge that subsume much of the functionality of these multiple applications, resulting in more streamlined and integrated platforms.

The realm of computing technology culminated in the late 1970s with the development of integrated library systems. The individual programs dedicated to individual areas of library operations eventually coalesced into business applications that addressed multiple areas of functionality based on centralized databases. Separate applications for each area of the library were consolidated into the first generation of integrated library systems. The earliest phase of library automation was characterized by specialized systems for each main area of library processing. Gaylord offered its Circulation 100 and CLSI offered LIBS100, which primarily addressed the circulation of books. Innovative Interfaces, Inc., offered its INNOVAQ product, which specialized in materials acquisitions. Libraries at this time could have products from different vendors to automate their operations. Each of these products, and new entrants into the arena, developed into full-fledged integrated library systems.

The ongoing evolution of publishing and content creation continually makes an impact on the types of materials collected by libraries. Libraries have increasingly become more involved with print and digital materials, thus creating the need for new tools and technologies to acquire, manage, and provide access to them.

The first decade of the twenty-first century saw a new phase of fragmentation in library technologies. The integrated library system was well established as the core automation system, adopted in all but the smallest of public and academic libraries in the developed world. As libraries began to acquire electronic resources, new tools were needed for each aspect of the management of and access to those materials.

- Integrated library systems, although comprehensive for the acquisition, management, and access

to primarily print materials, saw their role in the overall technology environment of a library diminished for those libraries that shifted their collections acquisitions to primarily electronic and digital resources. See the section “Library Services Platform or Integrated Library System” later in this chapter for more details.

- OpenURL link resolvers emerged in the early 2000s to assist libraries in providing a manageable approach to linking from citations to the full text or other services to make articles available to library users. These products were able to provide context-sensitive linking to the full text on the server of the publisher to which the library subscribes. Hard-coded links used prior to the emergence of link resolvers were unsustainable due to the massive numbers of e-journals and articles to which libraries provide access and in the enormous effort required each time the library changed its subscriptions or when a publisher adjusted its servers.
- Knowledge bases of electronic resources provide a database that describes the content packages to which libraries subscribe. The knowledge base provides current lists of each of the e-journals included in any aggregated content product and the years covered, the syntax needed to link to individual articles, and many other details related to the body of library-oriented electronic content. These knowledge bases support OpenURL link resolvers and other applications that benefit from data related to e-resource holdings. A knowledge base of e-journal holdings describes the totality of the content potentially available to libraries. Link resolvers would include a profile of the library's subscriptions to inform its ability to provide direct links to items available to a library patron directly or to offer alternative services for those not found within the library's collection of subscriptions.³
- A–Z listings and other finding aids are often associated with link resolvers and make use of the e-resource knowledge base.
- Electronic resource management systems provide specialized capabilities for acquisition, description, and other operational tasks associated with aggregated content products, e-journals, and other packages of electronic content. These products usually rely on a knowledge base of e-content products to simplify management activities. Electronic resource management systems provide functionality not traditionally included in an integrated library system, such as coding and tracking of license terms, collection of usage statistics, analysis of value and performance of content packages, and other functionality specific to this type of content. Electronic resource management systems include financial management components

to manage expenditures relative to established library budgets. They have to handle multiple procurement models, including standard annual subscriptions, open-access selections, purchase of backfile collections, and other scenarios.

- Libraries may also maintain one or more publishing or repository platforms where they store, describe, and manage documents or other content objects on behalf of their institutions. These publishing platforms might include repositories for electronic theses and dissertations or institutional repositories for holding local copies of published scholarly articles, research reports, institutional publications, and other materials. Digital asset management systems or other platforms for managing collections are needed for libraries with digitization initiatives for manuscripts, photographs, or other materials or for managing natively digital content.
- Digital preservation platforms provide additional layers of functionality to a digital asset management environment to ensure the long-term viability of digital materials.

The emergence of library services platforms brings another round of consolidation of functionality that brings together several categories of functionality that had been handled in separate products. The library services platform in general will replace multiple incumbent products, including the integrated library system, any formal or informal products or processes to managing electronic resources, and knowledge bases of e-content resources. These platforms can also address link resolution, though this functionality spans a gray area between resource management and discovery.

Library services platforms should not be considered monolithic self-contained systems that become the only technology product a library will need. We have noted that library services platforms generally do not handle discovery, though many providers will offer a library services platform and a discovery service as an integrated suite. The current products also do not necessarily serve as publishing platforms to replace institutional repository or large-scale digital asset management systems. Some of the products may have basic capabilities, but content publishing has not been a main focus of development for these products.

The broader scope of these products must be taken into consideration relative to their cost. It may not be a fair comparison, for example, to evaluate the cost of a library services platform relative to an integrated library system that addresses a narrower scope of resources. The library services platform may replace three or more incumbent systems, usually the integrated library system, the electronic resource management system, and a link resolver and its knowledge base. When delivered as a web-based service, it also displaces local servers and their associated hardware,

software, environmental, and personnel costs. A much larger portion of a library's technology support infrastructure will be concentrated in a library services platform rather than dispersed among multiple products and processes that may have characterized the incumbent environment.

Definition and Characteristics

A library services platform enables libraries to acquire and manage their collections, spanning multiple formats of content, including at a minimum physical materials and electronic content. These products support multiple procurement processes, including those related to items purchased for permanent ownership, those made available through paid licenses and subscriptions, and those selected from open-access sources. They offer a metadata management environment offering multiple schemas as appropriate for each of the respective material formats, including at a minimum the MARC family of metadata standards and Dublin Core. A library services platform may include an integrated discovery service or support a separately acquired discovery interface by exposing all needed APIs and other interoperability protocols. Library services platforms are offered through a multi-tenant platform, providing all staff and patron functionality through browser-based interfaces. These products provide knowledge bases that represent the body of content extending beyond the library's specific collection.

Functional Characteristics

Refining this general definition with more detail, some of the characteristics of a library services platform include the following.

Management of Electronic and Print Formats of Materials

This genre of products consolidates the management of print and electronic materials into a single platform, taking advantage of common data stores, task workflows, and other points of efficiency. Archival materials, institutional records, and large-scale digital assets may eventually be subsumed within library services platforms, but are usually still managed in separate systems.

Replacement of Multiple Incumbent Products

As noted above, the implementation of a library services platform in most cases will displace existing

technical infrastructure components including the integrated library system and electronic resource management systems. For libraries that have not implemented electronic resource management systems, data and processes managed in local spreadsheets and databases can be more structurally managed through the library services platform.

Extensive Metadata Management

The library services platform supports multiple metadata formats as appropriate for each format, including MARC, Dublin Core, or other XML standards. The need to manage multiple formats of collection materials comes with the need to break outside of the exclusive use of the MARC family of metadata standards. A library services platform will support MARC and non-MARC metadata, either through a normalized internal set of data structures or through a mechanism that natively stores different types of records. New metadata formats based on linked data, especially BIBFRAME, have not yet been operationalized, but they provide an example of new and emerging metadata practices that will need to be adopted by all resource management systems in the relatively near future.

BIBFRAME
<http://bibframe.org>

Multiple Procurement Workflows

The library services platform supports procurement workflows for purchased, licensed, and open-access materials. One of the limitations of the integrated library system is related to its orientation to procurement processes for direct ownership. As libraries become increasingly involved in the licensing of electronic materials, many aspects of this type of business arrangement did not fit within the structure of the integrated library system. License terms, tracking of individual titles within aggregated packages, and end-user linking mechanisms were usually accomplished in other ways and often by a different set of library personnel. Despite the considerable overlap in some aspects of the process, these separate processes resulted in a fragmented and less operationally efficient operational workflow. Library services platforms integrate the acquisition and management of electronic and print resources into a common platform, data stores, and task workflows. An initial phase of this integration may come with placing an electronic resource management module within the same interface as that for print management, but the full integration of the

management of these different categories of materials in a completely integrated set of business processes more completely satisfied the vision of the library services platform.

Knowledge Bases

The library services platform includes knowledge bases and bibliographic service from which local collections are drawn or defined. The model of the integrated library system assumes a reliance on external resources for the metadata involved in collection description and management. The emergence of electronic resources led to the use of knowledge bases provided with the service that functioned as a built-in metadata repository. Libraries using these products did not have to create their own databases of e-resource holdings, but could rely on a knowledge base maintained by the supplier. The local collection was defined by a profile that appropriately filtered the comprehensive knowledge base into the specific resources held by the library. The library services platform expands this knowledge base approach to a wider set of resources. At least some of the library services platforms include a built-in knowledge base for both print and electronic resources. Examples include WorldCat as the global bibliographic resource upon which WorldShare Management Services relies; Alma, which includes a Community Catalog of resources available to all libraries as they define their local collections; and ProQuest Intota, which relies on an expanded knowledge base that was originally created in support of the company's link resolver and electronic resource management products.

Built-in Collection Analytics

Although integrated library systems usually include a standard set of reporting tools, library services platforms are often able to provide more advanced capabilities for collection analysis and assessment. Those deployed through multi-tenant platforms may be able to not just provide analysis of the library's local collection independently, but to also use broader data from the platform and its knowledge bases.

Conceptual Organization

The organization of functionality of a library services platform may deviate from the traditional ILS modules (cataloging, online catalog, circulation, acquisitions, serials management, authority control). Fulfillment, for example, may be used to represent the tasks and activities related to the lending of physical materials and the

provision of access to electronic resources. Metadata management may be used for describing functions that support MARC-based cataloging, describing digital items in Dublin Core, and managing knowledge base profiles for electronic resources.

Discovery

Library services platforms integrate with a discovery service rather than provide a traditional online catalog. Library services platforms differ in their approach to patron interactions compared to integrated library systems. The online catalog module of the integrated library system provides direct access to the collection and patron-oriented features through internal and proprietary mechanisms. Library services platforms have a more indirect relationship with patron interfaces. Discovery services belong to a separate product genre. For most of the library services platforms, the concept of an online catalog does not apply. Library services platforms expose the APIs that enable a discovery service to provide these services. In some cases, the provider of the library services platform also offers a discovery service. The relationship with discovery services is explored in chapter 3.

Technical Characteristics

Library services platforms have been developed to follow the prevailing concepts of current technology. While the specific architectures and technology components found within each of the products in the category of library services platforms may differ, some general technical characteristics can be expected.

Beyond Client/Server Computing

The current generation of integrated library systems was developed during the era when client/server computing prevailed. This model of distributed computing continues to be seen in existing applications, but only rarely in newly created products. Software applications may continue to be layered into client and server tiers internally, but that architecture is not conspicuous in end-user deployments. Almost any new software-based product created in recent years would be designed to be deployed as web-based service rather than software that has to be installed on either institutional or individual computers. The previous era of client/server computing required the installation of software on a server that provides the basic functionality of the system for that organization, including the business logic and data storage needed to support that organization. Each organization that uses that product

would have its own separate installation of the software and independent copies of its own databases. The individual users in the organization that operates the software would also need to have software installed on their own computers. These client applications provide the user interface, manage communications with the server component, and may perform additional tasks such as checking for the validity or integrity of data. This client/server architecture provided advantages over the earlier era of mainframe base computing, but it required significant administrative overhead in the need to install and maintain software components.

Multi-Tenant Platforms

A multi-tenant application serves all of the organizations or individuals using it through a single instance. The service is delivered through a single codebase, and all users of the application operate from the same version of the underlying software. Data structures are organized to segregate data that pertains to each institutional or individual user or to allow selected data stores to be shared globally. These multi-tenant systems are generally distributed globally, with data centers in different continents. Users in one region access the system from the nearest data center, with the ability to shift access to another should a failure occur. Most modern services rely on multi-tenant deployment, including business-oriented products such as Salesforce.com, e-commerce environments like Amazon.com, social networks such as Facebook, or messaging utilities like Gmail. Multi-tenant applications can support massively large-scale services.

This style of computing is not new to the library arena. Many well-established library-oriented products are offered in through multi-tenant platforms:

- WorldCat.org
- most electronic content products
- discovery services, such as Summon, EBSCO Discovery Service, and Primo Central
- some library automation products:
 - Apollo from Biblionix
 - the 360 suite from ProQuest
 - EBSCO A-Z, LinkSource, etc.
- library services platforms offered as multi-tenant services, including Alma, OCLC WorldShare Management Services, and ProQuest Intota

A variety of benefits are gained through multi-tenant applications in the library arena. Vendors that offer a product based on this architecture operate a single instance of the codebase that is able to take advantage of a large pool of hardware resources and software components. Adding new customers increases resource consumption by only small

increments. Database tunings, configurations, software patches, and other routine system maintenance activities can be done once and applied globally. For companies serving a large customer base, maintaining a single large multi-tenant platform can be accomplished with fewer technical personnel compared to having to install and maintain thousands of separate institutional instances. Patches applied to the software to fix bugs take effect for all customers at once, compared to having to perform upgrades to hundreds or thousands of separate servers.

Applications can evolve gracefully in a multi-tenant environment. New features or fixes to existing functionality can be added to the global instance on a frequent schedule since this model does not impose software installation tasks on end users. Some needed enhancements, such as those needed to address a security issue, may be deployed entirely transparently to end users. Significant changes in the behavior of the system might be offered initially as optional features that can be tested by end users before becoming activated in the production platform.

Libraries benefit from multi-tenant platforms as well. Given that all the technical administration is executed by the vendor, the burden to the library is very light. In most cases the library will not need to allocate technical personnel for the administration related to their use of the system. In larger libraries, there may be higher-level tasks that require the attention of a systems librarian or functional expert related to institutional configuration issues, data loading, or interactions with other local systems. Smaller libraries will operate these products with very little local intervention.

From the library perspective any form of hosting can reduce the need for managing local equipment and its associated involvement of technical personnel. The difference between the vendor hosting a server-oriented system and a multi-tenant platform is more subtle from the library's perspective. Either version shifts responsibility for the technical infrastructure from the local institution to the vendor.

- Multi-tenant systems may offer built-in content resources, such as knowledge bases and bibliographic data sources.
- Multi-tenant systems usually offer a higher-level, more abstract configuration process.
- Server-oriented systems may perform well in implementations with very high transaction loads. The hardware can be scaled and software optimized to handle peak periods. Most large urban libraries, for example, continue to rely on locally hosted server-oriented integrated library systems.

For many libraries the practical differences between a vendor-hosted server-oriented system (ASP)

and a multi-tenant platform can be subtle. Whether the technical architecture of a product is multi-tenant or relies on a separate institutional instance may have a relatively small impact on how the software functions for a library. The difference between a system housed and managed by the institution versus either of the hosted models (SaaS or ASP) makes substantial operational impact.

Web-Based Interfaces

Library services platforms provide web-based interfaces, requiring no local software in servers or staff workstations. The integrated library system emerged during the client/server phase of technology. These products were based on data stores and business logic residing on servers housed in the data center of the library and software installed on library staff workstations that provided a graphical user interface that performed some processing, usually related to error checking, communications optimization, and presentation-oriented tasks to off-load processing from the central servers. Library services platforms, in contrast, provide all functionality to library personnel via interfaces presented through their web browsers. The data stores and business logic reside on a multi-tenant platform hosted by the vendor, eliminating the requirement for a local server, or an institutional server hosted by the vendor or other co-location provider. Delivering all interfaces via web browsers eliminates the often substantial overhead involved in the installation and upgrades of staff workstation clients and institutional server software, hardware, and operating systems.

Services-Oriented Architecture

The current preferred framework for software development is based on the creation of high-level functionality composed of many reusable lower-level granules of functionality called services. This services-oriented approach enables efficient and flexible software development since each small task need only be coded once. Low-level services can be organized into middleware that provides a generalized set of resources for higher-level business applications. Domain-specific functionality can be developed on top of the middleware layer to focus development on unique work rather than tasks common to most software applications.

APIs Exposed for Extensibility and Interoperability

In addition to the interfaces provided for staff to use via their web browsers, library services platforms also

provide application programming interfaces. These interfaces are not consumed by humans, but rather listen to requests from external systems or programs and provide appropriate responses. APIs can enable advanced reporting capabilities by providing data managed within the system to external applications that will calculate statistics, perform analysis, and control formatting. APIs can also be used to programmatically update data, such as global changes or other tasks that may not be built into the staff interfaces. APIs that perform updates are generally carefully secured and limited to authorized personnel or processes to avoid accidental changes or data corruption. In the same way that all of the functionality of the staff interface must be well documented, the developer of the system must also provide detailed documentation of each of the APIs exposed.

Interoperability

Library services platforms interoperate with external applications such as ERP (enterprise resource planning), financial systems, student account management, and learning management systems via APIs rather than batch load of records. For many institutions, the library and its resource management systems represent only one component of the technical infrastructure that supports the enterprise. Library systems often consume data managed by another system, such as receiving patron records from a university's student management and human resource management systems. The financial data and transactions managed by the library's acquisitions processes often need to be transmitted into the financial management of its higher-level institution. Ideally, these data transfer and synchronization tasks can be accomplished through the APIs of the respective systems. At a minimum, data files can be extracted via APIs that can then be imported or loaded into an external system.

Subscription Pricing

Providers generally offer library services platforms through a subscription-based business model. For installed software, for large applications such as an integrated library system, the business model was based on an initial amount paid for the initial license, plus additional annual charges for ongoing maintenance and support. Software-as-a-service is usually offered through an annual subscription fee set according to the size and complexity of the organization. The first year might include some additional costs associated with migration and set-up. The fixed cost of the subscription displaces a variety of direct and indirect

costs associated with installed software applications, including hardware, operating systems, and data center environment, as well as technical personnel. The annual subscription cost for a SaaS product is generally higher than the maintenance fees associated with a locally hosted application, but the total costs should generally be comparable when all expense categories are calculated.

A Maturing Set of Products

Library services platforms can no longer be considered "next-generation systems," but rather by now well-established products that have seen implementations in hundreds of libraries. The conceptual design of the products, which later become known as library services platforms, began in 2009. Multiple organizations entered an intense phase of product development that culminated with some implementations as early as December 2010. By the end of 2014, almost 1,000 libraries have implemented one of the available library services platforms. Many others having signed contracts for a library services platform and are in the installation process.

Most Products Well into the Adoption Cycle

The completeness of development and the maturity of each of the products that can be considered within this genre vary (see table 1.1). Ex Libris Alma and OCLC's WorldShare Management Services have seen production use for more than two years and have matured considerably beyond their initial release. Quali OLE, though in production in two libraries, currently addresses only print functionality, and the next version, which also manages electronic resources, is expected to be ready for implementation in early 2015. ProQuest Intota is available in what the company characterizes as a foundation release that focuses on the management of electronic resources and does not yet include the functionality for print. The Sierra Services Platform from Innovative Interfaces embodies characteristics of both a library services platform and an integrated library system. Since its release in mid-2012, over 495 libraries have placed Sierra into production, reflecting a strong level of acceptance of this product. We'll look at each of these products in more detail in chapter 4.

A key component of a technology strategy relates to assessing the level of risk associated with any given product or category of products. While some libraries see advantages in taking calculated risks by participating as development partners, beta testers, or early implementers of a product, the vast majority of libraries must take a more cautious approach.

Table 1.1. Production installations as of December 2014

Product	Installations	Sales
Alma	150	370
WorldShare Management Services	270	340
Kuali OLE	2	10
Intota	0	21
Sierra	495	560
Total	917	1,316

Libraries can look to their peers to help them assess risk. Libraries in the first wave of testing and adoption assume the highest level of risk. The level of risk declines as a product builds an installed base. Libraries can solicit information from libraries that have previously implemented the product to learn more about how it has performed and whether it has the features and capabilities expected. Reliance on recommendations from reference sites is a long-standing component of the research performed by a library as it considers strategic technology products.

From Development to Implementation Phase

Library services platforms have been in the deployment phase for several years, providing an increasing body of evidence regarding their efficacy. Information gathered from libraries that have gained firsthand experience with these products can boost confidence in whether it performs as advertised or if it fails to fulfill expectations. Such assessment data can apply to a new product genre or concept, to the individual products that constitute that genre, and to a product's use in specific types of libraries.

The maturity of a product can be considered in terms of a series of benchmarks, including these:

- Completion of initial development. Has the development of the initial version of the product been completed? The initial version may not provide every feature anticipated, but to be considered complete, it should address the full range of functionality at some level.
- Early production phase. At least a small number of libraries have implemented the product and are using it as their daily operational system and have been able to decommission their incumbent systems.
- Mass deployment. The product is considered a routine offering, with dozens or hundreds of libraries using it in production.

Technology products seem to never achieve a final point of development when they might be considered

“finished.” Even integrated library systems, which have been on the market for decades, continue to see enhancements to provide new features and capabilities, to fix bugs, and to address security issues. New products, such as library services platforms, will usually see intense ongoing development following the initial version. This ongoing development may result in new features, increased stability, or faster performance, which will be deployed incrementally. Products deployed through multi-tenant platforms can be enhanced gradually, rather than in the large-step version releases of the previous generation.

Sources to Assess Implementation Patterns and Acceptance

A variety of resources are available that help libraries assess the maturity of a product in terms of its development cycle and implementation patterns.

- “Library Systems Report,” published annually by *American Libraries*, includes sales statistics and other data provided by vendors for each of their major products. This report covers integrated library systems, library services platforms, discovery services, and other strategic library products. The number of sales and installations reported provide an important measure of the acceptance and maturity of the product. This report continues the “Automation Marketplace” published in *Library Journal* that I authored between 2002 and 2012.
- Implementation data from libraries.org. *Library Technology Guides* includes the libraries.org directory, which documents the strategic automation products used in libraries in addition to other details. The data in libraries.org cannot be considered comprehensive, but it is the most complete resource for this type of data. It provides strong coverage of public and academic libraries in North America and Europe. Particular attention has been given to documenting the libraries that have been involved with selecting and subsequently implementing library services platforms. Statistics and charts from libraries.org are used in this report to illustrate the adoption patterns of library services platforms.
- “Library Automation Perceptions Survey.” Conducted through *Library Technology Guides*, the “Library Automation Perceptions Survey” has been conducted annually since 2007. This survey is completed by libraries to rate their impressions of products in a variety of categories. The 2014 Perceptions Survey collected data from October 22, 2014, through January 15, 2015. The 2014 edition of the perceptions survey was not published by the time of the completion of this report,

but preliminary results have been included for the library services platforms we cover.

Library Technology Guides
www.librarytechnology.org

Uneven Time Line among Products

The current state of the development of library services platforms reflects considerable unevenness. Conceptually, this model of resource management has been in play since around 2009. In that year OCLC, the Quali OLE project, and Ex Libris had begun exploring these concepts with libraries and began general product design. Concerted development took place on multiple products from 2010 through 2012. OCLC was the first of this group to achieve a move into the implementation phase, with Craven-Pamlico-Carteret Regional Library System, a small public library consortium, placing WorldShare Management Services into production in November 2010. Boston College became the first library to implement Ex Libris Alma in July 2012. Innovative Interfaces announced Sierra in April 2011, and it was implemented in Hillsdale College a year later in April 2012. Following three phases of development, Quali OLE Version 1.5 was implemented in Lehigh University in August 2014. ProQuest announced its intention to build a library services platform, later branded as Intota, in June 2011, considerably later than OCLC, Ex Libris, or Quali OLE. No libraries have yet put the full version of Intota into production, though several have implemented a preliminary package that includes Summon, 360 Link, Intota Assessment, and a version of Intota for electronic resource management. This version does not yet allow the libraries to decommission their integrated library system.

Development Strategies: *Greenfield versus Brownfield*

How quickly an organization can develop an incredibly complex software application such as a library services platform relates to many factors. Organizations with a large development capacity will have an advantage. The number of personnel allocated for software development provides one metric. Organizations with a development team's programming infrastructure already in place will naturally have an advantage over those that must recruit, train, and establish new processes and procedures. Each of the organizations involved in the development of library services platforms is relatively large with personnel allocated to

product design, software architecture, programming, quality assurance, and testing.

Another interesting aspect of the library services platforms concerns the extent to which each is an entirely new product and which have built upon existing components. One can use concepts in the software development realm borrowed from other kinds of projects. Software projects can be considered "greenfield" or "brownfield" depending on whether they incorporate previous development efforts. Definitions of these terms as applied to software development are given in Wikipedia:

- "Brownfield development is a term commonly used in the IT industry to describe problem spaces needing the development and deployment of new software systems in the immediate presence of existing (legacy) software applications/systems."⁴
- "A greenfield is a project that lacks any constraints imposed by prior work. The analogy is to that of construction on greenfield land where there is no need to work within the constraints of existing buildings or infrastructure."⁵

In the library services arena, a distinct trade-off can be seen in the greenfield versus brownfield approaches. A brownfield project has the potential to shorten the development phase, but it can also moderate the extent to which the product is able to thoroughly revise functionality and be expressed through new technology architectures and infrastructure components. The offerings in the genre of library services platform exhibit varying development strategies.

OCLC WorldShare Management Services took the greenfield model. An entirely new technology platform was created for the service. It is not known to have borrowed programming code or components from any of the integrated library systems that the company has acquired (Amlib, OLIB, LBS, CBS, Sisis Sunrise, and BOND Bibliotheca). The WorldShare Platform does leverage the content of the massive WorldCat bibliographic service. It also uses the existing OCLC Connexion as its initial cataloging interface as it works toward a full cataloging module based on the WorldShare Platform. OCLC also positions the existing WorldCat Local service as the discovery interface for WorldShare Management Services. In 2014 OCLC launched WorldCat Discovery Service on a new platform to eventually replace WorldCat Local and its FirstSearch service.⁶

The development of Alma by Ex Libris can be seen as a greenfield project. Alma was developed on an entirely new codebase apart from its Voyager and Aleph integrated library systems, its Verde electronic resource management system, and its SFX link resolver. The company had two existing integrated library systems that were both quite successful, with ongoing use in some of the world's largest and most prestigious

libraries. Voyager was developed by Endeavor Information Systems, seeing its first production use at Michigan Technological University in December 1995. Aleph, originally developed in the 1980s, had evolved through multiple cycles of technology, but was not considered appropriate as the basis for the company's new strategic platform. The content of the Alma knowledge base incorporated and extended the one created for SFX, but the platform and code are new. Ex Libris packages Primo and Primo Central as the discovery service for Alma. Primo was itself a greenfield service, created in 2006, that has been enhanced and extended over its product history.

The Kuali OLE project can be considered a hybrid approach. The codebase for the domain-specific functionality of Kuali OLE is entirely new. The project opted to make use of software components, including the Kuali Rice middleware and Kuali Financial System. Kuali Rice provides a modern services-oriented foundation, but it was not created to support multi-tenant services. Kuali Financial System is in the process of being redeveloped by the new KualiCo organization.

ProQuest has taken a strategy for its new Intota library services platform that leverages its existing products in addition to the development of an entirely new codebase. ProQuest, continuing the products of Serials Solutions, entered the library software development arena recently enough that all of its products have always been developed to be deployed on multi-tenant web-based platforms. So while Intota builds on some existing products, they do not present some of the same considerations as those that other organizations may face relative to products that were created in previous decades based on fundamental computer architectures that have long since fallen out of favor. ProQuest has released an initial Intota package that includes the well-established Summon discovery service, 360 Link, Intota Assessment, and a new Intota electronic resource management module. The ERM component has been deployed on a new platform but carries forward functionality from 360 Core and 360 Resource Manager.

Innovative Interfaces was able to leverage a significant portion of the Millennium codebase in the development of Sierra. Throughout its corporate history, Innovative has based its development strategy on building on established functionality. In creating Sierra, Innovative preserved the layer of the Millennium codebase that supports the business logic and functionality, surrounded by new technology for database management, a layer that exposes the functionality through the services-oriented architecture, and a new set of Java-based staff clients. As can be seen in table 1.2, this brownfield approach enabled the creation of Sierra through a much shorter development phase than those that followed the greenfield model. Only a year transpired from the initial announcement

of Sierra in April 2011 until Hillside College placed the software into production in April 2012.

SirsiDynix has taken a hybrid approach. Its BLUEcloud suite can be considered a library services platform since it embodies many of the characteristics of the genre. It is deployed through a multi-tenant web-based platform, manages electronic and print resources, and delivers its functionality through browser-based interfaces. At this point in its development, however, the BLUEcloud suite relies on the implementation of one of the SirsiDynix integrated library systems, Symphony or Horizon.

The development time line of the library services platforms reflects, as expected, a longer period of development for the products that are developed through the greenfield model. Ex Libris was able to create the initial version of Alma in around thirty-six months from the time that its intention to develop the product was announced. The initial production of Kuali OLE came just under fifty months following the beginning of its initial planning project, with more time and work underway until the full version that manages electronic resources has been completed and implemented. The brownfield model allowed Innovative to install Sierra only twelve months following its initial announcement. OCLC placed its WorldShare Management Services into production in its first site after twenty months of development, comparatively rapid for a greenfield project. It must also be considered that this first site, Craven-Pamlico-Carteret Regional Library System, implemented a very early version of the system due to a major failure of its incumbent system. OCLC made the general release of WorldShare Management Services in July 2011, still reflecting an aggressive twenty-six month development cycle. These observations generally show that those projects that are able to take advantage of existing components come to completion in shorter time frame than those that take an entirely fresh start. More important, it shows the enormous investment of resources required to develop a library services platform.

While Kuali OLE was implemented by the end of 2014 in two libraries, these libraries have not yet implemented the components still under development for managing electronic resources. A version of ProQuest Intota has been implemented that manages electronic resources, but not print collections.

Given the uneven state of development, libraries may question whether they should move forward with the consideration of new systems or wait until more systems have become more complete and have seen implementation. One line of reasoning might suggest that a library should wait until all of the products have been completed, reached a certain state of maturity, and seen production implementations. Others might argue that there are at least some products in the genre that are finished, at least in their initial versions, and have seen hundreds of production implementations.

Table 1.2. Development phase for library service platforms

Product	Announcement	First Production	Time	Current Implementations
Alma	July 2009	July 2012	36	150
WMS	April 2009	Nov 2010	20	270
Sierra	April 2011	April 2012	12	495
Kuali OLE	June 2008	Aug 2014	49	2
Intota	June 2011	—	42 (to date)	0

Libraries especially interested in open source software may find it worthwhile to wait to observe the progress of Kuali OLE, especially regarding the anticipated capabilities to also manage electronic resources. Libraries with strong ties to ProQuest may want to hold out for the completion of the full version of Intota. ProQuest has put together an interim package of products that allows a library to begin taking advantage of its capabilities for everything but management of the print collection.

The number of offerings in the genre of library services platforms remains relatively narrow. Compared to the number of integrated library systems that have been developed over the history of library automation, this number seems uncomfortably small. We have also seen an often painful process of product consolidation that has taken place through the mergers and acquisitions of the last decade or two. It is not likely that the genre of library services platforms will expand in the near future. Each of the current products is produced by quite strong organizations, providing a reasonable level of confidence that each of these products will endure and reach ever higher levels of maturity and adoption.

Library Services Platform or Integrated Library System

Despite the emergence of the genre of library services platforms, integrated library systems remain a viable option for many libraries. The integrated library system has been the cornerstone of library automation since the mid-1970s and will continue into the future. These two products will continue to coexist for the foreseeable future.

The advent of library services platforms has split the library resource management arena into two threads of development. These two categories cannot, however, be considered as entirely distinct. There are considerable areas of overlap, and some of the directions of development underway in the integrated library system arena may bring these two categories to increasing levels of overlap in the future.

There is already considerable movement among the integrated library systems to shift to all browser-based

interfaces, to offer online catalogs with increasing characteristics of discovery interfaces, and to manage multiple types of materials.

Significant development has taken place among the integrated library systems widely used in public libraries to support integrated management and lending of e-books. This integration includes staff-oriented tools to more easily manage the acquisition of new titles from the major e-book providers, but to also conduct the lending and the provision of the e-book to library patrons through the interface of the library's catalog or discovery interface. These advancements have been seen more in the integrated library systems oriented to public libraries, such as Polaris, Library Solution, and Apollo. E-book integration has been a strategic emphasis of BiblioCommons.

Another configuration takes a hybrid approach to the integrated library system and the library services platform. The SirsiDynix BLUEcloud includes a suite of applications that fall well within the definition of library services platform. Its components including eResource Central, the BookMyne mobile platform, and the functional modules such as BLUEcloud Circulation and BLUEcloud Cataloging—all reside on a web-native multi-tenant platform. These products do not operate entirely independently, but rely on an implementation of one of SirsiDynix's integrated library systems, either Symphony or Horizon. SirsiDynix has developed a set of APIs for Symphony and Horizon, called Web Services, that expose the APIs needed to participate in the BLUEcloud environment as well as interoperate with other external scripts or applications.⁷

One of the key issues covered in this issue of *Library Technology Reports* concerns providing guidance for when a library should consider selecting a library services platform or an integrated library system as it moves forward in its technology strategies. These products have considerable overlap among these two product genres.

The November 2013 issue of *Smart Libraries Newsletter* addressed some of the considerations that apply between integrated library systems and library services platforms. That article suggested that at least some of the integrated library systems were evolving into a more progressive set of characteristics that embody increasing similarities to library services platforms.

Table 1.3. Matrix of general features of the categories of resource management systems

Category	Integrated Library System	Progressive Integrated Library System	Library Services Platform
Resources managed	physical	print, electronic	electronic, physical
Technology platform	server-based	server-based	multi-tenant SaaS
Knowledge bases	none	none	e-holdings, bibliographic
Patron interfaces	browser-based	browser-based	browser-based
Staff interfaces	graphical desktop (Java Swing, Windows, Mac OS)	browser-based	browser-based
Procurement models	purchase	purchase, license	license
Hosting option	local install, ASP	local install, ASP	SaaS only
Interoperability	batch transfer, proprietary API	batch transfer, RESTful APIs,	APIs (mostly RESTful)
Products	SirsiDynix Symphony, Millennium, Polaris	Sierra, SirsiDynix Symphony/BLUEcloud, Polaris, Apollo	WorldShare Management Services, Alma, ProQuest Intota, Sierra, Kuali OLE
Development strategy	brownfield	brownfield	greenfield (mixed)

Table 1.3 shows an updated version of the matrix of considerations highlighting this evolutionary track of development.

Some degree of affinity can be seen between type of library and the category of resource management system adopted.

Library services platforms currently see higher levels of adoption by academic libraries than other types. Academic libraries face a major operational challenge in managing collections of predominantly electronic resources with the ongoing need to maintain their print collections. The fundamental tenet of library services platforms to provide comprehensive resource management spanning content format types directly addresses this need.

Public libraries continue to see vigorous circulation of their physical collections, supplemented by an increasing portion of lending of e-books and other digital materials. Integrated library systems, especially with the e-book lending integration tools now available, continue to serve public libraries well.

School libraries have quite specialized needs, including the need to manage relatively small collections of print books with special attention to selections by reading level. These libraries also offer access to electronic resources, but in somewhat different ways than university and college libraries dealing primarily with issues relating to age-appropriate resources. School libraries primarily make use of specialized integrated library systems and discovery tools from companies such as Follett, Book Systems, Alexandria, and others.

Table 1.4 provides data describing the types of libraries that have implemented each of the products. The counts represent the library organizations that are known to have selected each product as recorded in the libraries.org database. As with other data taken

based on libraries.org, caveats apply. Numbers shown were taken at the end of 2014. While this is a group of products very closely tracked, some implementations are not made public, so in some cases numbers may be somewhat lower than total reported by vendors. Library counts represent a very rough measure. Some libraries may include multiple branches or facilities, and there is substantial variation in the collection size and other metrics of each library.

Table 1.5 shows the distribution of implementations according to the collection size of the library. It illustrates a pattern that, currently, higher proportions of large libraries have implemented Alma with WorldShare, and Sierra is skewed more toward medium-sized libraries. These figures also show that the number of installations is much larger than the number of libraries represented, illustrating that many have implemented these products via consortial arrangements.

Support for Library Consortia

From the earliest phase of the history of library automation, organizations have worked together to share systems to lower costs and to expand the pool of resources available to the users. So while sharing systems among the members of a consortium is not new, recent years have seen many new large-scale projects. Notable examples include these:

- **Illinois Heartland Library System** (427 libraries) has consolidated the systems of four previous regional library systems into a single implementation of Polaris.
- **The approximately 100 public libraries of Northern Ireland** have implemented SirsiDynix Symphony as they consolidated four previous consortia.

Table 1.4. Distribution of implementations by library type

Product	Academic	Public	School	Special	Other	Libraries	Installations
Alma	269	1	0	31	63	364	111
WorldShare	171	9	7	11	26	224	175
Kuali OLE							
Sierra	367	1,134	9	13	101	1,624	452
Intota							

Table 1.5. Distribution of implementations by collection size

Product	Very Large (>1,000,000)	Large (200,000– 1,000,000)	Medium (20,000– 200,000)	Small (<20,000)	Libraries	Installations
Alma	50	78	37	4	364	111
WorldShare	7	40	129	10	224	175
Sierra	114	248	746	218	1,624	452

- **All of the public libraries in the Republic of Ireland** announced their selection of Sierra to serve all of the 32 public library services that include around 170 individual branches, consolidating the individual incumbent implementations.
- The **public libraries of the state of South Australia** have recently completed the implementation of a state-wide automation system using SirsiDynix Symphony, consolidating many previously independent integrated library system implementations.

There have also been some high-profile projects that provide shared technology infrastructure to large groups of academic libraries through shared instances of library services platforms.

- The **Orbis Cascade Alliance** completed the implementation of its 37 academic library members on January 7, 2015. These libraries had previously worked together as a consortium to share resources using separate integrated library systems and resource-sharing technology. The consortium originally used Innovative's INN-reach to facilitate resource-sharing requests and routing, changing to WorldCat Navigator in 2008. In October 2012, the Alliance announced its selection of Ex Libris Alma as a single shared automation system for all of its members.
- Following a long planning and procurement process, **Wales Higher Education Libraries Forum (WHELP)**, a consortium of the national library and the major academic libraries in Wales, announced its selection of Alma as the basis of its shared library management strategy.
- The **BIBSYS** consortium of 105 members that includes the National Library of Norway and the

major academic and research libraries, selected Ex Libris Alma in December 2013. Implementation is underway, with an anticipated completion date in late 2015. BIBSYS had previously developed its own system to serve its members.

- The **LIBROS** consortium of 16 academic institutions in the state of New Mexico announced its selection of OCLC's WorldShare Management Services in January 2014. By late December 2014, all of the libraries had completed their migrations.
- The **Private Academic Library Network of Indiana (PALNI)**, a consortium of 23 academic libraries, has implemented WorldShare Management Services.
- **Cooperating Libraries in Consortium**, a consortium of the academic libraries of eight small colleges and universities, has selected ProQuest Intota and has implemented Summon and the foundation release while continuing to operate its Millennium integrated library system.

Other projects known to be investigating or in the procurement process for a shared resource management environment include these:

- **VALID**, a group of academic institutions in the state of New Jersey. Representatives of this group have been involved in the Kuali OLE project, working toward the possibility of a shared consortial implementation. No specific timetable has been announced.
- The **40 publicly funded universities and community colleges in the state of Florida** are in the process of setting a new strategy for a shared automation system. Florida has a history of shared automation systems, with the community colleges and universities each operating state-wide

systems. Currently the community colleges share a single implementation of Ex Libris Aleph, while each of the universities uses separate instances of Aleph, with a shared discovery interface. Consideration is now underway for a system to be shared among both groups. An “Invitation to Negotiate Next Generation Integrated Library System” was issued on December 15, 2014, by the Complete Florida Plus Program, the recently established organization with a portfolio that includes responsibility for library automation.⁸

Notes

1. Marshall Breeding, “Smarter Libraries through Technology: The Beginning of the End of the ILS in Academic Libraries,” *Smart Libraries Newsletter* 31, no. 8 (August 2011): 1–2, accessed May 6, 2015, <http://journals.ala.org/sln/issue/viewIssue/302/64>.
2. Marshall Breeding, “A Cloudy Forecast for Libraries,” *Computers in Libraries* 31, no. 7 (September 2011): 32–35.
3. Marshall Breeding, “E-resource Knowledge Bases and Link Resolvers: An Assessment of the Current Products and Emerging Trends,” *Insights: The UKSG Journal* 25, no. 2 (2012): 173–82.
4. Wikipedia, s.v. “Brownfield (Software Development),” last modified December 2, 2014, http://en.wikipedia.org/wiki/Brownfield_%28software_development%29.
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7. Marshall Breeding, “Smarter Libraries through Technology: The Roles of Integrated Library Systems and Library Services Platforms,” *Smart Libraries Newsletter* 33, no. 3 (2013): 1–4, accessed May 6, 2015, <http://journals.ala.org/sln/issue/view/283>.
8. See <http://uwf.edu/media/university-of-west-florida/offices/procurement/bids/14itn-04aj/14ITN-04AJ.pdf>.

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Selection and Procurement Strategies

The procurement, selection, and implementation of any strategic library automation product has always been a complex process for libraries. These products are involved with almost all aspects of the library's operation, so any change must be made carefully to ensure the least disruption through any transition, and the library must have a high level of confidence that any new system will offer substantial benefits.

The process for procuring integrated library systems is well established. Each library must follow its own procurement rules and processes required by its governing agency or organization. The functional specifications for library technology products tend to be shared widely. A library undergoing a selection process can develop its own set of specifications and requirements that are informed by procurement documents that might be available. Each library naturally has its own set of concerns and operational issues that it expects to be addressed by the new product.

The need to acquire a new product can be driven by a variety of circumstances or issues:

- The incumbent system is no longer supported by its supplier.
- The needs of the library have changed since the incumbent system was implemented. A common scenario involves the need to manage electronic resources in ways not addressed by the incumbent product.
- The library is not satisfied with the performance of the supplier.
- The cost of maintaining the current system is determined to be higher than the value received and there is evidence that a new product could be acquired and operated at a lower level of cost.

The emergence of the new library services platforms provides an alternative that many libraries may see as beneficial. The existence of a new category of resource management products also complicates the selection process to the extent that libraries may have to decide whether to pursue a library services platform or an integrated library system.

The current state of the library technology industry does not lend itself to processes that are specifically limited to one or the other category: library services platform or integrated library system. Any decision to focus on one category over the other will usually come only after the library has established its strategic priorities and has done a preliminary review of the capabilities of the available products.

In developing a library technology strategy, some of the key considerations might include these:

- Whether to automate as a stand-alone library or to join in a shared implementation with other library partners. Those already sharing a system via a consortium may want to evaluate possibilities of expanding to include new members or merging with other consortia with mutual interests. Libraries that have historically operated their own independent automation systems may want to investigate any opportunities to form a new alliance or join an existing consortium. Independent implementations will remain the most common strategy.
- Assessment of the scope of collections and services expected to be managed by the new system. As noted in chapter 1, many libraries have ended up with a fragmented technology support environment. The availability of library services platforms opens up the possibility that multiple systems

could be subsumed into a single platform. Libraries will need to assess the extent to which they expect specialized collections such as archives or digital resources to be within the scope of the proposed new system.

- As discussed in chapter 3, several options apply to how a library will manage patron discovery relative to a library services platform. Many libraries may prefer, or at least be willing, to accept the discovery service packaged with a library services platform. Others may have discovery services in place that function well and are expected to remain in place.
- Existing product scenarios. Libraries with a positive relationship with the vendor of their integrated library system or discovery service may be interested in pursuing its library services platform via a sole-source procurement process. Libraries that ultimately pursue a sole-source process do so only after considerable investigation of all the alternatives.
- Many institutions may be required to always follow a competitive procurement process, even when they have a predisposition toward a particular vendor or product.
- When conducting a competitive procurement, libraries may opt for different approaches, depending on the expectations or requirements of their business offices and on their preferred methods for gathering sufficient information to evaluate products and make a selection. Some may

follow a more lightweight approach where they develop a vision document or request for information that articulates their general characteristics and high-level strategic requirements and invites vendors to respond with proposals that describe how their product would meet those expectations. Another approach might involve the development of a detailed request for proposals that not only expresses general expectations but also presents a detailed list of functional requirements in each area of library operations the system is expected to address. The creation of such a detailed RFP requires a significant amount of time and effort by library personnel but can lead to more clarity in the specific capabilities that may or may not be present among the competing systems.

- Consideration of an open-source product is usually addressed as part of the high-level strategy discussions. In the integrated library systems arena, there are open-source products supported by commercial firms that can be considered in most procurement scenarios. Only one open-source option, Quali OLE, is available in the library services platform category. Libraries interested in this option would likely pursue an engagement with the project's existing library partners and commercial support affiliates rather than expect the product to fit into a standard competitive procurement process. As the product matures, commercial entities may be able to respond to RFPs oriented to library services platforms.

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Relationship with Discovery

Library services platforms address the management of library resources, but they may optionally be packaged with a discovery interface. In general terms, discovery services and library services platforms belong to separate product genres, but the lines between the genres may not be absolute. These two types of products do not operate entirely independently. Content components and functionality that reside in a library services platform have a direct or indirect role in the search or presentation of resources in patron-facing discovery interfaces.

Discovery services facilitate access to resources for library patrons. These products include a discovery interface that presents a variety of features related to the search and retrieval of materials from library collections, patron self-service requests, and a variety of other capabilities. Index-based discovery services will also provide a large central index populated with citations and full text representing the general body of library-oriented content. Discovery interfaces are available as commercial products and as open-source software. Index-based discovery services are currently offered only as commercial services. Many other resources are available that describe the genre of discovery services.

Resource management products such as integrated library systems or library services platforms ultimately facilitate access to library materials by patrons but are operated by library personnel. The richness of description, detailed profiling of active subscriptions, and current status of whether any given item might be available for lending are examples of some of the support functions relevant to discovery services.

Some—but not all—of the organizations that have created a library services platform also offer a discovery service. The following section discusses the matrix

of options possible between discovery services and each of the library services platforms.

Ex Libris: Alma + Primo

As a company engaged in providing technology products for academic, research, and national libraries, Ex Libris began shaping a new product strategy as early as 2006 based on a more unified approach for both resource discovery and management. The company began its development of a new patron interface, called Primo, in 2006. The initial versions of Primo provided a more modern end-user interface that could be used with its own Aleph and Voyager ILS products as well as with those created by other organizations.¹ Primo included a relevancy-based search and retrieval component that could be populated by the library's ILS and any other local or remote repositories of interest and from which the library would have the technical ability and rights to harvest its metadata. In July 2009, Ex Libris announced Primo Central, an article-level index that could be integrated with any existing Primo installation or set as a target for MetaLib, the company's federated search utility. When Ex Libris created Alma as its new resource management product, the company positioned Primo as its patron interface and discovery service. Additional functionality was created for Alma to allow it to deliver all the functionality expected from an online catalog (OPAC via Primo).

Since Alma exposes a broad set of APIs, it is technically feasible to use discovery products other than the one offered by Ex Libris. The library can export bibliographic records to populate a third-party discovery interface and make use of protocols such as Z39.50 and SIP2 to implement real-time availability

and patron account functionality. Information related to e-resource holdings can likewise be exported to facilitate linking to full text and other services related to access to electronic materials.

Ex Libris positions Primo as the primary interface for Alma. No implementations are known to use some interface other than Primo with Alma.

Innovative: Sierra + Encore

Innovative Interfaces launched Encore as a discovery interface in 2006. Encore can be used with either Millennium or Sierra. Encore offers an interface with faceted navigation and relevancy-based search and retrieval. Innovative also continues to support WebPAC Pro as an online catalog module that functions with Millennium and Sierra. Libraries implementing Sierra have multiple options regarding patron interfaces. They can offer WebPAC Pro or Encore, and some have integrated open-source discovery interfaces.

Encore has been developed as a discovery interface, but Innovative has not created its own index-based discovery service. Instead, Innovative has partnered with EBSCO Information Services to take advantage of the API of EBSCO Discovery Service to present search results through Encore. This option is available to libraries that subscribe to EBSCO Discovery Service and have purchased Encore in a package marketed as Encore Duet.

Libraries using Sierra with open-source discovery interfaces include the Marmot Library Network in Colorado. This consortium created a highly customized discovery environment based on VuFind that it uses with Sierra with special attention to the integration of e-book lending. Along with the Douglas County Libraries, Marmot Library Network has developed a platform that enables libraries to manage their own e-book collections in addition to those offered via commercial e-book vendors such as OverDrive, 3M Library Services, and Baker & Taylor. The Nashville Public Library in Tennessee, eiNetwork of public libraries in the Pittsburgh, Pennsylvania, area, the Upper Hudson Library System, and Grinnell College are other examples of libraries using Sierra that have implemented VuFind as their discovery interface.

The bond between Sierra and Encore can be seen to be somewhat looser than some of the other combinations of discovery services and library services platforms.

OCLC: WorldShare Management Services and WorldCat Discovery Service

OCLC positions a close integration between WorldShare Management Services and its discovery products. The

organization is currently in transition from the WorldCat Local discovery service, which was initially offered as early as 2007, to the WorldCat Discovery Services announced in January 2014.

WorldCat Discovery Services, as does WorldCat Local, includes an article-level discovery index. OCLC offers multiple options on the configuration of WorldCat Discovery Services relative to the indexing available.

Since June 2012, OCLC and EBSCO Information Services have had a partnership that would enable libraries to use EBSCO Discovery Service with WorldShare Management Services. The University of Massachusetts–Lowell has implemented WorldShare Management Services, using WorldCat Local as its catalog search, and offers EBSCO Discovery Service for searching articles. Few, if any, libraries are using EBSCO Discovery Service as the full patron interface replacement for WorldCat Local.

ProQuest: Intota + Summon

ProQuest positions Summon as the patron interface and discovery service designed to work with Intota. The conceptual design of the product is based on a tight integration of the knowledge bases across the product components, spanning the electronic resource management, link resolver, and Summon discovery service.

Intota will expose the APIs that will conceivably support other discovery interfaces. None of the libraries on track to implement Intota have announced plans to use a discovery service other than Summon with Intota.

Kuali OLE: No Discovery Component

From its initial design phase, the Kuali OLE project has considered the discovery layer out of scope. The Kuali OLE project, which focused its efforts on supporting staff functions, chose not to create functionality for discovery or direct patron services. Rather than directly provide a discovery layer, Kuali OLE was designed to integrate with any of the other major products available, including both open-source and commercial versions. To facilitate integration with discovery interfaces, Kuali OLE exposed APIs to service requests related to communicating the status of materials and patron account details. Metadata records managed in OLE can be exported to populate the indexes associated with a discovery service.

The design of Kuali OLE also does not support a traditional online catalog. The functionality associated with this ILS module must be incorporated into the discovery interface that the library chooses to implement along with Kuali OLE.

Table 3.1. Matrix of library services platforms and discovery options

Product	Bundled Discovery Product	Open-Source Discovery Implementations	EBSCO Discovery Service Partnership?
WorldShare Management Services	WorldShare Discovery Service		yes
Alma	Primo with Primo Central		no
Kuali OLE	none	VuFind, Blacklight	yes
Intota	Summon		
Sierra	Encore	VuFind	yes

The institutions implementing Kuali OLE have followed diverse strategies for discovery interfaces. Both the University of Chicago and Lehigh University have developed patron interfaces based on VuFind. Indiana University, slated to move to Kuali OLE in 2015, has developed a custom interface with Blacklight.

EBSCO has joined the Kuali Foundation as a Kuali Commercial Affiliate to facilitate the integration of its EBSCO Discovery Service either to provide its index for article-level discovery or to provide a comprehensive patron interface. The University of Chicago integrated EBSCO Discovery Service into its VuFind discovery interface along with Kuali OLE.

EBSCO Discovery Service: Integrated with All Resource Management Systems

EBSCO Information Services has not developed a library services platform, but has instead formed partnerships with many vendors and projects. EBSCO Discovery Service ranks as the dominant index-based discovery service and has considerable overlap in its customer base with academic libraries that have implemented one of the library services platforms. EBSCO has publicly announced partnerships with Innovative Interfaces and OCLC and has joined the Kuali Foundation as a Kuali Commercial Affiliate. EBSCO does not currently have a partnership with Ex Libris. Many libraries using Aleph and Voyager use EBSCO Discovery Service, including some that have announced plans to move to Alma.

Table 3.1 summarizes the matrix of options possible between discovery services and each of the library services platforms.

Discovery Strategy Issues

One of the major issues in the development of the technology infrastructure for a library relates to whether the resource management and the discovery components should be acquired as an integrated suite from a single provider or as separate products selected

independently. Some of the reasons for implementing a discovery interface offered by same provider as the resource management system include these:

- Pricing and packaging. A vendor will usually offer significant discounts to library organizations as incentives for them to purchase a resource management product and discovery product together. These discounts can result in savings to the library relative to purchasing products from separate vendors. In some cases, the library may have long-term agreements in place for a discovery service that extend through the implementation of a library services platform.
- Support. Acquiring both resource management and discovery from a single vendor simplifies problem resolution. When multiple strategic products are acquired from different providers, it may be more difficult to identify and resolve problems since there is no single entity for support.
- Installation and integration. When acquired as an integrated product suite, the discovery and management components come fully integrated, taking advantage of either proprietary internal communication mechanisms or predefined programming of the respective APIs. In the absence of this preconfigured integration, the providers of the discovery service and the library services platform and the library will need to collaborate and cooperate to implement the needed integration tasks, including:
 - exporting and synchronizing collection metadata and holdings with index of a discovery service
 - responding to requests for status of items and service requests
 - managing patron records in tandem with discovery interface
- When the library selects products from two vendors, the points of responsibility for ensuring that these two products work together properly becomes more complex.
- Consistent conceptual design. When both products are produced by the same vendor, it can be expected that they would follow the same general

set of assumptions and concepts relative to the management and access to resources. How the library services platform organizes functionality has at least some impact on resource discovery. Knowledge bases or bibliographic services handled in the resource management system, for example, may lead to some operational tension when used with a discovery service based on a different set of assumptions.

Some advantages to selecting discovery and management components independently include these:

- Addressing needs of library users independently from those of library personnel. Some libraries may determine that the product that best addresses its expectations for discovery and other patron-oriented functionality differs from the product that best meets their requirements for internal automation and managing their resources. A library might determine that a given discovery service provides better coverage for its collection of resources, which may take preference over other options, including the one integrated into its resource management system.
- Customization. Some libraries may prefer to develop a highly customized environment for their patrons based on a diverse set of components, including those provided by multiple vendors as well as open-source software. A library might, for example, use an open-source discovery interface, such as VuFind or Blacklight, that operates with a resource management product from one vendor and an index-based discovery service from another. While this approach requires considerable technical development capacity, it may be well suited for large libraries that have complex patron and staff requirements that may not be entirely fulfilled by any given off-the-shelf product suite.
- Reducing dependence. Some libraries may prefer not to be entirely dependent on the performance of a single vendor but to work with multiple providers. A library may also prefer to make use of

open-source software that it can support independently or through multiple support or development firms.

Acquiring discovery and resource management products from the same vendor in some cases may cost less and be easier to install and operate. But rather than following the path of least resistance, many libraries will find it worthwhile to address other concerns with these product implementations. In some scenarios, a discovery service provider may offer financial incentives and be able to manage integration in a way that approaches the degree of integration associated with a single-vendor solution.

Both the discovery service and the resource management system need to offer a robust set of APIs in order to make it possible for libraries to operate outside of the constraints of a product suite. Libraries that implement discovery and management products from the same vendor may have some scenarios that involve integration with additional services.

Libraries appreciate the possibility of multiple options in their automation strategies. Some may eventually decide to acquire their management and discovery components as a package due to easier integration, cost incentives, and better functionality. A vendor that forces the issue by not allowing other options may find itself working against the grain in this era of technology where libraries expect openness and flexibility.

Looking at the patterns seen in the implementations to date, however, we observe that the ties between library services platforms and discovery services from vendors that offer them are quite strong. Very few libraries opt to unbundle Alma/Primo, WorldShare Management Service/WorldCat Local, or Intota/Summon. Only a minority of libraries use third-party discovery services with Sierra.

Note

1. Marshall Breeding, "OPAC Sustainance: Ex Libris to Serve Up Primo," *Smart Libraries Newsletter* 26, no. 3 (March 2006): 1, accessed May 6, 2015, <http://journals.ala.org/sln/issue/view/370>.

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Major Products

Ex Libris Alma

Ex Libris, one of the largest companies in the library technology industry, specializes in products for academic, research, national libraries, and consortia. The company created Alma as an entirely new product designed to address the needs of these libraries, especially as they have come to manage collections dominated by electronic resources.

Organizational Background

Ex Libris, based in Israel, operates as a global company with many international offices and distributors, including two in the United States. As of the end of 2013, Ex Libris employed a workforce of 536, with 194 allocated to software development. The company is currently owned by Golden Gate Capital, a major private equity firm based in San Francisco, California. Matti Shem Tov has been president and chief executive officer of Ex Libris since May 2003.

The following time line notes the key milestones in the corporate history of Ex Libris:

October 16, 2012: Golden Gate Capital acquires Ex Libris from Leeds Equity Partners.

August 5, 2008: Leeds Equity Partners acquires Ex Libris Group.

November 21, 2006: Francisco Partners acquires Endeavor Information Systems from Elsevier.

June 26, 2006: Francisco Partners acquires Ex Libris.
1999: Walden Israel and Tamar Ventures invest in Ex Libris Group.

July 1997: Ex Libris acquires Dabis, a German company offering the BIS library automation system.

1996: Company reorganized as Ex Libris group.

1995: Yissum Aleph and Ex Libris, Ltd. merge into a single company.

November 14, 1994: Endeavor Information Systems founded.

1986: Ex Libris, Ltd. founded.

1983: Aleph Yissum founded to commercialize ALEPH.

1980: ALEPH software created at the Hebrew University of Jerusalem.

Other Library Technology Products

The company offers two well-established integrated library systems, Aleph and Voyager. Aleph was developed by Ex Libris beginning in the 1980s and had been developed through multiple generations of technology and is used by some of the largest and most complex library organizations in the world. Among the 2,300 libraries using Aleph are the British Library and the libraries of the University of Oxford and Harvard University. Voyager was developed by Endeavor Information Systems, which was acquired by Ex Libris in November 2006. Voyager is likewise a very well-established product among large research libraries, with over 1,200 installations, including the Library of Congress. Ex Libris also offers a variety of other products, including Verde for electronic resource management, the SFX Link Resolver, the Rosetta digital preservation platform, and the Primo and Primo Central discovery service.

General Description of Alma

Alma embodies the concept of “unified resource management” upon which Ex Libris builds as the foundation

for its functionality. This idea of the unification of library resources was also inherent to the design and development of the company's Primo discovery interface that was launched in 2006. Alma was intended to bring together the main categories of content that libraries manage into a single resource management system.

Although Ex Libris had two very successful integrated library systems, it developed Alma entirely anew. Both Aleph and Voyager were developed in a previous era when print materials dominated library collections and before electronic resources became the focus of library content acquisitions. Both products were also based on outdated computing frameworks. The company had also developed the Verde electronic resource management system, but it was also not deemed to be a suitable foundation for the company's new flagship resource management product.

Alma base-designed from the onset to be deployed on a multitenant platform with browser-based interfaces. To support Alma's globally distributed customer base, its deployment has been distributed through data centers in multiple countries on multiple continents, including the United States, Singapore, the Netherlands, and Singapore. Consistent with the characteristics of current applications based on software-as-a-service, all of the staff interfaces of Alma are provided through the web browser used by library personnel, require no software or plug-ins for staff workstations, and do not require the library to operate any software on local servers.

Consistent with the general expectations of a library services platform and the company's key concept of unified resource management, Alma enables the library to manage both electronic and print resources. Libraries implementing Alma will not only migrate from their existing integrated library system but will also shift the management of electronic resources from previously established processes. Those that have previously implemented electronic resource management systems such as Verde will be able to migrate data. Alma also subsumes the functionality provided by link resolvers, providing a knowledge base of e-resource holdings, extending what the company originally developed for SFX.

Development Time Line

Major events related to the development and deployment of Alma from Ex Libris include the following:

December 19, 2014: Ex Libris reports 370 total institutions with signed contracts for Alma and 150 libraries in production.

December 18, 2014: Welsh Consortium chooses Ex Libris Alma and Primo for shared resource management environment.

August 2, 2014: LIBISnet Library Network in Belgium places Alma into production.

April 29, 2014: Ex Libris launches the Ex Libris Developer Network.

December 31, 2013: Ex Libris reports 329 total contracts for Alma for "Library Systems Report."

December 4, 2013: BIBSYS Consortium in Norway selects Ex Libris Alma.

October 9, 2012: Orbis Cascade Alliance selects Ex Libris Alma and Primo.

July 2, 2012: Boston College becomes the first library to put Alma in production.

January 6, 2011: Ex Libris announces that its unified resource management system will be called Alma.

December 1, 2010: Ex Libris delivers the second partner release of Alma to development partners.

July 6, 2009: Ex Libris announces development initiative for Unified Resource Management—later branded as Alma.

Adoption Phase

Alma has been in the adoption phase since its initial production implementation for Boston College in June 2012. Since that time, Ex Libris has seen positive results as it markets the product to other academic and research libraries. By the end of 2012, the company reported 126 cumulative contracts for Alma, 329 by the end of 2013, and over 370 by mid-December 2014. At that time, over 150 libraries were using Alma as their production environment.

The success of any product may not be adequately represented by the number of installations alone. A consideration of the size of the libraries reveals that a fairly high percentage of installations are in the large or very large category. For example, of 364 libraries that have selected Alma, 50 have collections of over 1 million volumes and another 78 are in the category of having at least 200,000 but less than 1 million volumes.

The overwhelming majority of libraries that have selected Alma are associated with colleges or universities (269 out of 364); 31 are special libraries; 15 serve government agencies (based on data from libraries.org).

Library Satisfaction

Forty-six libraries using Alma responded to the 2014 "Library Automation Perceptions Survey" (see table 4.1). While the satisfaction levels can be considered moderate, it is interesting to note that libraries using Alma rated their satisfaction with its management of electronic resources considerably more positively than that for print.

Table 4.1. Responses to the 2014 “Library Automation Perceptions Survey” from libraries using Alma

Category	Responses	Response Distribution										Statistics		
		0	1	2	3	4	5	6	7	8	9	Mode	Mean	Median
ILS Satisfaction	46			2	1	1	4	11	17	10		7	6.43	7
ILS Functionality	46		1		1	3	6	17	13	4	1	6	6.09	6
Print Funtionality	46			1		3	4	14	9	13	2	6	6.59	7
Electronic Functionality	46			1	1	1	4	12	10	14	3	8	6.74	7
Company Satisfaction	46		2		1	3	2	5	19	9	5	7	6.67	7
Support Satisfaction	46	1		2	1		4	11	20	5	2	7	6.33	7
Support Improvement	44	1		2	1	4	9	8	5	9	5	5	6.09	6
Company Loyalty	45	1	1			2	6	2	11	13	9	8	6.96	7
Open Source Interest	44	18	7	11	2	3	3					0	1.41	1

Kuali OLE

General Description and Strategy

Kuali OLE is an open-source resource management system developed through a series of initiatives with funding from The Andrew W. Mellon Foundation. Kuali OLE was created as an enterprise-level business system to support academic libraries. The software was designed to manage print and electronic materials and to support the workflows that correspond to the processing of each format. Kuali OLE is being created through a community-source development model, one where the open-source software is produced through a process organized through a defined set of participating organizations. A consortium of academic universities participated as investing partners, each contributing local personnel and financial resources.

The Open Library Environment began working under the auspices of the Kuali Foundation in 2009 as it began its initial software development. Joining the Kuali Foundation gave the project the opportunity to take advantage of both governance processes and technical components. Rather than creating its own nonprofit corporation to serve as the legal entity to manage intellectual property and provide organizational and legal support, the project was able to tap into the resources and structures already in place to support the other projects, which were primarily oriented to administrative support for higher educational institutions.

The OLE project also opted to take advantage of technical infrastructure created through other Kuali projects. The conceptual design of the software was based on the services-oriented architecture. As a complex application, the software would require the creation of many lower-level services, workflow tools, transaction management, and other components. Rather than create this infrastructure from scratch, software projects often choose to build on top of existing service bus applications, or middleware. Kuali Rice was developed to support Kuali Student, Kuali Financial System, and

other projects. As part of its engagement with the Kuali Foundation, OLE opted to use Kuali Rise as the foundation for its software development.

In addition to Kuali Rice, the OLE project drew from components of the Kuali Financial System to support some of the business-oriented functions, such as those related to resource procurement and fund management.

The Kuali projects have made a major shift beginning in about September 2014 toward a commercial business model. A new organization, named KualiCo, has been founded to develop the Kuali projects more aggressively and to provide hosting and other commercial services related to the projects.

Each of the Kuali projects operates under separate governing boards. So far, the Kuali OLE board has not yet made a move to engage with the KualiCo but continues to pursue its own development and deployment agenda.

Development Time Line

Major events related to the development and deployment of Kuali OLE include the following:

September 11, 2014: The Andrew W. Mellon Foundation awards \$333,000 to NCSU for Phase II of Global Open KnowledgeBase.

August 22, 2014: KualiCo formed as a professional open-source company.

August 20, 2014: University of Chicago Library placed the Kuali OLE software into production.

August 14, 2014: HTC Global Services, Inc. joined the Kuali OLE partnership as a Tier 1 investment partner.

August 4, 2014: Lehigh University places Kuali OLE into production.

December 5, 2013: Kuali OLE System Partners receive \$882,000 grant from Andrew W. Mellon Foundation.

November 19, 2013: Kuali OLE Team announces the release of OLE 1.0.

June 25, 2013: EBSCO Information Services joins Kuali Foundation as a commercial affiliate.

December 6, 2012: Kuali OLE project is awarded \$750,000 from Andrew W. Mellon Foundation. This grant supported a third year of development of the Kuali OLE software.

March 15, 2012: The Andrew W. Mellon Foundation awards \$499,000 to NCSU for the Global Open Knowledgebase (GOKb). Allied with Kuali OLE, North Carolina State University led a project to develop the Global Open Knowledgebase to provide support for the management of electronic resources. GOKb worked to create an open-access knowledge base of electronic resources and an open-source platform for its deployment, management, and integration with resource management systems. This knowledge base would provide alternatives to those associated with commercial link resolvers and electronic management systems, including some distinctive structural extensions in addition to describing the body of scholarly resources. While GOKb was designed to be used in a variety of contexts, its integration with Kuali OLE version 2.0 helps extend its scope to electronic resource management.

January 24, 2011: HTC Global Services is the development partner for the Kuali OLE.

December 10, 2009: Indiana University is awarded \$2.38 million grant from The Andrew W. Mellon Foundation to develop library software. Building on the conceptual work of the initial design phase, this two-year project began the process of specifying the functionality of the system based on teams of experts drawn from each of the participating organizations, refining the conceptual framework, and beginning the creation of the software. Now under the Kuali Foundation, the project was led by Indiana University and included Lehigh University, University of Chicago, University of Maryland College Park, University of Michigan, the University of Pennsylvania, Duke University, North Carolina State University, and representatives from a consortium of colleges and universities in Florida. A commercial software development firm, HTC Global Services, was contracted to assist the project with architecture design, project management, quality assurance, and programming.

June 13, 2008: Mellon Foundation provides \$475,700 for Reconceptualizing Technology for Modern Library Workflows—OLE. Duke University was the lead institution for this project, with Lynne O'Brien, Director for Academic Technology and Instructional Services, serving as the coordinator. Other participating institutions included

University of Kansas, Lehigh University, the University of Pennsylvania, the National Library of Australia, Library and Archives Canada, Vanderbilt University, the Orbis Cascade Alliance, Rutgers University, the University of Florida, the University of Chicago, Columbia University, the University of Maryland, and Whittier College. These institutions represented the interests of different types of organizations, such as large libraries from large universities, smaller colleges, consortia, national libraries, and archives. This project fleshed out the original concept into specific areas of workflow, breaking away from the traditional ILS modules. Preliminary work was accomplished to begin expressing the design into a services-oriented architecture. Organization recommendations included investigating joining with the Kuali Foundation rather than establishing its own nonprofit corporation for project administration.

Deployment and Adoption Status

Kuali OLE has been placed into production in two libraries by the end of 2014. Lehigh University became the first when it completed the migration from its SirsiDynix Symphony ILS on August 4, 2014. The University of Chicago shifted from its SirsiDynix Horizon ILS and INNOVAQ acquisition module on August 20, 2014. For both of these libraries, the initial implementation was meant to address the management of their physical resources needed to replace their legacy ILS. Their use of the product to also manage electronic resources will come in 2015 once Kuali OLE 2.0 becomes available.

Other institutions known to be actively working toward the implementation of Kuali OLE include:

- Indiana University
- Duke University
- North Carolina State University
- University of Maryland, College Park
- University of Pennsylvania
- Villanova University
- Bloomsbury Consortium of the University of London Library Systems Association

VALID is an initiative of the Virtual Academic Library Environment of the academic libraries in New Jersey. Representatives from the academic libraries in New Jersey have been involved with the Kuali OLE project since its inception in 2007. According to the project's website, institutions that have indicated interest as early implementers include New Jersey Institute of Technology, College of New Jersey, Drew University, Rutgers, and William Paterson University.

Current Status

Kuali OLE can be considered in its late development phase and early adoption cycle. The software has been placed into production successfully at one of the largest academic libraries (University of Chicago) and a smaller academic library (Lehigh University). Both of these initial implementations were based on Kuali OLE v. 1.5, which provided the ability to fully migrate from their existing ILS products. At the time of this writing, the software has not been used to also manage electronic resources, a key component of the project's stated vision. This phase of implementation is expected later in 2015.

Kuali OLE finds itself amid some recent changes related to the broader set of Kuali projects. In August 2014, following a series of workshops involving stakeholders among the various Kuali applications, a decision was made to form a new commercial company, later named KualiCo, to accelerate development and offer hosting and other services. This shift represents a change in business models that will place the new KualiCo in more of a position of control for the projects that opt to engage with it. KualiCo will employ its own team of developers and will set a development agenda that will produce new versions of the products more quickly than was happening via the community-source model. KualiCo anticipates producing more of an integrated suite of products rather than the individual products that operate entirely independently of each other. The business model for KualiCo will be based on selling services, especially hosting and support of the Kuali applications.

No immediate impact has been seen on the Kuali OLE project. As of the end of 2014, Kuali OLE continued to operate under its own board, and development continued along the previously planned course, with HTC Global serving as the primary development firm under the oversight of the Kuali OLE board and specification and testing performed by functional councils.

Any complications for Kuali OLE may relate to the other Kuali components upon which it was based. In order to jump-start development, Kuali OLE decided to use Kuali Rice as its middleware to support basic services and common tasks and workflows needed for a complex business application. Kuali Rice also provides the document store and is the basis for the delivery of the staff interface.

OCLC WorldShare Management Services

OCLC ranks as one of the largest and most influential organizations globally that provides services and products to libraries. It was founded in 1967 to provide a shared cataloging service to libraries in the state of

Ohio and expanded nationally and internationally in subsequent years. Organized as a nonprofit corporation, OCLC is governed by a board of trustees and advised by councils appointed from its membership. The organization provides major services related to cataloging, resource sharing, collection analysis, virtual reference, and many other tasks. Its research division explores trends and technologies with potential interest to libraries. OCLC also has a long history of involvement in producing or distributing library technology products. It provided one of the major library automation products of the 1980s called LS/2000, but exited from the library automation arena in 1990 when it sold its Local Systems division to Ameritech. OCLC has since reengaged with library automation, acquiring a variety of companies that produce integrated library systems in different global regions, including Sisis Informationssysteme, Fretwell Downing, PICA, Amlib, and BOND.

Organizational Background

The following time line shows some of the organizations that have become part of OCLC through its organizational history. OCLC has created a wide variety of products and services both through its own development and through the acquisition of other companies and nonprofit organizations.

- October 1, 2013:** OCLC acquires Huijsmans en Kuijpers Automatisering.
- April 18, 2011:** OCLC acquires the assets of German library system provider BOND.
- March 17, 2010:** EBSCO Publishing acquires the NetLibrary Division from OCLC. OCLC sells NetLibrary to EBSCO Publishing.
- August 1, 2009:** OCLC sells Preservation Service Center to Backstage Library Works.
- September 12, 2008:** OCLC acquires Amlib.
- January 11, 2008:** OCLC acquires EZproxy from Useful Utilities.
- July 3, 2007:** OCLC acquires remaining shares of OCLC PICA.
- August 14, 2006:** OCLC acquires DiMeMa, Inc., which produces CONTENTdm.
- July 1, 2006:** OCLC acquires Research Libraries Group.
- January 3, 2006:** OCLC acquires Openly Informatics.
- November 2, 2005:** OCLC PICA acquires Fretwell-Downing Informatics.
- June 27, 2005:** OCLC PICA acquires Sisis Informationssysteme.
- August 2004:** OCLC absorbs 24/7 Reference Service from Metropolitan Cooperative Library System.
- November 12, 2003:** OCLC acquires CAPCON.
- 1999:** OCLC acquires 60 percent ownership of PICA BV. OCLC acquires Library Technical Services (LTS).

January 1999: OCLC acquires WLN.
October 1997: OCLC acquires Blackwell North America's authority control service business.
July 1997: OCLC sells Information Dimensions to Gores Technology Group.
1997: PICA takes a majority share in newly founded company ALS International Limited.
June 1993: OCLC acquires Information Dimensions, Inc., from Battelle Memorial Institute.
April 1990: Ameritech acquires LS/2000 from OCLC.
1985: OCLC acquires MetaMicro.
August 1983: OCLC acquires Avatar.
1967: OCLC Founded as Ohio Online Library Center.

Development of WorldShare Management Service

In April 2009, OCLC announced its plans to develop a new resource management system that leveraged its massive WorldCat bibliographic service. Rather than depend on bibliographic databases laboriously created by each library, this new product would provide a complete set of circulation, acquisitions, serials management, and related capabilities to extend the cataloging and bibliographic services and resource sharing in place for WorldCat. In simplified terms, a library would manage its local collection by attaching item-specific records to its holdings as represented in WorldCat.

To support this new conceptual approach, OCLC developed a new multitenant platform and software application to provide these new resource management capabilities, generally called the WorldShare Platform, which supports specific applications such as WorldShare Management Services. Consistent with its involvement with libraries in all parts of the world, the WorldShare Platform has been deployed through multiple data centers located in multiple continents. The WorldShare Platform was developed following the services-oriented architecture. In addition to its web-based staff interfaces, the WorldShare Platform exposes APIs to enable library programmers or external applications to access its data and functionality. These APIs are intended to allow libraries or other organizations create applications or widgets beyond those developed directly by OCLC.

OCLC WorldShare Management Services provides capabilities to manage a library's collection of electronic resources in addition to its print collections holdings via a component called WorldShare License Manager. OCLC has created a knowledge base of e-resource holdings to facilitate the management of these resources.

The following time line describes the major benchmarks in the development of WorldShare Management Services:

December 19, 2014: OCLC reports that 270 libraries are live on WorldShare Management Services and a total of 340 have signed contracts.
June 12, 2014: University of Delaware is first ARL and 200th library to go live with OCLC WorldShare Management Services.
January 21, 2014: LIBROS consortium of sixteen academic libraries in New Mexico selects WorldShare Management Services.
January 9, 2014: Private Academic Library Network of Indiana of twenty-three institutions selects OCLC WorldShare Management Services as its cloud-based library management system.
December 31, 2013: OCLC reports 177 total installations of Sierra for the "Library Systems Report."
July 1, 2011: General release of WorldShare Management Services.
November 18, 2010: Craven-Pamlico-Carteret Regional Library System places WorldShare Management Services into production.
April 22, 2009: OCLC announces new Web-scale Management Services (later branded as WorldShare Platform).

Adoption Phase

Following a development period that began around April 2009, WorldShare Management Services saw its first production implementation in November 2010 by the Craven-Pamlico-Carteret Regional Library System. The implementation was based on a very early version of the platform, as this library faced the need to rapidly implement a new system due to a major failure of the hardware that supported its incumbent ILS. The general release of the system came in July of the next year.

As of December 2014, 270 libraries have implemented WorldShare Management Services as their production environment, migrating from their prior ILS installations. OCLC reported a total of 177 libraries that had signed agreements to implement the product at the end of 2013.

While a diverse mix of libraries have selected WorldShare Management Services, around three-fourths are associated with colleges or universities. Out of the 224 libraries using the product represented in libraries.org, 171 are academic, 11 are special, and 9 are public libraries.

Libraries from all size categories have selected WorldShare Management Services. Around 80 percent of these libraries are medium-sized with collections between 20,000 and 200,000 volumes. The product has not seen wide adoption in the large library sector with collections over 1 million volumes. It has entered the ranks of the members of the Association of Research Libraries with its installation in the University of Delaware in June 2014.

Table 4.2. Responses to the 2014 “Library Automation Perceptions Survey” from libraries using WorldShare Management Services

Category	Responses	Response Distribution										Statistics		
		0	1	2	3	4	5	6	7	8	9	Mode	Mean	Median
ILS Satisfaction	72	1		1	2	1	3	10	28	22	4	7	6.88	7
ILS Functionality	71	1			2	3	8	12	31	11	3	7	6.51	7
Print Functionality	70	1	1			1	4	8	15	33	7	8	7.21	8
Electronic Functionality	70	1	1	1			7	10	20	23	7	8	6.93	7
Company Satisfaction	71	1		2		1	1	6	15	34	11	8	7.39	8
Support Satisfaction	70			2		1	3	8	19	18	19	7	7.41	8
Support Improvement	69			2		2	13	9	14	17	12	8	6.86	7
Company Loyalty	72	1	1	1		2	1	4	15	23	24	9	7.57	8
Open Source Interest	71	36	15	3	9	4	1			2	1	0	1.28	0

Product Satisfaction

The 2014 “Library Automation Perceptions Survey” received 72 responses from libraries that have implemented OCLC WorldShare Management Services (see table 4.2). The statistics for the satisfaction responses reflected moderate levels of satisfaction, which reflects well on a relatively new product. More in-depth analysis will be given when the full report is published based on the survey data. One preliminary observation is that the satisfaction level given for print functionality (7.21) was more positive than that for its capabilities for electronic resources (6.93).

ProQuest Intota

ProQuest ranks as one of the largest companies providing products and services for libraries. In addition to its many content products, it also provides a variety of library resource management and discovery products, primarily through its business unit Serials Solutions, which it acquired in March 2004. In January 2014, the Serials Solutions name was phased out, reflecting its full integration into ProQuest.

Organizational Background

The following time line outlines some of the major events in the corporate history of ProQuest that relate to its resource management and discovery products.

January 20, 2014: ProQuest retires Serials Solutions brand.

November 21, 2013: Initial version of Intota Assessment launched by ProQuest.

June 22, 2011: Serials Solutions announces strategy to build Web-scale management solution, later branded as Intota.

January 19, 2009: Serials Solutions launches Summon discovery service.

January 10, 2008: Serials Solutions brands its e-resource knowledge base as KnowledgeWorks.

November 15, 2007: Serials Solutions launches the 360 Counter E-Resource Assessment Service.

March 29, 2007: Serials Solutions rebrands its products under the Serials Solutions 360 suite.

October 4, 2005: Serials Solutions launches E-Resource Management System.

June 9, 2005: Jane Burke named general manager of Serials Solutions.

January 13, 2005: Serials Solutions launches Central Search federated search product.

March 9, 2004: Serials Solutions acquired by ProQuest.

December 5, 2002: Serials Solutions launches OpenURL link resolver Article Linker, later branded as 360 Link.

March 2000: Serials Solutions founded.

Development of Intota

ProQuest has taken a staged approach to the development of Intota, integrating and extending existing products as well as creating new components and functionality. The initial phase produced new functionality not offered in a traditional integrated library system. This new functionality centers on enhanced electronic resource management and collection analytics and assessment tools that span print and electronic materials. During the initial phase, libraries adopting Intota would do so in tandem with their existing ILS implementation. Only with the availability of the complete Intota product will libraries be able to decommission their legacy ILS.

ProQuest had been a pioneer in the index-based discovery realm, but initially resisted developing a resource management product that also addressed print materials. The company had held to a strategy of focusing on the electronic resource collection of academic libraries. In June 2011, ProQuest announced that it would develop a product to provide comprehensive

management of print as well as electronic resources. In January 2012, ProQuest branded this new product as Intota.

ProQuest's Summon discovery service can be considered a well-established product. It was initially released in June 2009 with a major new version in created in 2013 with a variety of new features to help library users find and explore resources related to their research interests. (See *SLN* May 2013 for more details.)¹

On its path toward the full product, ProQuest has released what it calls Intota v1, a package of new and existing products that together provide functionality for discovery and management of a library's resources, except for the management of print resources. The package includes Summon, 360 Link, Intota Assessment, and the new Intota E-resource Management.

- The Intota ERM extends the existing capability of its 360 Resource Manager with new features and automated workflows.
- ProQuest had also developed its 360 Link OpenURL link resolver and its associated knowledge base. In June of 2014, the company released a new version that included new capabilities such as Index-Enhanced Direct Linking.
- Intota Assessment has been available since 2013, providing a variety of metrics for both print and electronic collections. Intota Assessment and Intota ERM are not deployed on the same technical platform but exchange data as needed. Intota Assessment displaces ProQuest's earlier 360 Counter service.

ProQuest continues to offer 360 Link and 360 Resource Manager as individual products outside the Intota v1 suite. Libraries interested in moving from the 360 Suite will be able to easily migrate to Intota through processes that ProQuest has in place and will not have to recreate any data or configuration profiles.

Intota v1 provides new capabilities for automated management of demand-driven acquisitions. Through an integration with Summon, records corresponding to a collections selected for DDA are activated in the knowledge base without the need for processing MARC records in and out of the library's ILS.

ProQuest has developed all of its strategic products as hosted services deployed on multitenant platforms with web-based interfaces. None of its strategic management products involve software that would be installed on a server in the library or client software for staff computers.

ProQuest has a strong emphasis on developing knowledge bases as the basis of its resource management products. Its KnowledgeWorks e-resource knowledge base originally developed for 360 Link, 360 Core, and 360 Resource Manager has been extended to

represent a broader array of resources, including those oriented to print resources. The knowledge base for Intota further extends the knowledge base created for those products, addressing additional resources and including data from other content resources available in the ProQuest portfolio.

Although Intota remains in the development phase, ProQuest has been consistent in its messaging that Summon is intended as the patron interface for Intota. Both products offer APIs that make it technically possible to create other product combinations.

Intota Development Time Line

ProQuest, via its then operating division known as Serials Solutions, became one of the earliest to enter the index-based discovery arena when it announced its Summon discovery service in January 2009. The company has been a later entrant into the arena of library services platforms. The following time line gives some of the major benchmarks in the development of Intota:

- Late 2015:** Anticipated release of full Intota product for comprehensive management of print and electronic resources that allows replacement of existing ILS.
- June 24, 2014:** ProQuest releases foundation version of Intota, providing management of electronic resources and collection assessment and decision support for print and electronic materials.
- November 21, 2013:** Initial version of Intota Assessment released.
- June 22, 2011:** ProQuest business Serials Solutions announces strategy to build Web-scale management solution, later branded as Intota.
- June 2009:** ProQuest releases Summon index-based discovery service.

Deployment and Adoption Status

Since the full version of Intota has not yet been completed, it is not possible to show implementation as with the other members of the library services platform category. Instead, we can provide data provided by ProQuest that lists libraries that have signed for the preliminary release and that have committed to implement the full version once it is available.

As of late 2014, ProQuest reported that 31 libraries had signed contracts to license Intota v1 (Summon, 360 Link, Intota Assessment, Intota ERM as they continue to rely on their existing ILS implementations). These libraries include:

- Aarhus Universitets Biblioteker (Denmark)
- Auckland University of Technology (New Zealand)

- Babson College
- Bibliotheca Alexandrina (Egypt)
- Canisius College
- Case Western Reserve
- Charles Darwin University (Australia)
- Clemson University
- College of the North Atlantic
- Concordia University Wisconsin
- De Montfort University (UK)
- Edge Hill University (UK)
- Edith Cowan University
- Florida Institute of Technology
- Florida State University
- Higher Education Colleges of Technology (UAE)
- Hong Kong Baptist University
- Humboldt State University
- James Cook University (Australia)
- Kuwait Health Science College
- Niagara College (Canada)
- Northumbria University (UK)
- Pittsburg State University
- Queen Mary University (UK)
- Queen's University (Canada)
- Staffordshire University (UK)
- University of Southern California
- Université Paris Diderot (France)
- University Campus Suffolk (UK)
- University of Victoria (Canada)
- USCH Library (Germany)

ProQuest reports another set of libraries that have committed to the full version of Intota and anticipate migrating from their existing ILS products once it become available:

- Ball State University (to migrate from SirsiDynix Symphony)
- Johnson County Community College (Ex Libris Voyager)
- Marist College (Ex Libris Voyager)
- SUNY Geneseo (Ex Libris Aleph)
- Worcester Polytechnic Institute (Ex Libris Voyager)
- Eastern Michigan University (Ex Libris Voyager)
- University of Texas–Arlington (Ex Libris Voyager)
- Texas Health Science Libraries Consortium (five members, Ex Libris Voyager)
- University of Huddersfield (SirsiDynix Horizon)
- University of Notre Dame, Australia (SirsiDynix Horizon)
- Cooperating Libraries in Consortium (CLIC; seven libraries, Innovative Millennium)

Sierra from Innovative Interfaces

Innovative Interfaces offers a variety of products and services for libraries, primarily oriented toward

the management and discovery of library resources. Founded in 1978 by Jerry Kline and Steve Silberstein, the company has created an evolutionary series of products that have steadily expanded in scope and that have been re-engineered through multiple generations of technology.

Organizational Background

Innovative currently ranks as one of largest companies in the library technology industry. For most of its corporate history, Innovative stayed out of the fray of mergers and acquisitions or external investors. Its only acquisition took place in 1997, when Innovative acquired SLS, a European company that developed the LIBERTAS automation system. The company experienced a major change in April 2012, when it was acquired by a pair of private equity firms, Huntsman Gay Global Capital (now HGGC) and JMI Equity.

The major milestones of the company can be seen in the following chronology:

June 1, 2014: Innovative Interfaces acquires VTLS.

March 31, 2014: Innovative Interfaces acquires Polaris Library Systems.

February 1, 2013: Huntsman Gay Global Capital and JMI Equity purchase remaining shares of Innovative Interfaces.

October 16, 2001: Jerry Kline purchases the outstanding shares of the company from cofounder Steve Silberstein.

April 30, 1997: Innovative acquires SLS.

1978: Innovative Interfaces, Inc. founded by Jerry Kline and Steve Silberstein.

Since the advent of its new ownership and management, Innovative Interfaces has expanded its global presence through opening a new office in Dublin, Ireland, and has launched Innovative India to assist in software development, service, and support. The company has also expanded through strategic acquisitions, purchasing Polaris in March 2014 and VTLS in June 2014.

Innovative Interfaces developed Encore as its discovery product, initially released in May 2006, providing the relevancy-ranked results, faceted navigation, enriched display of results, including cover images, tables of contents, and a simple interface with a single search box. The company continues to offer WebPac PRO as the conventional online catalog that can be used with either Millennium or Sierra, unlike other library services platforms that operate only with a discovery interface. Innovative introduced Encore Synergy in April 2010 to enable discovery of article-level content through real-time connections to remote resources using web services. Encore Synergy did not follow the index-based search model in the same way

Table 4.3. Responses to the 2014 “Library Automation Perceptions Survey” from libraries using Sierra

Category	Responses	Response Distribution										Statistics		
		0	1	2	3	4	5	6	7	8	9	Mode	Mean	Median
ILS Satisfaction	276	10	5	10	16	15	34	45	84	46	11	7	5.90	7
ILS Functionality	276	3	9	11	11	12	28	38	74	64	26	7	6.32	7
Print Funtionality	276	2	4	7	12	12	13	20	58	100	48	8	6.97	8
Electronic Functionality	268	9	15	12	20	30	33	50	48	36	15	6	5.38	6
Company Satisfaction	276	18	13	11	13	20	38	41	65	45	12	7	5.48	6
Support Satisfaction	267	18	12	15	21	21	28	43	57	39	13	7	5.30	6
Support Improvement	267	30	11	10	21	39	61	26	32	23	14	5	4.66	5
Company Loyalty	269	25	6	15	16	23	34	31	40	37	42	9	5.52	6
Open Source Interest	274	90	53	39	19	24	23	10	9	2	5	0	2.13	1

embodied by other discovery services. In June 2012, Innovative launched Encore Duet, which provides article-level discovery via API access to EBSCO Discovery Service. Encore Duet requires that the library also subscribe to EDS from EBSCO in addition to purchasing Encore from Innovative.

General Description of Sierra

Sierra, Innovative’s latest strategic product offering, brings forward the features and functionality of the company’s previous products into a newly created technology platform. The evolutionary product development can be seen in the following time line:

- December 22, 2014:** Innovative Interfaces reports 495 libraries live on Sierra and a total of 560 contracts signed.
- December 31, 2013:** Innovative reports 336 total installations of Sierra for the “Library Systems Report.”
- May 4, 2012:** Bloomfield Township Public Library becomes the first public library to place Sierra into production.
- April 25, 2011:** Innovative announces Sierra Services Platform development.
- May 26, 2006:** Innovative Interfaces launches Encore discovery interface.
- August 1995:** Innovative launches its first web-based online catalog.
- 1991:** Innovative develops INN-Reach system.
- 1989:** Innovative interfaces develops Circulation Module for INNOPAC.
- 1987:** Innovative interfaces develops online catalog module for INNOPAC.
- 1985:** Innovative Interfaces develops Serials Control Module.
- January 1982:** Innovative launches INNOVACQ SYSTEM 100.

1978: Innovative Interfaces develops OCLC-CLSI interface.

The development strategy for Innovative has been to advance the functionality of its previous resource management products into each next-generation system. Millennium had proven itself as one of the most successful integrated library systems on the market and was generally regarded as offering quite sophisticated functionality for circulation and technical services. The product also had a reputation as a relatively closed and proprietary application. Sierra, in contrast, was designed to embrace the service-oriented architecture, providing a set of RESTful APIs for programmatic access to the functionality and data within the system. Sierra also offered access via SQL requests to the underlying PostgreSQL relational database.

Innovative completed the development of the initial version of Sierra in only twelve months—the period that occurred between its initial announcement and the first library to place the software into production. Innovative developed a new platform for Sierra that included new layers of technology surrounding the business logic carried forward from Millennium. Sierra relies on PostgreSQL an open-source relational database engine instead of its own proprietary database or Oracle, as was used by Millennium.

In contrast to Millennium, which divided functionality into separate modules for circulation, cataloging, acquisitions, and serials, Sierra offers a unified, non-modular staff client with access to all the capabilities of the system, activated selectively according to the security profile of the staff member.

Innovative has not created knowledge bases as part of its product strategies for the management of electronic resources. Sierra was not initially developed for deployment through multitenant software-as-a-service. Rather, current deployment options are similar to Millennium, where the software is installed locally in

a library or consortium or as separate instances hosted by Innovative.

Deployment and Adoption Status

Sierra has proved to be an extremely successful product when measured by the number of libraries that have selected and implemented the product. By December 2014, Innovative reported that 560 libraries have signed contracts for Sierra and that 495 are using it as their production environment. A total of 1,625 libraries and 3,675 individual branches are recorded in libraries.org as using Sierra.

The libraries selecting Sierra represent a very diverse mix when considering library types and size categories. The largest portion, around 56 percent, falls into the medium-sized category; 16 percent are

small, 18 percent large, and 8 percent very large. Public libraries dominate, with about 70 percent of the overall set; 23 percent are academic libraries.

The satisfaction levels of libraries using Sierra are moderate, as seen in the 2014 Library Automaton Perceptions Survey, which received 276 responses from libraries using the product (see table 4.3). Preliminary observations include a higher set of ratings for its print functionality (6.97) compared to its capability for electronic resources (5.38).

Note

1. Marshall Breeding, "Serials Solutions to Launch Summon 2.0," *Smart Libraries Newsletter* 33, no. 5 (May 2013): 2–5, accessed May 6, 2015, <http://journals.ala.org/sln/issue/view/281>.

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