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Streamlining Data for Cross-Platform Web Delivery

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Smartphone users expect the presentation of Web sites on their mobile browsers to look and feel like native applications. With the pressure on library Web developers to produce app-like mobile sites, there is often a rush to get a site up without considering the importance of reusing or even restructuring the data driving the Web sites. An additional challenge is the content maintenance required of any Web site, regardless of platform, underscoring the advantage of pulling content from other systems to decrease redundancy. This article highlights case studies from two large research universities, examines how each one is streamlining its data for multiple Web-based platforms, and discusses how to work toward making data more flexible so content is delivered from single source points rather than duplicated on individual delivery platforms.

KEYWORDS *academic libraries, Web sites, data management, content management, API, platform, mobile*

INTRODUCTION

Today's libraries are facing more complex Web challenges than ever before as they work to provide users with seamless research experiences, requiring numerous services to communicate with one another and access content shared across multiple platforms. Although the functionality provided in

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these services is important, the portability and flexibility of the data is also crucial in order to decrease redundancy, make content maintenance easier, and allow the data to be adaptable for each desktop or mobile platform. It is our role as members of the library community to help create cultures of reusable, flexible data that can be accessible on any platform.

Libraries use an array of systems in a mixed environment of homegrown, vendor-supplied, and open source applications, posing a challenge to seamless access. Technology environments in which all applications are completely built by libraries themselves would still have difficulty reusing data sources for diverse online distribution. Most library technology environments have very few internally-built applications, especially smaller libraries that do not have developers on staff. Many vendor systems provide APIs (Application Programming Interfaces), which can provide the ultimate level of flexibility for providing data when and how a library needs them to be delivered, under their control, and while meeting the needs of a specific library's users.

The path to flexible data for Web delivery within libraries is not an easy one, but both library users and content managers will appreciate the efforts taken with such an approach. This article examines case studies highlighting efforts to streamline data at two different research libraries: the University of Alabama Libraries in Tuscaloosa, Alabama (http://www.lib.ua.edu/) and the University of Houston Libraries in Houston, Texas (http://info.lib.uh.edu/). These two large libraries' experiences and ambitions to create environments of flexible data are useful for Web and systems librarians struggling with similar challenges. In addition, these case studies attempt to demonstrate the benefits of these efforts for library users.

LITERATURE REVIEW

The information technology field is abundant with online articles about using APIs, open source software, and tools to help manage specific types of content. However, the library field lacks resources that specifically address the challenges and solutions involved in managing a lot of data across multiple systems and presenting them to users in more streamlined, useful ways. Two specific articles offer advice on integrating systems, streamlining data, and taking advantage of Web services to improve user experience: *Beyond Information Architecture: A Systems Integration Approach to Web-Site Design* by Krisellen Maloney and Paul J. Bracke (2004) and *Web Services and Widgets for Library Information Systems* by Godmar Back and Annette Bailey (2010).

In addition to those articles, there are a few books that contain chapters or small sections that address this topic. In *Content And Workflow Management For Library Web Sites: Case Studies*, Holly Yu (2004) explained in one chapter the importance of database-driven Web sites, but most of the book

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focused on the workflow for maintaining content within content management systems (CMSs). In the book, *Library Mashups: Exploring New Ways to Deliver Library Data*, editor Nicole Engard (2009) included articles from 25 significant contributors around the world, and many of these articles provide great insight and how-to tips on streamlining data as well as mashing multiple services together to create new services.

CHALLENGES TO STREAMLINING DATA

As more digital and online services are expected by our users, libraries typically operate more than one Web-based system. A large library will likely manage a more robust array of systems than a small library. Consequently, with an increase in the number of applications comes an increase in complexity when striving to make the systems work seamlessly together across a library's Web presence. It becomes difficult to reduce the amount of content silos, as many of those systems are CMSs.

Many academic libraries today run CMSs for their main, public-facing Web site, allowing library staff to easily manage content without knowing markup languages. With the proliferation of vendors providing user-friendly, relatively inexpensive, and easy-to-configure cloud-based library services, many libraries are now, in essence, managing multiple CMSs. For example, great numbers of libraries are using tools like the Library à la Carte (http://alacarte.library.oregonstate.edu/) or Springshare's LibGuides (http://www.springshare.com/libguides/) for CMSs to manage their research or course guides and incorporate more social interaction functions into their Web presence. Some libraries are even using CMSs to manage the content of their libraries' mobile Web site, self-help knowledge bases or FAQ systems, calendaring or event systems, and news blogs. Updating content across so many different CMSs could prove to be a daunting task or a disaster without incorporating a plan to streamline the content and reduce duplication of both content and content management efforts.

In addition to multiple CMSs, libraries also run multiple complex Web-based, database-driven applications like the library's catalog, course reserves, ILL services, digital libraries, and institutional repositories. Some libraries also use tools for managing structured data that include the administration of staff directories, electronic resources, library hours, branch information, and more. Additionally, Web-scale discovery platforms have become common applications for enhancing the findability of a wide range of library resources. These systems pull together disparate content into a single index for a better search experience in traditional and mobile Web environments. They have varying degrees of flexibility to enable libraries to pull information from the catalog or other repositories for display in other Web pages. Discovery layers are powerful components of many modern academic libraries' Web environments, but they do not preclude the need for other tools that help manage numerous other services and functions across multiple platforms.

Library users also interact with these library systems across multiple client platforms, including desktop computers, tablets, and other mobile devices. The systems may not work the same across each of these platforms. Traditional mobile alternatives may not be optimal for larger tablet platforms. Touchscreen devices create additional challenges for determining how best to create an interface that is usable and works effectively across platforms.

The number of entry points to find and use library resources has grown due to a number of reasons. First, libraries are increasing the number of Web-based library services and systems they offer to users. Second, these systems are integrating within external systems such as CMSs, course guides, and even social media tools like Facebook. Multiple entry points increase the chance of student success in finding appropriate resources. However, streamlining data and presenting it uniformly within each of those access points poses more challenges for libraries. If not implemented properly, the numerous access points could become confusing to users and create challenges for librarians trying to pull information out of one system and into another.

MAKING AN INVESTMENT

Streamlining data is potentially a costly venture. Integrating homegrown, open source, or vendor products into existing Web sites, services, and platforms is time consuming, especially when care is taken to avoid disruption to users. The availability of appropriate staffing is also a major consideration. Open source initiatives require library staff who are trained, have the skills, or have experience in implementing flexible data solutions. Vendor-supplied products also require staff investment but come with support systems to assist libraries with their efforts.

If your library is interested in streamlining data for cross-platform Web delivery and it is able to make changes to its Web environment, it might be helpful to ask several questions before making an investment in this venture:

- Is the product or service that contains your data open source or licensed?
- Is the service hosted remotely or locally? Does it matter? If hosted, can I pull my data out of the system, and in what format?
- What are the system's inherent API capabilities? How detailed is the documentation about what the API can do? Does the API permit complex interactions or simply widget construction?

- Is there a mobile counterpart? How robust is it? How different is the interface on each platform? Is the functionality that is available on the desktop version also available on the mobile version?
- What are my overarching organization's mobile efforts? Are they streamlining data sources that might be helpful to know about for my library's data environment?
- Are community collaboration opportunities available? If there are, is the broader campus or general community focus what is best for my library's data environment?
- How well will the product integrate with my library's existing systems?

Knowing the answers to these questions before making an investment in money, staffing, and time will help you come closer to the ultimate goal of having a more flexible environment for your data.

CASE STUDIES: TWO LIBRARIES, ONE GOAL

Like many academic libraries, the University of Alabama (UA) and the University of Houston (UH) face a vast array of challenges with providing users with comprehensive library services across platforms, interfaces, and environments. As the technologies students use expand from traditional desktop/laptop devices to smartphones and tablets, library staff want to build usable applications and interfaces to meet these users where they are. To support this goal, both UA and UH are working to ensure data is not replicated for the purpose of delivery across platforms.

UA

At UA Libraries, the Web Services Department is responsible for all Web and application development and maintenance. The department consists of two library faculty members and three professional staff. Members manage multiple Web sites, the discovery application, and an open source digital CMS along with numerous other projects. The department and the libraries operate in a mixed environment of homegrown, vendor-supplied, and open source applications. Like many academic libraries, UA Libraries relies on a variety of technologies for a broad range of services, but also works with institutional applications of which there is more limited control. The libraries have been and continue to be engaged in a variety of campus technology efforts that provide an opportunity to increase the visibility of library services in applications and sites with a broad set of functions and greater student usage.

Blackboard Mobile (http://www.blackboard.com/platforms/mobile/overview.aspx) and Blackboard Learn (http://www.blackboard.com/platforms/

learn/overview.aspx) have been the primary campus applications that have been integrated with online library services; however, they have provided a considerable challenge to data delivery efforts. Blackboard Mobile is a suite of mobile applications that can feature a variety of campus resources including course registration, maps, and event calendars. The libraries implemented basic library search functions and contact information within UA's Blackboard Mobile app. While the contact information was static, the search functionality relied on REST APIs (http://en.wikipedia.org/wiki/Representational_state_transfer) from the libraries' discovery application. Thus, the AquaBrowser discovery system was linked to Blackboard Mobile simply by passing queries through URLs. The main tasks for implementation of the library search feature involved mapping XML fields and setting the appropriate labels for those fields. The work to integrate library services into Blackboard Mobile provided UA with an institution-wide library presence in a full-featured native app for iOS and Android and a robust Web app for Blackberry.

The greater challenge for continued service integration with Blackboard Mobile arose when the libraries switched to a new discovery application. Library staff had to rewrite the query strings and XML field mapping and work with Blackboard to deliver those changes into an updated version of the mobile app. The data source changed, so the applications that relied on that data source must adjust. This is indicative of the reality of technological change and data streamlining efforts. Building cross platform services from multiple data sources does not preclude the necessity of future changes and adjustments as underlying data sources change over time.

UA's Blackboard Mobile app has a broad reach across campus. Delivering library services to that environment was not something the libraries had the resources to accomplish if replicating data sources and building separate applications were required. In this case, streamlining data delivery was made possible because the vendor's application had robust APIs that made it possible.

Blackboard Mobile and Blackboard Learn are quite different products, and their technical structure varies, making library staff's work with Blackboard Learn a separate and unique challenge. At UA, Blackboard Learn has a broad reach as faculty members rely on this CMS platform for delivering information and resources to their students. Library integration is essential because without course-specific resources available from within Blackboard Learn library, users may never realize they exist. With Blackboard Learn, the libraries' focus had been getting the information and resources from library course guides into the respective course in Blackboard. Course guides are created using Springshare's LibGuides (http://www.springshare.com/libguides/), which provides limited APIs for presenting guide data in other Web environments or sites. While LibGuides still represents a separate source from the library Web site or discovery application, the APIs provide efficiencies in delivering LibGuides' content across platforms without replication. Integrating search functionality into Blackboard Mobile and LibGuides' data into Blackboard demonstrates the importance of application APIs.

Third-party products can limit the ways in which staff can deliver data, but homegrown systems are limited only by themselves. When internally developing any Web site or application, it is essential to consider how you can get the content into different platforms or online environments. Database-driven Web sites and applications make this capability easier, but there is still much that careful planning can improve with regards to representing your data in other places.

APIs are critical for third-party applications, but they are also something to build into your own systems. You can accomplish this through implementing a RESTful architecture to provide access to your application's data via URL parameters. An application that can return XML output via SOAP or REST protocols opens up the options for streamlining data delivery to a variety of Web and mobile environments. Web applications with this level of capability may be further in the distance for your Web development capacity or needs, so starting simple with just getting your data into a database may be a more reasonable first step.

SQL-based Web databases are widely used in popular applications like WordPress (http://wordpress.org/) and Drupal (http://drupal.org/). Those CMSs provide a quick way to get static Web content into a database. Database variants such as MySQL are not only open source but also have strong user communities and many useful tools. The staff at UA libraries spent a considerable amount of time moving sites into Drupal and moving numerous client-based Access databases to the Web-friendly MySQL platform. These Access databases were sitting in folders on Windows share drives of staff workstations, and moving them to a Web-based environment was essential to facilitate cross-platform delivery. Database-driven sites also make mobile use much easier. Moving these databases had the side effect of drastically improving staff workflows and eliminating arduous steps used to update these old databases for Web display.

The largest internal development project at the University libraries was the Acumen (http://acumen.lib.ua.edu/) digital collections application. Acumen serves in the same capacity as a product like OCLC's CONTENTdm (http://www.contentdm.org/). It is built with PHP and a MySQL database with Solr handling searching and indexing (see Figure 1). Acumen also has OAI compatibility, allowing for the item metadata to be harvested which provides flexibility in how the content of Acumen is accessed. OAI already enables staff to easily pull Acumen material into our discovery application. The UA libraries staff continues to explore other possible delivery platforms, but feel confident they have built a system with the requisite functionality for streamlined data output to multiple sources.

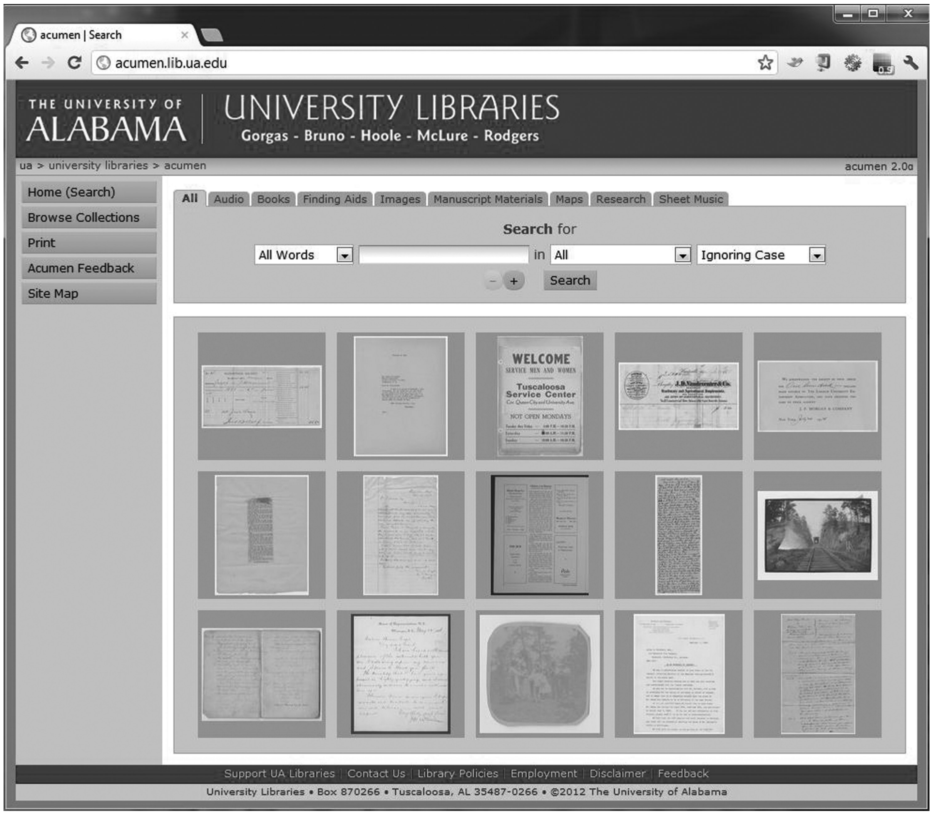


FIGURE 1 Acumen is UA Libraries' open source digital collection application with OAI compatibility.

Homegrown and third-party applications provide different challenges, but in the end the functional goals with regard to data output and accessibility are the same. It is important to be able to get the data out to various applications, sites, and platforms. The platform seeing the greatest growth among those accessing library services at UA is mobile. When considering how to get our content mobile-ready, we considered what information users would want to see on these devices and how that information should be displayed. Smartphone screens are limited, and mobile users generally are not doing extensive scholarly research via their phones. Tablets present different challenges for data delivery because they have greater screen sizes but very different user interfaces and input methods.

When considering mobile use, library staff must decide between building a native app or a mobile app. In this case, mobile apps made the most sense because the staff did not have to learn multiple mobile operating systems or purchase an iOS SDK. For our main Web site, the libraries looked toward existing mobile frameworks to quickly push its efforts forward. They considered multiple frameworks before settling on JQuery Mobile (http://jquerymobile.com) due to its flexibility in handling different mobile operating systems and its capability to easily pull data from many of the existing data sources used by our full Web site. However, this framework does not solve the problem of data duplication if there is no existing capability to pull and represent content in a mobile environment. Some data use REST APIs or automatically render for mobile, but a considerable amount of Web site content does not. While the Web content is in a database, it still must be properly wrapped for a mobile environment. This is not to say that the content is not mobile accessible; the pages render perfectly on all the smartphones and tablets tested. It is perhaps more accurate to say that the content has not been optimized for those platforms.

The UA Libraries work with multiple third-party, homegrown, and vendor-supplied applications and have attempted to gain the best efficiencies possible from those systems to push library resources and services to users in a variety of other applications, sites, and platforms without duplicating content. Despite the libraries' best efforts, work remains to bring multiple data sources together. For third-party and vendor-supplied products, APIs are critical. It is important to understand the API functionality of any external application. With homegrown applications, it is important to properly design them with the ability to share data across multiple environments.

UH

UH Libraries, like the University Libraries at UA, work in a mixed environment of homegrown, vendor-supplied, and open source applications. The Web Services department consists of two full-time librarians, a one-year contract library fellow, and four professional staff. Of those four staff, one is a project manager, two are Web developers, and one is a Web designer. Department members develop and manage multiple Web sites and online services, conduct user experience testing, and provide Web usage data analysis. Web Services librarians and staff also work closely with the other departments within the libraries who manage discovery tools, metadata, electronic resources, digital libraries, finding aids, and work on numerous other projects with appropriate stakeholders. The UH Libraries continuously investigate the possibility of providing information across multiple platforms any time a new service is introduced. In most cases, this involves developing new processes or developing new programs to facilitate interactions. It is essential that the data be portable and flexible so when the time comes to move to another system, all data are not lost.

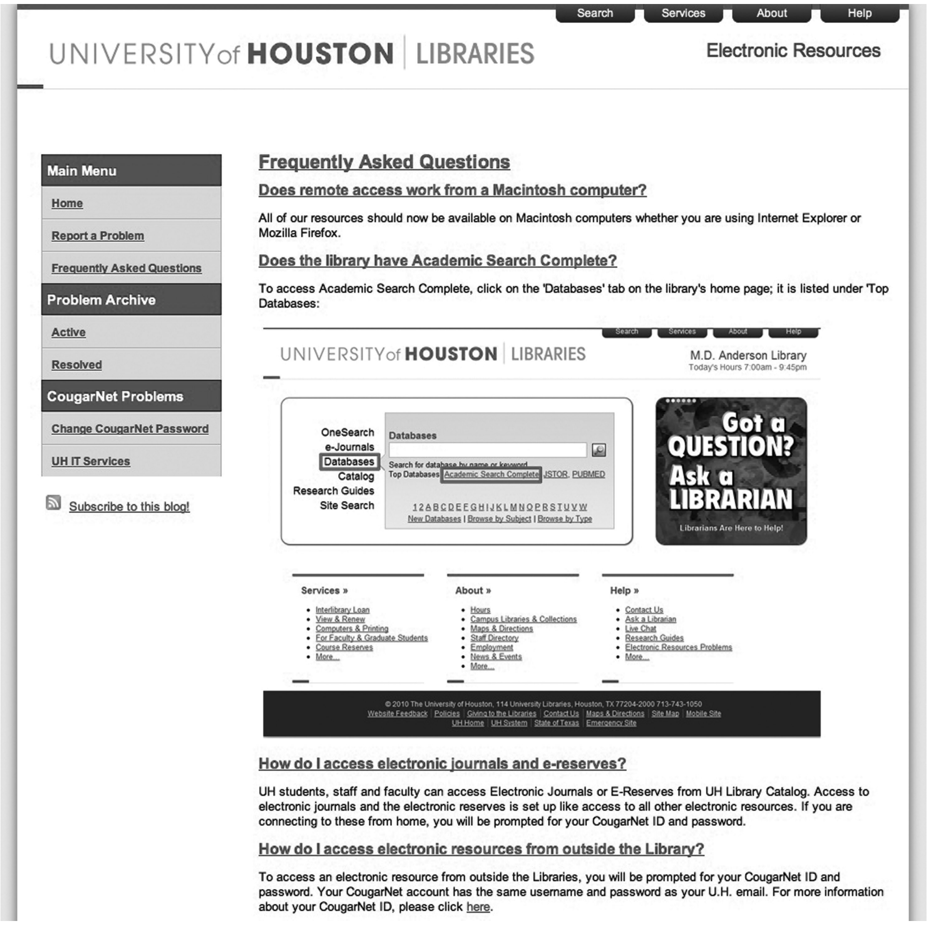
Staff and librarians at UH Libraries try to adhere to the COPE philosophy: Create Once, Publish Everywhere. This philosophy was originally conceived by Daniel Jacobson, formerly the Director of Application Development for NPR, currently the lead API engineer for Netflix, and co-author of *APIs:*

A Strategy Guide (Jacobson, Brail, and Woods 2011). COPE suggests that staff try to build CMSs (and not Web publishing tools), focus on separating content from display, and ensure content modularity and portability. Staff and librarians follow these philosophies when developing homegrown systems; proprietary systems are more closed and limit their ability to modify or port data. The following scenarios showcase what the UH Libraries are doing to accomplish integration of data among several different interfaces.

An example of the UH Libraries' application of the COPE philosophy can be seen in the implementation of LibAnswers. Springshare's LibAnswers (http://www.springshare.com/libanswers/) is a reference management system, reference analytics tool, and knowledge base. It is essentially a CMS, and librarians and staff were initially concerned about information on the main Web site being replicated within LibAnswers. Although easy to configure for each library environment, they took their time in integrating the knowledge base portion of the system across libraries' Web presence because it was not always cognitively obvious how to best configure it for each of those environments. Staff systematically approached different service areas of the main Web site, such as the Help pages for the catalog, ILL service, discovery service, etc., and moved content from the main Web site into LibAnswers in a FAQ style.

A great example of how UH library staff are trying to streamline the content within LibAnswers is to take a look at the Libraries' Electronic Resources Help page, where all the content on the page is dynamically pulled from LibAnswers (see Figure 2). Even on the UH Libraries' Facebook page (https://www.facebook.com/uhlibraries) there is a tab called "Library Help" with a LibAnswers knowledge base search box embedded on that page. By doing it this way, the page does not have to be updated often, at least until Facebook changes its structure for the page and staff must make adjustments. The content users will encounter in all these unique places now has the same written voice because it is coming from one source. Also, because of thoughtful planning, librarians are now delivering consistent help at multiple points-of-need across the libraries' Web presence. Planning the content in this way allows staff to pull specific pieces of content out of the knowledge base and display it in other places, such as within Blackboard Learn or on the mobile Web site.

Embedding tools like the LibAnswers knowledge base in multiple places across a library's Web site is just one simple approach to streamlining data. Fortunately, UH Libraries have a Web Services team with developers who can create more advanced solutions in support of the COPE philosophy. Running Drupal as the CMS for the main Web site has also been helpful, because Drupal is not just a CMS but an application development tool as well. UH staff have successfully built several custom modules with API functionality. The next several examples go into more detail.



Frequently Asked Questions

Does remote access work from a Macintosh computer?

All of our resources should now be available on Macintosh computers whether you are using Internet Explorer or Mozilla Firefox.

Does the library have Academic Search Complete?

To access Academic Search Complete, click on the 'Databases' tab on the library's home page; it is listed under 'Top Databases:

Search
Services
About
Help
UNIVERSITY of HOUSTON | LIBRARIES
M.D. Anderson Library
Today's Hours 7:00am - 9:45pm
OneSearch
e-Journals
Databases
Catalog
Research Guides
Site Search
Databases
Search for database by name or keyword
Top Databases: Academic Search Complete, JSTOR, PUBMED
1 2 A B C D E F G H I J K L M N O P R S T U V W
New Databases | Browse by Subject | Browse by Type
Got a QUESTION? Ask a LIBRARIAN
Librarians Are Here to Help!
Services »
Interlibrary Loan
View & Renew
Computers & Printing
For Faculty & Graduate Students
Course Reserves
More...
About »
Hours
Campus Libraries & Collections
Maps & Directions
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UH Home | UH System | State of Texas | Emergency Site

How do I access electronic journals and e-reserves?

UH students, staff and faculty can access Electronic Journals or E-Reserves from UH Library Catalog. Access to electronic journals and the electronic reserves is set up like access to all other electronic resources. If you are connecting to these from home, you will be prompted for your CougarNet ID and password.

How do I access electronic resources from outside the Library?

To access an electronic resource from outside the Libraries, you will be prompted for your CougarNet ID and password. Your CougarNet account has the same username and password as your U.H. email. For more information about your CougarNet ID, please click here.

FIGURE 2 Content specific to electronic resources is pulled out of LibAnswers and displayed directly into the ER Help page to reduce redundancy.

Like all libraries, the UH Libraries license electronic resources for users. With information about databases already being in both the catalog and electronic resources management system, library staff were determined to streamline the display of data on the Web site. They wanted to have the ability to pull the list of available databases from their Innovative Interfaces' Millennium (http://www.iii.com/products/millennium_ils.shtml) system and easily display that list on the Web site. They accomplished this by developing the Electronic Database System (EDBS) application. This application, which is also a Drupal module, automatically takes in the MARC file from the catalog and parses the file in order to store the information on the Web site and display specific details about the databases. There is also an administrative part to the module that allows liaison librarians to determine what databases should be displayed on each subject page, and they show up automatically under their predefined category on that page. The subjects (http://info.lib.uh.edu/edbs/subject) and the types (http://info.lib.uh.edu/edbs/type) are predetermined by the Metadata and Bibliographic Services Department.

Future plans with EDBS include making the database list on the Web site work with the mobile site using RESTful API calls. The API call would allow the mobile site to communicate with the main site and display the same database information. Additionally, the new implementation would provide a marker to show which databases are mobile-friendly. Using this marker, the staff can also filter out only the mobile-friendly databases to display on the mobile site.

Another custom Web application that developed within the UH Libraries was the Staff Directory System (SDS). The goal was to create a staff directory that could be edited and maintained in one place and be serviced in multiple systems. Building the system in this way allowed for staff directory changes to be automatically updated in all of the other locations, such as the main site, mobile site, and intranet. UH Libraries developed this Drupal module with RESTful API calls to provide the different types of information, including a list of departments, all staff, just librarians, just subject librarians, and contact information. The information is kept consistent across the various systems even though the display varies.

The Libhours application was originally developed with an approach similar to the development of the previously mentioned EDBS. The Millennium system provided a table that kept the library hours for various library branches across campus. This table was output to a file that was then saved to the site, processed, and then displayed on the Web site. RESTful API calls were created so that other systems could pull the same hours information and display it within those systems. This mobile Web site also used Libhours. The mobile site had RESTful API calls to the Web site to get the hours and then display them in a mobile-friendly interface compared to the main Web site. However, there was a problem with this approach. The Millennium system could not differentiate among the different university sessions and periods (such as spring break, fall semester, etc.) within the same location. When the branch hours varied at different times, a lot of manual manipulation of the file was required for it to display the correct times for the different periods.

The solution was to completely rebuild the Libhours application so that it no longer used the Millennium file. The downside was that staff no longer had one place to input the hours information. Since Millennium could not display all the information required in the file, they felt having more accurate data outweighed the task of some data duplication. They have since totally rebuilt the Libhours Drupal module with a new look for the user interface and also an administrative interface where library staff can enter their own hours for each location. Even with the new Libhours application, the RESTful

API calls are still available to let them pull hours into the mobile site from the main Web site.

In addition to building custom applications in order to more easily distribute data, staff also built an API to interface with a third-party system, CONTENTdm. At the time, they were running version 5.4, and they needed a solution to help add the desired functionality requested by the Digital Services Department and digital library users. An API call was made to create citation information for a specific collection or item from within CONTENTdm. The citation API was used to make sure the citation information was pulled along with a digital image within the Digital Cart application, which was another custom system developed for the digital library. Future plans include building a mobile site for the digital library. API calls will be used to get the digital images into a mobile-friendly site and allow library users to have the digital library in the palm of their hands.

This is just a selection of applications the staff and librarians have implemented to assist with efforts in making content more flexible. The UH libraries continue to look for ways to further streamline systems to allow for easier data collection and system maintenance, all while enhancing users' experiences interacting with these systems and services.

TAKEAWAYS AND CONCLUSION

The experiences of technology librarians and staff at UA and UH are not unique. Many libraries face similar data challenges. What is noteworthy is the concerted efforts both organizations have undertaken to reduce data duplication. The case studies showcase the importance of APIs in both third-party applications and homegrown solutions as a key to avoiding duplicate data stores. The UA and UH perspectives also demonstrate the necessity to approach purchasing or developing an application with not only an understanding of the need to re-use an application's data but also with a plan of how to accomplish this task based on where the data must go. With third-party products, some of the control that makes data streamlining easier is likely out of your hands. A seamless environment of concentrated data sources delivered to a multitude of online environments is the goal, but realistically, this is only partially attainable in today's complex library technology environments. The work of these two academic libraries is focused on pushing the effort to streamline data sources as far as possible in their environments to provide flexible data delivery and conserve staff time and effort. Librarians can use these approaches to develop a strategy for better managing data sources in their own organization.

Modern libraries face technological barriers to providing resources and services consistently across multiple platforms and devices. User expectations pose significant challenges. With mixed applications from vendors, open source libraries like Sourceforge (http://sourceforge.net), and local development personnel, data must be portable and come together in a sensible way for users. However, libraries also must be efficient in not duplicating efforts or data to make it possible to achieve this ambitious goal with limited resources. Both UH and UA library staff relied on API functionality from third-party applications as well as homegrown solutions. This functionality repeatedly proved a key component of their data streamlining efforts, including CONTENTdm, LibGuides, Millennium, and the open source Acumen application. More generally, Web-based, database-driven sources have the ability to provide administrators—and even users—with the ability to extract and re-represent data in multiple ways. Neither UH nor UA have completely mastered sole-source data streams, but they have gained considerable efficiencies and learned to recognize the components needed in their future applications to help them continue working towards that goal.

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