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Enhancing Resource Sharing Access through System Integration

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### Abstract

The application and IT ecosystem of academic libraries typically includes multiple systems, with crucial functions requiring using or sharing information between them. However, library systems are often not well integrated, making workflows and system interactions less than optimal for both staff and patrons. The method to integrate systems that the IDS Project took was to create a middleware platform, IDS Logic, that can connect multiple library systems and open or vendor web services to create the best resource sharing experience for staff and patrons. One specific application that is hosted within the IDS Logic middleware platform is Article Gateway, which uses resource sharing technology and workflows to deliver fast or instant access to research material to users with little or no staff time and removes as many barriers to user access as possible. Where resource sharing has typically sought to deliver articles in one-to-two days, libraries using Article Gateway typically deliver a significantly higher percentage of articles to patrons within a few hours.

### Enhancing Resource Sharing Access Through System Integration

Resource Sharing is an area of academic libraries that often serves to illustrate the operational effect of larger issues such as disparate systems needing integration, and increasing costs for access to journal content. Resource Sharing departments also help to create solutions and different approaches to major issues, benefitting both library users and library staff.

Electronic subscriptions occupy an ever increasing majority of budgets and prevent libraries from expanding services in other areas. There are few attractive options for libraries who want to provide access to research materials to users in a way that is cost effective and simple for users. Libraries are caught between subscriptions to single journals, large research collections, or article-level purchasing that either involves delays or must allow expensive access to everyone, which can become costly. The IDS Article Gateway platform, developed by the IDS Project and SUNY Polytechnic Institute Cayan Library, uses resource sharing technology and workflows to deliver fast or instant access to research material to users in a way that involves little or no staff time and removes as many barriers to user access as possible. Where resource sharing has typically sought to deliver articles in one-to-two days, libraries using Article Gateway deliver a high percentage of articles within four hours. The IDS Article Gateway is delivered through IDS Logic, a middleware platform created by the IDS Project that aims to integrate different library systems and connect with vendor web services to help Resource Sharing departments improve existing services and deliver new services.

### **Literature Review**

In the past several years, there are many examples of individual libraries using Application Programming Interfaces (APIs) or web services to address issues, streamline work, or enhance library functions. Additionally, library vendors are beginning to include access to

extract data from systems through APIs, and to allow for connection to systems via web services and APIs. However, beyond groups such as OCLC's developer's network (<https://www.oclc.org/developer/home.en.html>) or the Ex Libris Developer network (<https://developers.exlibrisgroup.com/>), which are meant for sharing ideas and code, there is not a large community or cooperative based on technology integration and development. The IDS Project brings together a community with ideas and strategies about how to improve libraries, and connects them with a platform and development expertise to integrate systems and foster innovation.

Recent examples of system integration through application and software development reveal how much effect software solutions can have on library functions. In 2011, Wayne State University created an application that connected data from its two systems, ILLiad and ArticleReach, and submitted orders to the Copyright Clearance Center API (Sharpe and Gallagher, 2011). It was estimated that upon implementation, the library would save over 500 staff hours per year that were previously spent paying royalties (Sharpe and Gallagher, 2011, p. 137). Services such as CCC and the global library cooperative OCLC are ripe for integration, and the positive effect in saved time is evident, even with integrative applications that are limited in scope.

As OCLC services overlap with many other systems, whether they are cataloging, resource sharing, or discovery such as WorldCat, the OCLC web services are key resources to leverage for system integration. Sarah Johnston of St. Olaf College developed Perl scripts to drive an application that uses the WorldCat Metadata API to create a "do-it-yourself" reclamation project (2015, p. 1). The project at St. Olaf allowed for a high level of automation for a reclamation of roughly 500,000 holdings, with only minimal staff intervention (Johnston,

2015, p. 5). Terry Reese, at Ohio State University, provided a thorough analysis of the OCLC Metadata API, seeing the creation of the API as “a welcome shift in how libraries are able to interact with their data, and a set of opportunities to develop new collaborations and workflows around the library community’s metadata operations” (2014, p.9). The API is a major shift from the environment that is “tightly controlled and coupled to the client software OCLC has provided to the cataloging community,” which has resulted in “a lack of innovation and integration of workflows, as the need to work with WorldCat hamstrung those efforts” (Reese, 2014, p.10). The ability to integrate systems changes how libraries can operate and frees them to work more effectively. Since OCLC services are so highly integrated into so many areas of libraries, having access to OCLC APIs or web services is crucial for libraries.

As resource sharing and library cooperation expands, especially outside of North American libraries, there will be an increased need to connect disparate resource sharing and library management systems as there are different systems used by international libraries. As OCLC has expanded resource sharing in Spain and other countries, Rodriguez-Gairin and Somoza-Fernandez (2014) identified a need to connect OCLC’s WorldShare Management platform with the GTBib-SOD Interlibrary Loan system already in use in Spain (p. 487). Further, the solution identified by Rodriguez-Gairin and Somoza-Fernandez (2014) was to use web services and APIs to connect the two resource sharing systems and remove the need for duplicate work in systems (p. 487).

In the International library software market, systems that allow and encourage interoperation are becoming prevalent, especially Library Services Platforms (LSPs). With LSPs becoming more open, there is an opportunity for further development and cooperation, in much the same way that current existing OCLC web services has allowed for development and

innovation. Breeding (2014) sees APIs as one of the primary ways to connect and unify library services and software (p. 22). The library technology environment involves maintenance of many different systems, “often with overlapping spheres of functionality or data.” (Breeding, 2014, p. 22). For libraries, “such a matrix of interrelated products and services brings considerable complexity as libraries manage each separately, while attempting to fit them into a coherent technology strategy” (Breeding, 2014, p. 22). However, with more major library systems offering APIs, “rather than considering each system as isolated and self-enclosed relative to how data flows in and out, the use of APIs opens the possibility for more dynamic interactions that are beneficial both in terms of more efficient operations behind the scenes and a more elegant presentation to patrons” (Breeding, 2014, p.24). Breeding sees the two-fold benefit of API usage as “Libraries benefit from APIs when they are able to perform tasks that are not possible through the bundled user interfaces or that automate tasks that otherwise might be performed through manual or batch processes” (Breeding, 2014, p.23). Improving the user experience and greatly optimizing staff capabilities or automation is at the heart of API usage. In his 2015 NISO white paper, Breeding goes further and indicates “there is a window of opportunity for a set of cross-vendor APIs to be defined within each of the areas of intersection among products” (p. 34). This “ecosystem of interoperable APIs might not be codified as standards, but instead as recommended practices that can be validated with compliance assessment” with defined cross-platform operations that should be available via APIs (Breeding, 2015, p.34). A task group proposed standards of API based interactions from an ILS to a discovery system, which would allow interoperability between ILS and discovery systems (Breeding, 2008, p. 18). Although library API standards have not been fully implemented, there

still is a high degree of interoperability via APIs, and standards proposed such as Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) are now widely in use.

Although not an Integrated Library System, the software platform that has allowed the most customization and optimization has been ILLiad, developed by Atlas Systems, and supported by OCLC. In many cases, ILLiad has been extended beyond its main purpose of being a complex hub for resource sharing into a core system that libraries have integrated into many areas and departments. With the experience developed by many libraries and the IDS Project in integrating LSP components, OCLC services, ILLiad, and other software systems, the potential is great for further development within the next few years.

As the IDS Project developed a community of highly talented librarians and staff, and systems matured to become more open to integration, there is now the ability to connect “mission critical” systems that will “support better, more informed decisions and free employees to undertake higher-value tasks,” which will ultimately “offer the capability to unlock talent and time” (Oberlander, 2012, p.15). The promise of freeing time and talent through improved systems was at the core of many of the software projects that have come from the IDS Project, which has resulted in staff who have more time for professional development, are more engaged with an innovative community, and can contribute more to their individual libraries and the IDS Project community.

One area of libraries that has a direct impact with users that has suffered from the lack of system integration and innovation in the past decade is borrowing articles. Borrowing or purchasing articles for patrons is a complex process that, beyond direct requesting of articles through the IDS Project’s ALIAS system, RapidILL, and OCLC’s direct request for articles, has not seen significant recent automation advancements. The one advancement in borrowing article



workflows has been mediated article purchasing through services such as CCC's Get it Now or Reprints Desk Article Galaxy service.

The literature on analyzing trends in ILL borrowing article requests indicates that there is a high potential for saving time and reducing costs in ILL borrowing, but users still place many requests manually, which may lead to incomplete citations. In Leykam's 2013 study of four years' worth of ILL borrowing requests, he found that 59 percent of requests were manually entered rather than use the library's link resolver, SFX (p. 106). Surprisingly, students manually entered ILL requests more often than faculty and did not use the direct linking capabilities of the open URL resolver (Leykam, 2013, p.110). Others, such as Ashmore and Allee, look at the accuracy and reliability of OpenURL data, with incorrect, inconsistent, or incomplete information (such as ISSN) being passed from aggregated databases or other indexes, leading to link resolver failures, and incomplete information being passed to the ILL system (p. 27, 2015).

Cost effective models for delivering access to articles and journals has also been a major thread in recent literature regarding resource sharing and collections. Heather L. Brown, in studying the comparison of copyright payments, found that over \$500 could have been saved in the course of a semester purchasing articles through document providers or publishers, with purchases being filled in almost half the time of traditional ILL (2012, p.101). Libraries, especially those in Health Sciences, are exploring multiple models to deliver articles that include purchase on demand, subscriptions, and resource sharing. In the case of Loyola Health Sciences Library, the use of a hybrid approach using CCC's Get it Now to deliver journal content saved the library an estimated \$640,000 over a two-year period (April 2014 – April 2016) in related access costs (Hendler and Gudenas, 2016, p. 368). In addition, Hendler and Gudenas see the value of ILL to deliver material in a cost effective and very quick manner (for Loyola under 11

hours), but also acknowledge that article purchasing has its place in the merged world of access and collection management (2016, p. 369). For the users in a Health Sciences Library, “if it is the weekend or if the user wants the article immediately, they might not elect to use ILL. Get It Now fulfills that need for immediacy and prevents customers going outside of the library to meet their needs.” (Hendler & Gudenas, 2016, p.369). For the University of California, Irvine, Imamoto and Mackinder (2016) found significant improvements in speed and relatively inexpensive cost associated with a pay-per-view pilot project with Reprints Desk. During the project, 72 articles were filled and a “vast majority of articles arrived within 36 minutes of placing the order” with “the average cost per article was \$34 plus a service charge of \$5.85” (Imamoto and Mackinder, 2016, p. 381). As libraries move towards different models for providing access to research material, there will certainly be a need for more complex configuration of delivery options based on user need and user status.

### **Background on the Development of IDS Logic**

The development of technology has always been focused on the needs of the IDS Project community and the Interlibrary Loan community as a whole. One of the first major IDS Project developments was the Getting It System Toolkit (GIST) that allowed staff to “easily route requests between ILL and acquisitions depending on a number of factors, such as user recommendations, the borrowing cost versus the purchase price, regional library holdings, and more” (Pitcher, Bowersox, Oberlander, & Sullivan, 2010). Another development focusing on user needs for ease of discoverability across siloed member catalogs was the consortial catalog IDS Search, providing users with an “intuitive search experience which enables libraries to easily customize the search interface and add geographic search limits” and allowing for an almost instant submission of ILL requests for items held at regional libraries (Oberlander & Rivenburgh,

2012). ILLiad™ Addon Development has also been focused on the needs of the Interlibrary Loan practitioner, allowing for faster ILL request processing time by connecting disparate systems and platforms to provide the information necessary for making intelligent processing decisions.

In ILLiad version 8.4, Atlas systems introduced Server Addons into their product, which was a major enhancement to the ability to pull external data automatically into ILLiad. As many tasks in ILL involve consulting external systems and gathering data, Server Addons were a major opportunity for libraries to customize and tailor the ILLiad software to specific needs to create optimal efficiency. Server Addons allow for reading from the ILLiad database, and also writing to most of the ILLiad database, except for the user table and lender address tables, where patron information and information about other libraries are stored. The ability to set the values and insert information into ILL transactions has proven to be a powerful tool for integrating other systems with ILLiad. In addition to being able to insert data, the statuses of transactions can be changed and notifications such as e-mails can be sent. Lastly, external commands to other systems that ILLiad regularly interacts with, such as OCLC ILL, can be sent via Server Addons.

Although Atlas released an ILLiad Web Platform API in its version 8.4, the ILLiad web platform does not allow for setting values or inserting data into ILLiad, and only provides read access. The Web Platform API does allow for notifications to be sent, such as emails and SMS messages, but no further functionality currently exists. Currently, Server Addons are the best way to connect external systems into ILLiad, and provide the best functionality to provide customized and efficient workflows that greatly increase levels of automation in resource sharing. This is why the IDS Logic platform was build using the functionality provided by Server Addons.

### **IDS Logic Technical Overview**

ILLiad Server Addons interact with ILLiad in much the same way that Addons in the ILLiad software client do by utilizing functions that perform actions. As ILLiad Client-side Addons were first designed to extend the functionality of ILLiad, first with user-based functionality within the client software, the simple but powerful programming language called Lua was used by Atlas for its Addons.

As Lua was intended for embedded lightweight uses, it does have its limitations, which is why IDS Logic takes an approach of creating Lua templates that can be rendered by PHP to allow for much more extensive, dynamic, and flexible software customizations. In addition, having a PHP to Lua interface allows for pieces of basic data to be pulled from ILLiad and sent to the IDS Logic server where more complex analysis and tasks as well as interactions with APIs can be performed with PHP or other software languages. After this analysis is performed, the appropriate actions can be sent back to ILLiad using the simpler functionality and commands available in Lua provided by Atlas. For example, core pieces of citation information might be pulled from ILLiad via Lua, sent to the IDS Logic server, where PHP is used to then send this citation data to APIs such as OCLC web services or CCC's Get it Now service, and then responses from these web services are brought back to the Logic server where complex rules and algorithms are applied to then determine the decision or data that is sent back to ILLiad via Lua. In some cases, the IDS Logic platform uses PHP to interact with several disparate APIs to get sufficient information to allow for automation of decision making. One example of this is the use of five sequential APIs to take an ISBN and identify related holdings and the number of

libraries owning. In short, Lua is the basic interface to interact with ILLiad and basic data within the transactions, while Logic and PHP act as the more robust interface with external web services and configurations based on library policies and processes, translating this into actions to send to transactions via Lua.

### **IDS Logic as a Platform**

As IDS Logic serves as the platform that integrates multiple systems, determining a way to streamline maintaining electronic holdings information and license information with the resource sharing workflow was necessary. ALIAS, the Article License Information Availability Service, was one of the first functions to be integrated into IDS Logic. Taking the approach that maintaining holdings in multiple systems isn't beneficial, ALIAS harvests data regarding electronic holdings that libraries already have in their knowledgebase software such as Ebsco's Full Text Finder or Serials Solutions 360 Link. ALIAS and IDS Logic accumulate this data for all 100 libraries and use this as the basic local article availability lookup and article direct request system. Thus, libraries have less maintenance, benefit from identifying items they own, and sending requests only to libraries who can deliver the article they need. Rather than create a separate system, ALIAS uses OCLC for sending these requests, which keeps more transactions in one familiar workflow. To do this, ALIAS and IDS Logic manages the status of OCLC libraries using the ILL Policies Directory API by OCLC to only send requests to libraries who are "upper case," or active to receive requests from other libraries. Since ALIAS uses OCLC, if IDS Libraries do not hold an article that is needed, which is rare, this request can then be sent to a broader set of libraries using OCLC via the Worldshare ILL article direct request process.

Another major service that highlights how IDS Logic functions as a platform that connects systems is Lending Availability Service. A major task of many resource sharing

departments is looking up call numbers and availability for books or other materials requested. Essentially, this task involves three major components: looking up information in a library catalog, applying policies based on subcollections or other criteria, and then acting upon the information in ILLiad to either route for searching or cancel the TN. Lending Availability Service pulls information from the citation in ILLiad and then sends this to IDS Logic, which then queries the library's Z39.50 server or availability API. The Z39.50 or availability API typically returns all needed information for libraries to cancel or route transactions for pulling from the shelves.

In some cases, IDS Logic can enhance existing software and processes by pulling further information and enabling libraries to make their processes even less time consuming. A key example of these enhancements is Borrowing Availability Service and Direct Request Enhancer to make more book requests go out automatically. Libraries can use Borrowing Availability Service to automatically check if they own items being requested by their patrons, which encourages libraries to allow requests for items they hold but aren't available to go out automatically without first manually checking their catalog. In addition, many users will request a rare edition or a version of an OCLC record not held by many libraries; these typically fail as direct requests. Direct Request Enhancer combines the usage of multiple OCLC web services such as xID and Borrowing Availability Service to find the best widely used OCLC record and title to send the request on, and if the library owns an alternate edition that is available, the request can be turned into an in-house document delivery request.

### **Article Gateway**

A major initiative that began in 2016, called the Article Gateway (AG) workflow, features the depth of what is possible with the IDS Logic platform. The AG workflow

streamlines and automates fixing of citations, checking for copyright clearance and compliance, and when needed, checking multiple article vendors for best prices, ultimately leading to an unmediated delivery for most requests. To ensure that copyright checking is as accurate as possible, borrowing articles all must have ISSN's and have fairly consistent citations. To achieve an all ISSN process without forcing staff to open many requests, citation data is sent to the PubMed web service and to the OCLC Worldcat and xID web service to harvest ISSN's, PMIDs, and other citation information that is then ultimately inserted back into the transaction for a verified and standardized citation. In addition, the date, volume, issue, and other citation information are then run through custom scripts that standardize citation information so that years and other citation data can be precisely compared. Additional queries, such as the "Rule of 5" query which checks to see if five requests from the same ISSN (or ISSN grouping for a journal) have been filled within the past year, are run to prevent the need for staff to review requests. If copyright limitations have been reached, the Article Gateway platform checks Copyright Clearance Center licensing fees, pricing from CCC's Get It Now service, and Reprints Desk Article Galaxy service. Whichever option offers the best value is then selected by Article Gateway, and the request is fulfilled with no staff intervention or delays. Whether a request is submitted with an incomplete citation, no ISSN, or for an article where a copyright payment is needed, IDS Logic and Article Gateway work to facilitate almost instant delivery.

A strong motivation behind the development of Article Gateway was to create a method of delivering pay-per-view article access that was unmediated with a high degree of configurability. However, when we began analyzing the ILL borrowing article workflow, we discovered that there were many more opportunities for improvement in automation that would have major effects on ILL services. In October of 2016, using ILLiad data for all 100 IDS

Project libraries from January 1<sup>st</sup> 2016 - October 24, 2016, we found that ILL borrowing requests remained in an ILLiad queue “Awaiting Copyright Clearance” for an average of 22.3 hours. The “Awaiting Copyright Clearance” queue is typically designated for requests that need staff review to determine if license fees need to be paid, or whether the CONTU or “Rule of 5” limits have been met. A total of 314,252 IDS Project borrowing article requests created between December 1, 2015 and November 30, 2016 were analyzed, with a total of 7.01 million hours (or 292,254 days) where requests sat waiting for staff to review copyright. Clearly, copyright clearance has a major effect on ILL delivery time.

Throughout the installation and implementation of Article Gateway at member libraries, we learned that many libraries were unwilling to automate purchasing of articles. Two major threads emerged, with one being that sometimes articles available for purchase can also be acquired through open access. Other times, articles are available freely online in a format that is not the final version, such as a pre-print in a repository, or are available to download from sites such as Research Gate, having been posted by the author. All libraries wanted to take advantage of true open access articles and we took this into account for development. Open access filtering is being built into Article Gateway using APIs such as PubMed, which will filter for open access links and content. However, libraries differed on whether they would point patrons to content that was not the “copy of record” or posted on sites that violate publisher’s rights. In these cases, Article Gateway is configured to allow libraries to make choices about how best to educate and engage with patrons about access, or to simply pay and deliver the article of record from a document delivery provider or publisher.

### **Article Gateway Workflow**

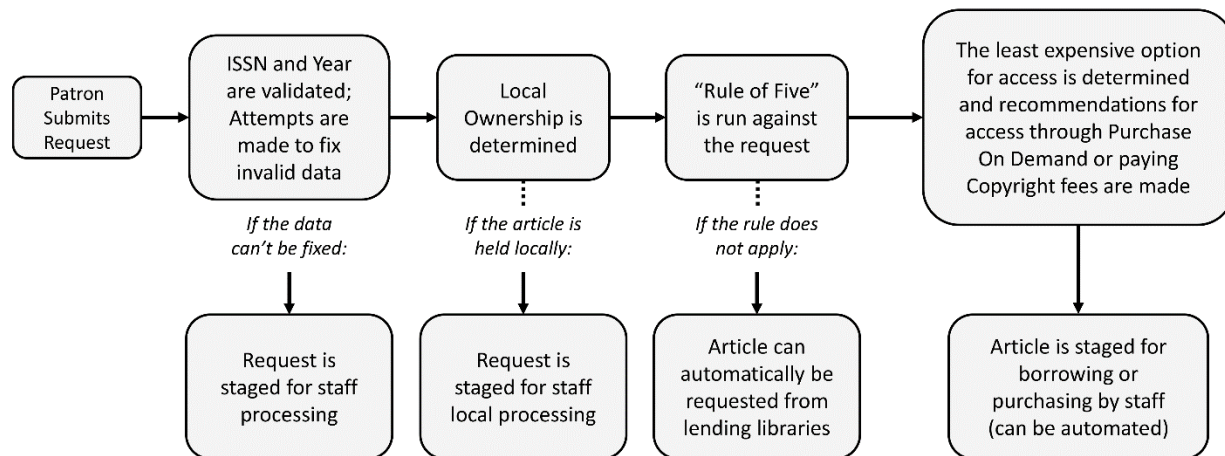


The first step in the Article Gateway workflow is to determine whether or not the article request contains standardized ISSN and Publication Date information. Through this process, the ISSN is standardized using the ISSN-L list to ensure that the ISSN for the request is the same for both print and electronic holdings. The ISSN-L, maintained by the International Standard Serial Number International Centre, “is a specific ISSN that groups the different media of the same serial publication” (ISSN-L). The information contained in the ISSN field in the request is also checked for length to separate out numbers that are either ten digits or thirteen digits in length, denoting that the request is for a Book Chapter and not a Journal Article. Requests that contain a ten or thirteen-digit number are separated from the remainder of the Article Gateway processes and put into a queue for staff to review. Next, the Journal Year of the transaction is standardized with the end result being information within the Journal Year field that is only four digits long. If the ISSN and/or the Journal Year field of the request cannot be fixed by the automated processes of Article Gateway, the request is placed into a holding queue for staff to intervene and manually fix the incorrect citation information.

After the ISSN and Journal Year have been standardized, Article Gateway checks to see how to acquire the article for the user. First, the user’s library holdings are checked to see if the request can be filled locally. If the article is not held by the requester’s library, the Rule of 5 is applied to the request. If the article has been published outside of five years from the creation date of the request submission, these articles are requested from potential lending libraries. For IDS Project libraries in particular, the holdings and lending licensing rights of the requested article are checked in the ALIAS database to automatically create a list of potential lending member libraries and the request is then sent out using OCLC’s Direct Request service. When an article cannot be fulfilled by IDS Project member libraries, these requests are then processed

manually to either be sent to Custom Holdings groups or other selected lenders. Now, if the requested article has been published within five years of the creation date of the request, specific steps must be taken to ensure that the Rule of 5 is being followed while processing the request.

For those requests that have been published within the last five years, Article Gateway performs a check across previous borrowing article requests fulfilled within the given calendar year to determine if the ISSN or ISSN grouping has been requested five times or more with articles published within the last five years. If the ISSN of the request has not reached the five article limit, that request will be routed to be filled through partner libraries or other standard processing means. However, if the request has reached the five article limit for the year, copyright fees will need to be paid if the article is borrowed from another library. This opens a unique opportunity for borrowing libraries because they have option not to pay borrowing copyright fees and rather to buy the article from Purchase On Demand providers, such as CCC's Get It Now or Reprints Desk Article Galaxy. At this step of the Article Gateway process, the least expensive option for acquiring an article is determined by querying the web services or APIs of CCC's Get It Now, Reprints Desk Article Galaxy, and copyright licensing fees. Once the price from each potential provider has been determined, a recommendation is made by Article Gateway and the article request is routed to a queue for staff purchasing or borrowing. If desired, these final steps of acquiring the article can be automated and the article can be delivered to the user within minutes. Figure 1 below provides a visual diagram for the Article Gateway workflow.



**Figure 1: Article Gateway Workflow**

An important point to remember when checking through a library’s previous transactions for adherence to the Rule of 5 is that in order to perform this check systematically and automatically, ISSNs from previous transactions need to be standardized. In the very first installations of Article Gateway, we realized that many times there was a need for staff to manually go through previous article transactions to ensure that these transactions contained both a standardized ISSN and Year. This process was rather cumbersome, especially later on in the calendar year where the number of article requests to fix grew each day. For this reason, the Batch Year Fixer and Batch ISSN Fixer were created to minimize the amount of previous transactions that needed to be manually fixed by staff. After these functions ran, the number of transactions that needed to be fixed was significantly reduced. Standardization of citations has been such a popular portion of the workflow that libraries have even used the batch standardization tool on old ILL data to make reporting and analysis more precise. However, even with Batch Fixers available for library use, it is recommended to implement Article Gateway toward the beginning of the year in order to potentially save staff time.

**The Effect of Article Gateway**

Three of the major goals of the Article Gateway tools are to significantly reduce the average turnaround time for ILL articles, increase the percentage of extremely fast delivery times (articles delivered within 4 hours), and reduce the amount of requests that staff need to manually process. One of the largest users of the Article Gateway system is the University at Albany. Prior to implementing Article Gateway, the University at Albany was using a combination of ALIAS and RapidILL to automate article request processing. However, both RapidILL and ALIAS require ISSNs to process article requests, and neither is capable of automatically checking copyright, so the percentage of article requests requiring at least some manual processing was high. Furthermore, staffing levels limited manual request processing to 9:00am – 5:00pm on weekdays, so article requests would often sit unprocessed for anywhere from 16 to 64 hours, preventing many requests from being filled quickly. To help resolve these issues, the University at Albany implemented Article Gateway during the summer of 2016.

To determine the impact of implementing Article Gateway at the University at Albany, article requests from a five month period following implementation (June 30 – November 30) were compared to article requests from the same date range during the previous calendar year. This comparison showed that the percentage of article requests requiring manual ISSN lookup and copyright processing dropped significantly upon implementation of Article Gateway (see Table 1).

	<b>Before Article Gateway Implementation</b>	<b>After Article Gateway Implementation</b>
Article Requests Filled	12,541	9,125
Article Requests Requiring Manual ISSN Lookup	6,070 (48%)	940 (10%)

Article Requests Requiring Manual Copyright Processing	5,403 (43%)	579 (6%)
Turnaround Time	median: 19 hours mean: 32.2 hours	median: 14 hours mean: 27.6 hours

**Table 1: Effect of Article Gateway on manual ISSN lookup - University at Albany**

By automating the ISSN lookup and copyright processing, Article Gateway significantly increased the percentage of article requests that could be processed automatically by ALIAS and RapidILL, which in turn led to faster turnaround times for article requests (see Table 2).

	Before Article Gateway Implementation	After Article Gateway Implementation
Article Requests Requiring Manual Processing	9,116 (73%)	1,522 (17%)
Article Requests Processed Automatically by ALIAS and RapidILL	3,425 (27%)	7,603 (83%)
Turnaround Time	median: 19 hours mean: 32.2 hours	median: 14 hours mean: 27.6 hours

**Table 2: Effect of Article Gateway on automatic article requesting - University at Albany**

A closer examination of article request turnaround times before and after the implementation of Article Gateway shows a dramatic increase in the number of articles delivered in four hours or less (see Table 3).

Delivery Time	% of Total Request Before Article Gateway Implementation	% of Total Request After Article Gateway Implementation
Under 1 Hour	5	13
Under 2 Hours	11	20
Under 3 Hours	16	26
Under 4 Hours	20	30

**Table 3: Effect of Article Gateway on article turnaround time - University at Albany**

Although SUNY Polytechnic Institute is a much smaller institution than the University at Albany, the effect of Article Gateway on article delivery was equally significant in improving service for a large percentage of the roughly 2,852 article requests placed from June 1, 2015 to

December 1, 2016. Table 4 below shows the total percentage of requests at SUNY Polytechnic Institute that were delivered in 24 hours or less, indicating that Article Gateway, by removing obstacles in the ILL borrowing article workflow, can make ILL a “near instant” option. Of the 2,852 requests, only 50 were purchased from document delivery providers (Reprints Desk or Get It Now), and of the 50 requests delivered by document providers, none were delivered in less than 2 hours, as only recently did SUNY Polytechnic Institute turn on automatic ordering of articles through document providers. With copyright clearance removed, the percentage of requests that are delivered within 2 - 4 hours through library to library lending can be significantly increased, and with automatic document ordering through document providers, the percentage of requests delivered almost instantly will increase even further.

<b>Delivery Time</b>	<b>Number of Requests</b>	<b>% of Total Requests</b>
Under 20 Minutes	117	4
30 Minutes and Under	223	8
60 Minutes and Under	422	15
2 Hours and Under	640	22
4 Hours and Under	826	29
9 Hours and Under	990	35
15 Hours and Under	1296	45
16 Hours and Under	1560	55
24 Hours and Under	1956	69

**Table 4: Effect of Article Gateway on article requests - SUNY Polytechnic Institute**

Through the case studies at SUNY Polytechnic Institute and University at Albany, the effect of Article Gateway in making ILL a nearly instant option that requires significantly less staff time is clear. With more configuration and by enabling Article Gateway to trigger purchases during certain days or times, the possibility of ILL as an increasingly meaningful part of the resource access and subscription landscape can become a reality.

### **Conclusion**

Based on the evidence provided through the case studies of the University at Albany and SUNY Polytechnic Institute, Article Gateway has made significant advances to both the workflow involved and the turnaround time in delivering article requests to users. In having Article Gateway manage the increasingly complex process of the borrowing article workflow, interlibrary loan departments can both save financial resources and leverage the time gained to provide new patron services. Over time, users at these libraries should grow to expect and receive faster access and will become comfortable relying on interlibrary loan departments when their requests have an expedient need. The improvements in delivering articles to patrons with minimal delays would not be possible without the complex middleware platform, IDS Logic, to integrate systems and vendor web services. The IDS Article Gateway is an example of how dedication to back-end integration and efficiency can result in improvements in patron services.

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