ILLiad: Customer-focused Interlibrary Loan Automation

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ABSTRACT. ILLiad is an interlibrary loan borrowing system designed and implemented in the University Libraries at Virginia Tech. ILLiad models the ILL borrowing process so as to track the status of an ILL request as it is processed, either by the staff or by software. This process approach to automating interlibrary loan is leading to fundamental improvements in ILL management and service. The process approach allows continued expansion and modification of the system, including the addition of electronic delivery of articles. The process approach results in substantial improvements in customer service by allowing customers to intervene directly in the borrowing process without staff assistance.

WHAT IS ILLIAD?

ILLiad is a model, implemented in software, of the interlibrary borrowing process at Virginia Polytechnic Institute & State University (Virginia Tech). The name "ILLiad" can be thought of as an acronym for **I**nter**L**ibrary **L**oan **I**nternet **A**ccessible **D**atabase. However, ILLiad is much more than a database that stores information about interlibrary loan requests. As a model of the entire borrowing process, ILLiad has many implications for service and future expandability.

ILLiad is the software that examines the current state of each ILL borrowing request. Depending on the state of the request, ILLiad may perform an action, such as sending an overdue notice to the customer if the book is overdue. Alternatively, ILLiad may inform the ILL staff of the need to perform an action, such as searching OCLC for possible lenders. Performance of an action usually alters the state of a request, thereby preparing the request for another processing step. Because ILLiad is a model of the complete borrowing process, the way remains open to replace staff actions with ILLiad actions by implementing additional algorithms in software. For instance, it will be possible to automate the process of verifying that a photocopy request falls within fair use guidelines.

In this paper, we describe the reasons for developing ILLiad, the goals established for the system, and the ways in which ILL customers interact with ILLiad. Then we describe how ILLiad is used by the staff to conduct interlibrary borrowing. The reader may view the public face of ILLiad on the World Wide Web at http://www.ill.vt.edu/.

WHY AUTOMATE INTERLIBRARY LOAN?

Interlibrary loan was once thought of, if it was thought of at all, as a minor part of reference service. ILL was a small, back-office operation that was considered a nice, but not particularly important, supplement to local collections. This view is changing rapidly, especially in large research and public libraries. Decades of inflation in journal and book prices have greatly reduced the purchasing power of libraries at a time when the quantity of published information, and the range of information needed to support multi-disciplinary research and education, has increased greatly. Today, interlibrary loan is a fundamental adjunct of collection development and reference service. ILL is now vital to the success of a library's clientele.

A new perspective on interlibrary borrowing at Virginia Tech emerged when ILL activity was considered in relation to activity levels in acquisitions and in circulation. For example, during

the 1996-1997 fiscal year, the borrowing unit of the Interlibrary Loan Department searched and ordered 20,716 items, an increase of nearly 8% from the previous year. During that same time, the Collection Development and Acquisitions Departments searched and ordered only 20,540 items, a decrease of nearly 11% from the previous year. Thus, interlibrary loan ordering already exceeds that of traditional collection development and acquisitions functions, and the disparity should increase. We should also consider that items obtained through ILL are most likely going to be used, in contrast to the well documented fact that many items purchased in large libraries remain unused after many years on the shelves. (1, 2).

In addition to its acquisitions function, ILL circulates returnable materials borrowed from other libraries. During the 1996-1997 fiscal year, the Interlibrary Loan Department circulated 6,163 items. This is nearly as many items as were circulated by the Geology branch library, and almost twice the circulation in the Veterinary Medicine branch library. Thus, the borrowing unit of the Interlibrary Loan Department may be viewed as a branch library in its own right, but one whose collection is shelved in widely dispersed locations.

The magnitude of interlibrary loan borrowing, coupled with the expectation of increased growth in borrowing, led to the conclusion that moving from a manual, paper-based system was worth exploring. Our belief that interlibrary loan is a major activity worthy of automating has been justified by the high level of use of ILLiad during its first four months of operation. During that time, fully one-fourth of the Virginia Tech faculty and about one-third of the graduate students made use of ILLiad. This level of use occurred at the end of the academic year and during a slow summer session. Almost nothing that occurs on campus affects such a large proportion of faculty and graduate students so quickly, unless it is a change in parking regulations.

GOALS FOR ILLIAD

Upon recognizing that interlibrary loan had a level of activity and a public service function that justified automation, general goals for the system were developed by the Interlibrary Loan Department. Included in the goals were:

- Customer identification through registration to assure successful delivery of materials, to eliminate repetitive input of customer information, and to prevent unauthorized use.
- Customer initiated requests submitted through online forms.
- Customer interaction to allow altering a request after submission, renewing a request, and tracking the progress of a request.
- Tracking and reporting of requests at every stage.
- Elimination of all paper records and manual record keeping.
- Statistical reports that could be shared with customers.

HOW WAS ILLIAD BUILT?

Virginia Tech's ILL process was first modeled as a flowchart. That flowchart, which is still evolving, today contains more than 490 individual steps and decisions. A complete printout in a readable font size would be about 24 feet long and 4 feet high. Within the chart, a group of steps and decisions represents a sub-process, such as clearing article requests for copyright fair use compliance or sending overdue notices. These sub-processes were implemented in software, the sum total of which constitutes ILLiad. The choice of what sub-process is to affect a particular request at any one time depends on the "state" of the request. Information about the customers, the requests, the lending libraries, and the status of a request is stored in a database named ILLData.

Designing the database

Designing ILLData was perhaps the simplest part of building ILLiad. The required data fields were already known from the content of the paper ILL request cards that had been in use for years, and from the content of various other paper files in the department. The content of these existing paper files was translated into several database tables as described below:

Transactions - This table contains the bibliographic information about the request, the OCLC lending string, the OCLC symbol of the library that supplied the item, and the UserName of the requester. The key to this table is the TransactionNumber assigned by ILLiad to each request as it is submitted by the customer.

Users - This table contains information about registered customers. Besides the usual names, addresses, phone numbers, and e-mail addresses, the Users table contains the customers' preferred method of delivery. It is linked to Transactions by the UserName field.

LenderAddresses - This table contains information about lending libraries. It is linked to the Transactions table by the OCLC symbol for the lending library.

Tracking - This table logs every change in the status of a transaction. It includes the date and time the status was changed and which staff member or customer changed the status. It is linked to Transactions by the TransactionNumber.

Invoices – This table stores any payment information needed by the lending institution. It is linked to Transactions table by the TransactionNumber.

ILLiad uses additional tables to manage its internal operations. These include Increment (where the TransactionNumber is created), Inventory (where data is stored from a hand-held scanner during the inventory process), and OCLCUpdates (where ILL numbers are stored awaiting an update, along with their status of received or returned).

Implementing the ILL process in software

Choosing the software environment in which to implement ILLiad was perhaps the most critical decision. Choices usually followed logically from conditions at Virginia Tech. The campus is heavily computerized and networked. Ethernet is available in many dorms and in some nearby apartment complexes. The dominant operating system is Microsoft Windows, though significant Mac and UNIX populations exist.

To accommodate customers on all platforms, we developed a Web-based user interface for customers. This interface was a logical extension of the simple Web forms that were already in use, and which already accounted for more than 90% of all ILL borrowing requests by the time ILLiad was put into production. We chose Microsoft SQL Server as the relational database engine for ILLiad because it is well integrated into the Windows NT Server environment used to network the department's PCs. To minimize programming, we chose Borland's Delphi as the development tool. ILLiad's live statistical reports displayed on the Web are generated through the Active Server Pages feature of Microsoft Internet Information Server version 3.0, which is the Web server included with NT Server.

ILLiad is a software model of the ILL request process. The progress of a request as it is processed is described by its "Status." A complete explanation of the 25 statuses used by ILLiad is available at the ILLiad Web site. However, the Status of a request is not a complete description of the "state" of the request. ILLiad determines the state of a request from its Status combined with other data. For example, a request is in an overdue state if the following three conditions are

met: 1.) the RequestType is a loan, 2.) the TransactionStatus is "Checked Out to Customer," and 3.) the current date is later than the DueDate.

A custom-written ILLiad client is used by the staff to process requests. The ILLiad client imports and exports OCLC information in a process facilitated by Passport for Windows macros. Other software components in ILLiad include Microsoft Word for Windows and Adobe Acrobat Exchange.

System Requirements

ILLiad requires the following computer configurations:

Customer workstations

- Any computer capable of running a Web browser that understands frames, tables, and forms. Netscape Navigator 3.0 and Microsoft Internet Explorer 3.0 and higher versions are examples of such browsers. Screen resolution of 800x600 pixels or higher is recommended for ease of use of the frames-based Web pages, but it is possible to work at lower resolutions. For those with small or low-resolution monitors, the customer-input pages are available without frames.

Database server

- Microsoft Windows NT Server 4.0, 64 MB of RAM recommended.
- Microsoft SQL Server 6.5 or greater, or another ODBC-compatible SQL database. Database is standard ANSI SQL compatible. Any industry standard SQL reporting tools will work with it.

Web server

- Microsoft Windows NT Server 4.0, 64 MB of RAM recommended.
- Microsoft Internet Information Server version 3.0 or greater. This is a free component of Windows NT Server 4.0.

Staff workstations

- Windows 95 or Windows NT client workstations.
- 15" monitors with resolution of 1024x768 pixels (17" monitors recommended).
- FAX modem in addition to Internet connection to transmit ALA request forms.
- Passport for Windows (for OCLC access).
- Web browser.
- For electronic delivery, the Ariel receiving workstation also should have this configuration, along with a copy of Adobe Acrobat Exchange.

Other software

- Microsoft Word for Windows (or any other ODBC compliant application suitable for formatting and printing book labels and checkout slips from data generated by the ILLiad client).
- Microsoft FrontPage 97 for maintaining Web page content.

WHAT THE CUSTOMER SEES AND DOES

Customer procedures

It is not possible in this article to illustrate the rich and colorful Web interface that is the public face of ILLiad. Readers should point their Web browsers at the Virginia Tech Interlibrary Loan page at http://www.ill.vt.edu to see ILLiad.

A customer accesses ILLiad using a Web browser. The first-time user registers for interlibrary loan service by filling out a form on a Web page. The customer supplies his name, e-mail address, campus mailing address, status and department at Virginia Tech, Virginia Tech ID number, and preferred method of delivery for photocopies, including a preference for electronic delivery of articles. The customer also specifies a username and a password of his choosing. This is the only time the customer has to supply this personal information. When submitting a borrowing request, the customer logs on to ILLiad with his username and password. His personal information is associated automatically with his requests.

When a registered customer logs on to ILLiad, he sees the ILLiad Main Menu. Usually he will request a photocopy or a book loan by clicking the appropriate button on a menu. Clicking a request button displays a request form. The customer fills in the bibliographic information about his request. He does not need to supply any personal information because it is already known to ILLiad. When the form is complete, the customer clicks a button to submit the information to ILLiad. The initial status of the request is "Submitted By Customer." If the request is for a photocopy of an article, ILLiad immediately updates the status to "Awaiting Copyright Clearance." The significance of these statuses will become apparent when we describe the staff functions of ILLiad.

Customers have other options on the ILLiad Main Menu. If a photocopied article has been received via Ariel, and if the customer prefers electronic delivery of photocopies, then clicking a button lists the articles for that customer that are available for download. These articles are stored by ILLiad in Adobe's Portable Document Format (PDF). They can be read or printed within the Web browser using the free Adobe Acrobat Reader.

Other selections on the Main Menu allow customers to view details about any outstanding requests. For each request they can view a complete TransactionStatus history of the request as it went through processing. This history lists the date, time, and staff member's name associated with each change in status that occurred during processing. Customers can revise any request that has not yet been processed by the staff. They can renew loans for items in their possession, and they can see complete information about all their past requests. If a request was previously cancelled by the staff for incomplete information, or because a source for the item could not be found, the customer can display that request, edit the content, and resubmit the request with additional information that might now make it possible to obtain the item. Finally, the customer can revise his personal information, including addresses, delivery preferences, and ILLiad password.

ILLiad composes and sends automatic e-mail notifications to customers when an item is received or when a request is cancelled. The e-mail messages are customized according to different pickup locations and customer characteristics. The message contains full details about the request, as well as other pertinent information, such as a reason for a cancellation and a call number for items owned by the Virginia Tech libraries.

Returnables are picked up by the requester in the Interlibrary Loan office. The items are checked out to the customer on ILLiad by wanding a barcode on the loan label printed by ILLiad and attached to the book.

It is worth emphasizing what the customer does not have to do under ILLiad. Unlike most paper and Web request forms, the customer does not have to supply personal information each and every time that he submits a request. This alone cuts in half the amount of time it takes the customer to complete each request.

Customer acceptance of ILLiad

During its first four months of operation, ILLiad was used by 1,444 individuals. This includes 363 faculty members, 813 graduate students, 102 staff members, and 166 undergraduates. It is not surprising that ILLiad was heavily used, as it is the only means of requesting items through Interlibrary Loan. What is remarkable is that the system was introduced in the middle of the second semester, a time usually regarded as undesirable for the introduction of significant procedural changes in academic routines.

The successful introduction of ILLiad can be attributed to several factors. First, about 90% of all ILL requests were already being submitted through Web-based forms. Paper request forms still existing at various library service points were gradually withdrawn over a period of months. As a result, the customer's interface with the ILL Department did not change greatly when ILLiad was introduced. Second, Virginia Tech is a computer literate campus. Most ILL customers enjoy the convenience and technological sophistication of an online system that allows them to work from home and office to submit requests. Third, the user interface was designed and redesigned for logical and easy use. Graphic images provide cues to help the customer navigate the menus. A request that contains errors is presented back to the customer with clear instructions for revision and resubmission. Fourth, ILL staff gave demonstrations of ILLiad and its benefits to reference and information desk staff. This helped reference personnel answer any questions when ILLiad was introduced.

The greatest stumbling block we anticipated when introducing ILLiad was the requirement that customers register for service and use a password to log on to ILLiad to submit requests. To avoid surprising our customers on the day ILLiad was introduced, we publicized the system on our Web pages and gradually shifted the existing Web environment into the new environment of ILLiad. Thus, the look and feel of the system for submitting requests was modified prior to changing the actual procedures. As a result, ILLiad's introduction was seen as a useful, convenient, and labor saving transition, rather than as a surprising or disruptive change.

Informing the customer

Having focused on the customer throughout the development of the public face of ILLiad, we wanted to keep the customers informed about the benefits of ILLiad. The best way to do this was to share with the customer everything the staff knew about interlibrary loan service. In particular we wanted to inform the customer about how long it takes to get items through interlibrary loan. This information is available to everyone through the Web-based ILLiad Reports.

ILLiad includes reports on turn-around time, on the distribution of delivery times, and on the status of all requests in the system. Other reports list the number of registered users from each academic department, the most requested journals, and the number of items obtained from each lending library. These reports are "live." That is, they are generated by ILLiad at the instant when the user clicks on the desired item on the report menu. The information cannot be more current or complete because it is based on every request in the system, not just a sample. Interlibrary Loan may be the first public service unit on campus that enables its customers to generate their own reports about the unit's scope and effectiveness.

Because of ILLiad Reports, we know that between March 17 and July 30 the Interlibrary Loan Department delivered 215 requested items within one day of the request submission. We also know that 55% of all successful requests are delivered to the customer within 7 days. The average time to obtain an item, from the moment it is submitted to ILLiad until the customer is notified that the item is available is 8.39 days. This time includes nights and weekends, not just weekdays.

WHAT THE STAFF SEES AND DOES

ILLiad includes a custom-programmed Windows client that the interlibrary loan staff uses to process ILL requests and to circulate borrowed items to customers. This client organizes much of the work according to the TransactionStatus of requests. The operator launches the client, logs on with his username and password, and sees a screen displaying the total number of requests for each status in the system. From this table, or from the ILLiad client menu bar, the operator selects a task to work on.

Validating new users

Anyone with Web access can fill out and submit ILLiad's registration form for new users. As part of preprocessing procedures, the staff clicks on the menu selection that displays a list of new registrants. The names are reviewed against lists of faculty, students, and staff at Virginia Tech so that only eligible registrants are accepted into the system. ILLiad sends an automated e-mail message to each registrant confirming successful registration or disavowal. Because of Tech's size and complexity, confusion can arise about service eligibility for individuals not directly part of the university community. The message disavowing a registrant provides an explanation and leaves the path open for correction of an error by the staff.

Copyright clearance

The operator selects Copyright Clearance from the ILLiad menu to display a window with the photocopy requests to be reviewed. Two other windows simultaneously display a list of all titles previously obtained that have reached the copyright fair use limits. The first of these windows displays the titles from which five or more items were obtained. The second window displays those titles for which multiple requests were obtained from a single issue. The operator compares each new request against the previously requested titles to determine if a copyright fee must be paid. If payment is required, the operator uses his Web browser to determine the copyright fee from the Copyright Clearing Center web page. He enters the payment information into the copyright payment fields in the ILLiad client window. The entry includes base fee, per page fee, and ISSN. The operator then clicks ILLiad's "Pay Copyright" button to submit the data to the ILLiad database. ILLiad then updates the transaction status to "Awaiting Request Processing." Periodically, ILLiad generates copyright payment reports to be used in paying fees to the Copyright Clearing Center.

For those requests requiring payment but not listed on the CCC web page, ILLiad changes the status to "Awaiting Document Provider Processing." The staff obtains the item through a commercial document provider who handles copyright payment as part of the provider's fee. Of course, there is always an option of cancelling a request if no means of paying the required copyright fees can be found.

Requesting items through OCLC

Requests ready for processing are searched in OCLC. The operator clicks the "Search Requests" button. ILLiad presents the operator with a list of all requests ready to be searched. After selecting one of the requests for processing, the operator switches to an OCLC search window in Passport for Windows and presses <Ctrl-S>. This invokes a macro that reads the request data from ILLiad and searches OCLC for the item. If the search does not result in a unique OCLC record, the operator continues with the usual manual search procedures. This may mean selecting a record from a menu, or revising the search argument if no records are retrieved by the automated search.

When a usable OCLC record is found, the holdings are examined and potential lenders are selected. The operator creates an ILL workform using the desired lending string. A Passport for Windows macro then copies all relevant data from the ILLiad request into the OCLC form. This includes customer name, article author and title, page numbers, etc. The macro then sends the request. After the request is sent, OCLC assigns an ILL transaction number and updates the workform display in Passport. The operator clicks a button on the ILLiad client window to import the OCLC number, the ILL number, and the lending string into ILLiad, where the information is attached to the customer's request. During this entire process the operator does not key any information about the requester nor about the item to be borrowed.

Receiving items and notifying customers

When an item arrives from a lender, the ILL staff clicks the ILLiad client's "Receive from Lending Library" button to call up a search form. The item can be searched in ILLiad by ILL number, ILLiad transaction number, customer name, book or journal title, and by several other fields. Once the request is found, the operator enters the due date (if applicable), the lender, and any special instructions for a loaned item.

If the incoming item is a loan or a printed photocopy, the operator queues the transactions for printing of mailing labels for articles and loan labels for loaned items. ILLiad then updates the status of each transaction to "Awaiting Customer Contact." The operator then clicks on the ILLiad menu selection "Contact Customers" and ILLiad sends an e-mail to the requester announcing arrival of the item. The e-mail contains all relevant information about the transaction. A small number of customers have indicated their preference to be notified by phone. For those customers, ILLiad prints a calling list and a staff member phones the requester with news that the item has arrived.

The printed articles are placed in envelopes for mailing and matched with the appropriate mailing labels. Loan labels are affixed to returnables, which are held for customer pickup. These labels are removable adhesive labels containing the requester's name, title of the loaned material, the due date, the number of pieces comprising the request, and any special instructions stipulated by the lending library. The loan labels also contain an ILLiad generated barcode that allows automated checkout and checkin on ILLiad.

If the item is a photocopy that arrived through ARIEL, and if the customer requested electronic delivery of such articles, then the ILL staff converts the Ariel file to Adobe's Portable Document Format (PDF). The PDF file is posted to the ILL server where it can be accessed by the requester through the Web. ILLiad automatically sends an e-mail to the requester announcing that the item is available for download. As little as eight minutes has passed from the time the e-mail was sent until the requester downloaded the item.

Returning borrowed items

When the customer returns a borrowed item, the ILL staff checks it in on ILLiad using the barcode on the loan label. ILLiad updates the transaction status to "Awaiting Return Label Printing". After checking in all returned items, the ILL staff prints return mailing labels and OCLC ILL forms by clicking a menu item on the ILLiad client. By printing these items on demand, ILLiad eliminates the need to file and store mailing labels and OCLC printouts used when returning items to the lender. There are no paper files whatsoever for interlibrary borrowing under ILLiad. Once the return paperwork is generated, the items are boxed for return and mailed back to the lender. ILLiad updates the TransactionStatus to "Request Finished."

BENEFITS OF ILLIAD

ILLiad enables the library to provide a number of services programmatically at the initiative and convenience of the customer. Such services include feedback to the customer about the current status of a request, enabling the customer to cancel a request or renew a loan, and enabling the customer to generate statistical reports about the performance of the interlibrary loan service.

In the Interlibrary Loan department, ILLiad saves time and eliminates typing errors. After searching a request using OCLC's Passport for Windows, a single keystroke by the operator copies all customer and request information from ILLiad to the OCLC ILL workform and sends the request on OCLC. ILLiad then copies back from OCLC the correct title of the item, the ILL and OCLC numbers, and the lender string. ILLiad stores both the title originally requested by the customer and the title on the OCLC record selected by the staff.

ILL staff are better able to answer customer inquiries because all data about a request is immediately available online. There is no need to search through multiple paper files when answering an inquiry. Customer service is improved by gathering statistical information about the performance of the lending libraries, enabling the staff to make better decisions when choosing a lender to supply an item.

While providing increased customer satisfaction, ILLiad is also saving time and money. Preliminary work measurements show that request processing is cut by an average of 9.7 minutes per item, which translates into a saving of more than $21,000 in student and staff time during the course of one year. This staff time is being devoted to improving other aspects of Interlibrary Loan service, including improved lending services to other libraries.

ILLiad's benefits are becoming apparent throughout the library. Detailed borrowing data contributes to informed decisions about collection development and cost avoidance. Finally, the investment in ILLiad is an example of "buying the future." The Virginia Tech interlibrary loan service is in a position to handle increased borrowing activity as customer needs increase.

ILLIAD "PROBLEMS"

ILLiad requires a higher level of computer sophistication on the part of ILL staff. To some this may be thought of as a problem. We see it as a benefit in that it develops the ability of the staff and the customers to take advantage of the power of software to improve services. As with other aspects of library automation, ILLiad requires the library to employ knowledgeable computer specialists who can deal with the inevitable hard disk and network failures. Some see this shift in the skill set of library employees as a problem. We see it as a natural evolution that is appropriate in an information organization.

Confidentiality of information submitted by a customer at a public Web workstation has been suggested as a possible problem. Web browsers cache information and create a history file on the local workstation. This allows a subsequent user of the workstation to access the system under a previous user's name using the browser's Back button to recall a page from the cache, or by finding a page with a user's personal information in the browser's history file. Customers concerned about this issue should take the kinds of precautions they are accustomed to using with any private information that is at risk to exposure in public places. They can access ILLiad only from their personal computer or an otherwise secure workstation. They can access ILLiad from the supervised public workstations in the Interlibrary Loan office in the library. If they are working at a public workstation in the library or a campus computer lab, then they can delete from the history file those pages that contain personal information. Also, they should exit from the Web browser before leaving the workstation. This prevents the browser's Back button from accessing the pages they were using.

FUTURE DEVELOPMENTS

ILLiad is being extended to automate the lending process. Rather than printing in duplicate the 45,000 lending requests received each year via OCLC, ILLiad will capture the requests to provide a completely online environment for lending. Data about items to be retrieved from the stacks for lending or photocopying will be downloaded to handheld computers. As items are retrieved, or not found, the status will be updated on the handheld computer. Information from the handhelds will be uploaded into ILLiad for transmittal to OCLC as to the final action on a lending request.

ABOUT THE AUTHORS

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ILLIAD AVAILABILITY

ILLiad is available under license from Virginia Tech Intellectual Properties, Inc. VTIP can be contacted at (540) 231-3593 or through its Web page at http://www.vtip.org/.

FOOTNOTES

1. Kent, Allen, et. al. (1979). *Use of Library Materials: The University of Pittsburgh Study*. Marcel Dekker, Inc.: New York. The authors of this classic study found that any given book had only about a 50% chance of being used in the seven years following its purchase.

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