

**DOCUMENT ORDERING STANDARDS:
THE ILL PROTOCOL AND Z39.50 ITEM ORDER**

BY

FAY TURNER

NATIONAL LIBRARY OF CANADA

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The problems confronting libraries these days are daunting, from increased volume of published and grey material, to increased cost of books, serials, library staff, and facilities to maintain collections. Library patrons, who have not been immune to the media hype about the information highway, are demanding immediate delivery of more information from a wider range of sources located around the world. All this is occurring while budgets allocated to libraries are diminishing.

In response to the challenge to do more with less, libraries are finding solutions in cooperative resource sharing arrangements such as shared acquisitions and cataloguing. In particular, libraries are turning from ownership to interlibrary loan (ILL) and commercial document supply sources to supplement their collections. Rather than working on the premise of just-in-case, that is, acquiring a broad range of material in anticipation of a potential need, libraries are turning to supply-on-demand to acquire material from other libraries and information suppliers as it is needed.

This growing dependency on interlibrary loan and document delivery services has spawned numerous conferences, workshops and committees devoted to issues pertaining to ILL and document supply. All aspects of traditional interlibrary loan are being re-examined to make it more cost effective and fast, including allowing the patron to initiate requests from user workstations, ordering from alternative sources of supply, and using electronic communication links between requesters and suppliers. The ARL North American Interlibrary Loan and Document Delivery (NAILDD) Project is one such initiative that has engaged the participation of not only libraries but also the bibliographic utilities and library software vendors to restructure and improve ILL.

In NAILDD and other focus group discussions, libraries are confirming that which has long been recognized -- technology is a key component in improving information delivery to patrons. Regardless of the supply source, placing orders should be easy and efficient. Today, new technologies and standards need to be applied to meet the challenges raised by the increased volume of information, decreased budgets and growing patron demands.

Two standards are now available to facilitate the ILL and document delivery process -- ANSI Z39.50 (specifically, the Extended Service for Item Order) and the ISO Interlibrary Loan Protocol. These standards provide uniform procedures for ordering material regardless of the systems or computers used by the requester or the supplier. This paper will describe these two standards, the advantages and disadvantages of using each and provide a high level model for their use in a distributed communications environment. Because there has been little discussion on the relationship between these two standards,

the model provides guidance on their application to different ILL and document delivery scenarios and participants.

For purposes of this paper the terms ILL and document delivery (ILL/DD) are being used in their broadest sense to encompass traditional loan arrangements between libraries as well as the provision of copies for non-returnable items to libraries and patrons by document suppliers. Items can range from books to images and can be delivered in either hard copy or in electronic form. Suppliers include libraries, fee-based library information suppliers, commercial information suppliers, bibliographic utilities and full-text database providers. However, the focus of the paper will be on the ordering of the item -- the activity which takes place between the identification of the desired item and its shipment. The delivery mechanisms possible for the shipment of the item are very numerous, from postal mail and courier service for hard copy publications to e-mail, FTP and Z39.50 Retrieval for electronic representations of an item. These will not be addressed here.

The ISO Interlibrary Loan Protocol Standard

The interlibrary loan protocol was approved as an International Standard in 1991 by the International Organization for Standardization (ISO) after several years of international consultation and review. The standard itself is made up of two documents which have ISO standard numbers assigned to them: ISO 10160 for the Interlibrary Loan Application Service Definition and ISO 10161 for the Interlibrary Loan Application Protocol Specification.

The Interlibrary Loan Protocol Standard is the international library community's response to ILL communication barriers resulting from the proliferation of incompatible ILL messaging systems. A variety of North American and European ILL systems have been developed for different hardware and software environments with each system supporting a unique set of messages and message formats. The different messages produced by these systems has made their exchange between disparate ILL systems impossible without elaborate conversion activity.

The interlibrary loan protocol is a communication standard which permits the exchange of ILL messages between systems that use different hardware and software by defining a standard set of messages and message formats. It also specifies transaction states to define each stage of an ILL transaction. The implementation of the standard not only enables the exchange of ILL messages between dissimilar systems but also provides a mechanism for the control and management of ILL transactions for both lending and borrowing activities.

Much of what goes on in the protocol is hidden from the user by the application and the user interface. The amount and way ILL information is presented to the user is dependent on the design of the ILL system. It is therefore possible to built ILL systems to meet local

processing or operational requirements; the only common feature of these systems would be the ILL protocol module.

ILL Protocol Features

The Interlibrary Loan Protocol Standard is very rich in features and capabilities thanks in large part to international participation in its development. For this discussion on standards for ILL/DD, the most relevant features of the ILL protocol are described below under the headings: protocol services and messages, transaction states, data elements, transaction types and transaction management information.

1. Protocol Services and Messages

The ILL protocol defines a full suite of "protocol services" representing all stages in an ILL transaction. These services formally embody actions that normally occur in ILL operations to indicate the progress of a transaction. Examples of ILL services supported by the protocol for the requesting library include request for copy or loan (ILL-REQUEST), indication of receipt and return of the borrowed item (RECEIVED, RETURNED), request for renewal of a loan (RENEW), notification that the item is lost (LOST) or damaged (DAMAGED), and request for the status of the transaction at the partner library (STATUS-QUERY).

Examples of ILL services supported by the protocol for the responding library or supplier include responses to requests (FORWARD, SHIPPED, ILL-ANSWER), response to renewal requests (RENEW-ANSWER), overdue notification (OVERDUE), return of item to collection (CHECKED-IN), and reports on the status of a transaction or errors (STATUS-OR-ERROR-REPORT).

A local system presents to the ILL system operator, e.g. ILL staff member, a user interface to enable these services to be invoked. The operator uses the ILL system to note various ILL activities rather than indicating them on paper forms. The use of individual services is mandatory or optional depending on the type of item supplied and the complexity of the transaction.

For each service there is a corresponding message, called an application protocol data unit (APDU), that can be sent to the partner library. The message is always sent for certain services, specifically the ILL-REQUEST, CANCEL, RENEW, OVERDUE, and RECALL services. For other services, the message may be inhibited (in certain circumstances) in which case no message is sent.

ILL protocol messages are exchanged over a communications network that is common to the transaction partners. However, the protocol does not state what type of communications network should be used. It is possible to exchange ILL messages in a store-and-forward mode using the electronic mail capabilities of X.400, the Internet (Simple Mail Transfer Protocol) or a commercial electronic mail service. ILL messages

can also be exchanged in a connection-oriented mode whereby the two ILL systems are directly connected to each other in a dialogue. In this mode requests and responses are exchanged while both systems are linked with the assumption that there will not be a significant delay between the sending of a request and its corresponding response. The connection-oriented mode of communication is possible over OSI (Open System Interconnection) communications networks and over the Internet.

2. Transaction States

For nearly all of the ILL protocol service and messages there is an associated "transaction state" that controls which service and message can be used next. Each stage of an ILL transaction is therefore identified by a state. The names of the states closely correspond to the names of the protocol services and messages, such as SHIPPED, RECEIVED, RETURNED, and OVERDUE. For example, when a request is sent, the state of the transaction for the requesting library is PENDING; when the request is received by the potential supplying library, the state of the transaction for that library is IN-PROCESS. Even when no corresponding message is sent when a service is invoked, a state transition still occurs in the local system. As a result, it is possible for an ILL transaction to have one state in the requesting library's system, e.g. RECEIVED, and another state in the supplying library's system, e.g. SHIPPED.

The transition between one state and the next within a transaction is controlled by a set of rules governing the sequence of services and messages permissible for a transaction. For example, these rules, which are embodied in state tables, will not permit the supplying library to send an overdue notice if it has not indicated (within the local system) that the item has been shipped. They also enable a library to determine the state of a transaction within its local system and, by sending a STATUS-QUERY APDU to the remote partner, find out the state of the transaction within the partner's system. This state information is also useful in determining the whereabouts of the item - has it been shipped, received, returned, or checked back into the collection of the supplying library.

3. Data Elements

For each protocol message, the ILL Protocol Standard specifies a comprehensive set of data elements specific to that message. These data elements are optional or mandatory, structured or unstructured. For example, the date, time and ISBN, when supplied, must be in the pattern defined for them by other ISO standards. Below are examples of the type of information covered by the data elements contained in the ILL-REQUEST APDU:

ILL-REQUEST

ID Information: transaction, requester (institution or individual), supplier

Date and time of protocol service

Delivery and billing addresses: postal or electronic

Delivery method

Optional messages required: e.g. RECEIVED, SHIPPED

Dates: expiry, need by, received, returned, due, renew

Type of service required: loan, photocopy, locations, estimate

Medium type desired: printed, copy, microform, machine-readable

Client info: name, status, ID

Item Identification:

call number, author, title, subtitle, sponsoring body, place of publication, publisher, serial title and number, edition, date of publication, place of publication, article title, article author, pagination, ISSN, ISBN, system no., etc.

Cost Information: Account no., maximum cost acceptable, payment provided

Copyright compliance

Permissions: to forward request to another library

4. Transaction Types

An important feature of the ILL protocol is that it can support different transaction types involving two or more transaction partners. The "Simple" transaction type involves two parties: the requester which could be a library or a patron, and the responder which could be a library or any organization that can potentially supply the requested material. Within a simple transaction scenario, a responder, if unable to fill the request, can also forward it to another institution.

The protocol also supports the role of an intermediary institution, such as a regional library or bibliographic utility that acts on behalf of a requester. The intermediary can send a request to a sequence of potential responders until a supplier is found. There are two types of mediated transactions. The first is the "Chained" transaction in which all messages relating to the transaction pass through one or more intermediaries; there is no direct communication between the requester and the document supplier. The chained transactions corresponds to the operations of many centralized agencies, such as the British Library Document Supply Centre, where not only the messages but also the documents themselves are routed through the intermediary.

The second mediated transaction type is the "Partitioned" transaction in which all messages leading to the supply of the item pass through the intermediary but all subsequent messages, such as the renewal request, overdue notice and the recall request, are exchanged directly between the requester and the supplier; the intermediary's role ends with the supply of the document. This scenario corresponds to the ILL services supported by bibliographic utilities such as OCLC.

5. Transaction Management Information

A protocol based ILL system has the potential to produce valuable management information about requests initiated as well as requests received. Because the ILL defines a rich set of data elements that can feed into a database, a system based on the ILL protocol can be an important source of transaction information. With the addition of a

statistics generating package, an ILL protocol transaction database can furnish reports on volume, success rate, turn around time, types of requests received or initiated, borrowers, suppliers, etc. A system that can produce this type of data is an invaluable tool for any library.

ILL Protocol Standard Summary

The ILL protocol is a communication standard involving the invocation of protocol services within a local system and the transmission of optional messages between two or more systems representing the transaction partners. The ILL protocol provides a wide range of services and options to meet the needs of most ILL/DD scenarios. Although it is separate from any searching application, the ILL protocol is an important component within the greater information retrieval process.

In an attempt to keep pace with a rapidly evolving technological and service environment, it is constantly being examined for possible additions. An amendment to the protocol will be approved in 1995 which will allow the requester to specify the preferred electronic medium to be used for transmitting the requested document.

Thus far, ILL protocol implementation activity has focused primarily in Canada and Europe. Within Canada, the ILL protocol has been implemented by the National Library of Canada, the Université du Québec (20 campuses) and two commercial software vendors whose products are installed in approximately 50 libraries. In Europe the protocol was implemented in 1990 as part of a European Communities funded project to exchange ILL messages between three national nodes: Pica in the Netherlands, LASER in Great Britain, and SUNIST in France. There are now other implementations in the Netherlands and Germany.

In the U.S. the ILL protocol has not as yet gained a foothold primarily because of the heavy reliance by libraries on the ILL facilities of OCLC and RLG. The first American implementation is currently being produced by the North Carolina Triangle Research Libraries Network (TRLN). TRLN is developing a comprehensive automated document delivery system for its member libraries.

Z39.50 Extended Services for Item Order

Since the approval of the ILL Protocol Standard in 1991, another protocol mechanism has been developed for interlibrary loan and document delivery within Z39.50 called the Extended Services service for Item Order.

Overview of Z39.50

Z39.50 is the U.S. National Standard for information retrieval. It was approved in 1992 by the National Information Standards Organization (NISO), the only organization

accredited by the American National Standards Institute (ANSI) to develop and maintain standards for information services, libraries and publishers. Z39.50 is a computer-to-computer communications protocol which defines a set of rules and procedures for searching databases and retrieving records.

The Z39.50 standard was developed to overcome the problems associated with multiple database searching such as having to know the unique menus, command language, and search procedures of each system accessed. Z39.50 simplifies the search process by making it possible for a searcher to use the familiar user interface of the local system to search the local database as well as any remote database system that supports the standard.

This capability is achieved by basing Z39.50 on the client/server model of computing. In this model, two computers interact in a peer-to-peer relationship with each computer having specific tasks for the function being performed. This model underlies the ILL protocol but is not explicitly indicated in the standard itself. Within Z39.50, the model is more obvious. In Z39.50 the client includes the "origin" and is that part of the local system which performs all the communication functions relating to initiating a search and requesting the return of records. The Z39.50 server includes the "target". It interfaces with the database in the server and responds to messages received from the origin, such as providing records that correspond to the search query. A searcher uses the familiar user interface of the client system which incorporates the origin part of Z39.50 to search any database, remote or local, interfaced to the target part of the standard.

The Z39.50 method of information retrieval is radically different from the traditional method commonly employed for database searching whereby a searcher uses a local terminal or computer to log into a remote system and then uses that system's unique menus and command language. This requires training and expertise in the unique features of each system selected in order to perform searches efficiently and effectively. The implementation of Z39.50 eliminates the need for expertise in numerous systems and training in the use of each.

The origin and target communicate using the connection-mode of communications in which both systems are directly linked in a dialogue known as a Z39.50 association. As in the ILL Protocol Standard, services are invoked in the local system which are transmitted as messages or APDUs to the remote system. Unlike the ILL protocol, there are no Z39.50 services that result only in local state changes, with no protocol messages sent. Examples of Z39.50 services include a request to begin a Z39.50 session (INIT), the search query (SEARCH), and a request for specific records from a list which correspond to the search query (PRESENT).

Z39.50 not only standardizes the messages to be exchanged between the origin and target systems, but also the structure and semantics of the search query, the sequence of message exchange, and the mechanism for returning records. The rules and procedures defined by Z39.50 enables systems that run on different hardware and use different library software to

perform numerous task relating to information retrieval. No matter what the underlying platform, systems are able to participate in an information retrieval session providing both systems support the standard.

Rather than go into any further details of the Z39.50 standard, the reader is referred to the articles on Z39.50 listed in the references at the end of this article.

While Z39.50-1992 supports basic information retrieval functions for bibliographic searching, it does not support many features currently available in some very sophisticated systems. The developers of the Z39.50 standard have therefore drafted another version of the standard which incorporates many more features to support both bibliographic and non-bibliographic searching. Z39.50-1994, which provides backward compatibility with Z39.50-1992 and is commonly referred to as version 3, has just been voted on by NISO. All ballot comments have been resolves and the standard is pending formal approval.

Extended Services

One of the new features offered in Z39.50 version 3 is the ability to order an item using the Extended Services service. A brief description of the Extended Services (ES) service will help to understand how Item Order works.

The ES service is rather peculiar because the services that can be requested via an ES service are not Z39.50 services in themselves, but are functions supported by the remote server system that are executed external to a Z39.50 session. ES services relate to information retrieval but go beyond the specific activities associated with database searching and record retrieval as defined by the standard. Standardized ES services include:

- Save a result-set for later use
- Save a search query for later use
- Define a periodic search schedule
- Update a database: add, replace, delete records
- Specify the delivery destination, e.g. printer, fax
- Order an item

These all represent services for which information may need to be kept beyond the life of the Z39.50 association in which they were requested. For example, a result set may be saved in one session and reused during a Z39.50 session that is different from the one in which it was created. Similarly, the processing of a request for an item may occur after the order has been received and after the session has closed. Many of these ES services already exist as features in information retrieval systems and have been added to Z39.50 as Extended Service services so that they may be requested in a Z39.50 session.

When the origin asks for an ES service, this results in an ES task. The execution of the ES task is not part of the Z39.50 association, but is performed by the target outside the

association as a separate function or within another application. The standard says nothing about how the target is to fulfill the task, i.e. it doesn't define how the target is to save the query or how it will process an order for an item. The execution of the task can be performed while the origin and the target are linked in a Z39.50 association or some time after the origin and target have ended their connection. When the target does not have to respond during the association, it can allocate its resources and workload more efficiently.

The acceptance of an ES task by the target system results in the creation of a Task Package, but is not an indication of the fulfillment of the task itself. This task package is a record containing information pertaining to the task and is kept in a special ES database maintained by the target. The information contained in a task package is a combination of some of the data supplied by the origin in the ES service request and supplemental data provided by the target. Two types of information are maintained in the task package: information that is common to all ES task packages, and information that is specific to each type of task package.

Examples of the common information supplied by the origin include the identification of the user to be associated with the task package; a name assigned to the task package; and who can access the task package. The target supplied common information includes the date and time the task package was created; the length of time the target will retain the task package; the status of the task package, e.g. pending, active, completed or aborted, etc.

The specific task package information supplied by the origin and target depends wholly on the type of task that the origin has requested. For example, if the origin asks for an ES task to save a result set, the task package will contain the name of the result set and the total number of records contained in the saved result set.

Even though the execution of an ES task is conducted outside Z39.50, the origin system discovers information pertaining to the requested task by using the services of the Z39.50 standard to search the ES database and retrieve the task package record which contains information supplied by the target. The origin can also use the Z39.50 to update or delete the task package records. The target updates the task package record by adding information about the task, such as the status of the task package.

Item Order

The Item Order Extended Service allows the origin to send the target a request for an item and to check the status of that order. The order may or may not be for an item found as a result of a Z39.50 search of a target's database. The item can be anything that the organization providing the service is willing to supply -- from a periodical article to a diagram to a chemical formula; it can be in paper or electronic form; and it can be for permanent retention or for loan only.

When an origin's request for an ES task for Item Order is accepted by the target, an Item Order task package is created in the target's ES database. The task package record contains information common to all ES task packages, as already described, plus information specific to Item Order.

Task Package Information Supplied by the Origin

The origin contributes the following order specific information as contained in the Item Order request:

1. Contact Information

Contact information includes the name, phone number and electronic mail address of the contact person for the request. The contact person could be the researcher placing the request but it can also be an intermediary agent such as the library staff member placing the request on behalf of a searcher.

2. Additional Billing Information

Billing information includes information on how the requested item will be paid for, for example, in response to an invoice, by prepayment, through a deposit account or by credit card. It also allows for the provision of credit card information, customer reference identifier, and customer purchase order number.

3. Item Identification

The origin system can identify the required item in three ways: a) the position of a record within a hit list which is known as a "result set" in Z39.50 terminology; b) an order form such as the ILL REQUEST APDU from the ILL Protocol Standard; or c) a combination of both of these. These options are described in detail below.

a. Result Set Name and Record

A "result set" is a set of records found when the target executes a query. The origin can request some or all of these records for display to the searcher. The searcher can name a result set and select specific records from it to be retrieved. If an item has been found as a result of a search, the searcher invokes the Extended Services service for Item Order and provides the name of the result set in which the required item is contained and the number of its position in that result set. This option assumes that the target has enough information about the item and the requester to be able to process the order.

b. Request Form

The second method for identifying the required item is the supply of request information by means such as an on-line request form. Although the structure and content of the request is not specified in the Z39.50 standard, the standard does suggest the use of the interlibrary loan request message contained in the ILL Protocol Standard (ISO 10161). By suggesting the use of the ILL-REQUEST APDU, the developers of Z39.50 acknowledge not only the existence of a standardized message which can be used for Item Order, but also the complementary relationship between Z39.50 and the ILL Protocol Standard. Item order becomes another vehicle for the transmission of the ILL REQUEST message and allows for the integration of Item Order requests into ILL protocol applications. However, in order for the ILL REQUEST APDU to be sent and accepted as an Item Order request, the two communicating partners must agree on its use through some mechanism such as a bilateral agreement or adherence to an implementation profile for Item Order.

By completing a form based on the ILL REQUEST APDU, the requester can supply detailed information about the required item, which may or may not have been found as a result of a Z39.50 search, e.g. author, title, publisher, pagination of an article, etc., as well as information about the requester, e.g. client identification, delivery address, etc.

c. Combination of Both

This third option is a combination of the result set name and record and the request form. This option assumes that the item has been found as a result of a Z39.50 search but that additional information needs to be supplied either about the required item, the requester or both. For example, the result set and record number identify a journal title but a request form, such as one for the ILL REQUEST APDU, needs to be completed to provide information about the specific article within the journal, e.g. the volume and issue of the journal and the article's title and author. The request form could also be used to supply delivery and billing address information or indicate whether a printed or electronic version of the item is preferred.

4. Supplemental Information

The last bit of information that Item Order allows the origin to provide is optional additional descriptive information about the required item. However, the standard does not define the content or format of this information. If sent, the two communicating systems would first have to have a common understanding of its composition.

Task Package Information Supplied by the Target

The target supplies the following specific Item Order task package information:

1. A Copy of the Request

If the origin identifies the requested item using a request form, such as the ILL REQUEST APDU, the target may include a copy of it in the task package. The target may also unilaterally construct a request form if it has been omitted by the origin.

2. A Status or Error Report

The target supplies information about the status of the Item Order request or indicates whether some error has been encountered that prevents the request from being processed. However, the Z39.50 standard does not define the content or format of these reports but does suggest the use of the StatusOrError Report APDU contained in the ILL Protocol Standard. The StatusOrError Report APDU provides information about the state of the ILL transaction, e.g. RECEIVED, SHIPPED, NOT SUPPLIED, CONDITIONAL, and the history of the transaction. It can also be used to report an error or a problem that has been encountered, such as an error in the syntax of the request, or a system problem which does not permit the processing of the request.

3. Supplemental Status Information

The target may supply additional status information as a supplement to the status information that may be provided in the Status or Error Report. The standard, however, is silent on the type of information to provide or the format it should take. This would have to be defined outside the standard and agreed to by the organization's that wish to use it.

Summary of Item Order

In summary, Item Order is invoked while the origin and target systems are linked in a Z39.50 association. The origin sends an Item Order Extended Services request to the target for an item which may or may not have been found as a result of a Z39.50 search. The target combines into an Item Order task package information common to all ES task packages and information unique to the Item Order task package which is derived from data supplied by the origin and by the target. The target can update the status of the Item Order task package at any time and the origin can check the status of the order by performing a Z39.50 search on the target's ES database. However, the actual supply of the item is outside the scope of the Z39.50 standard.

There are not as yet any implementation of Item Order in commercial or proprietary library systems. Some document suppliers are experimenting with it, but because Item Order is so new and very little experience has been gained in its implementation or use, there is still uncertainty concerning its application to the library environment.

Which Standard to Implement: Item Order or the ILL Protocol?

With two official standards available for requesting an item, a rather confusing picture arises when planning the automation of interlibrary loan and document delivery facilities for libraries, commercial document suppliers and for patrons. Which standard should be implemented -- the ILL Protocol or Z39.50 Extended Services for Item Order?

There was substantial concern within the ISO community that Item Order was moving into a domain already covered by the ILL protocol standard and that these two standards would be competing. Even though there is an overlap in the functions these standards perform, they are unique and meet different operational requirements. In a distributed communications environment, they can be used to complement rather than compete with each other.

The choice of implementing Item Order or the ILL protocol depends on a number of factors that need to be considered individually and in combination. The factors worth examining are:

- Type of Service Required
- Follow-up Messages Required
- Source of Request
- Mediated vs. Non-mediated Transactions
- Transaction Control and Management Information Required
- Existing Implementations

Each of the factors is discussed below. To avoid confusion with the different terminology used by the ILL and Z39.50 standards, the term transaction is being used to refer to all the services and messages associated with the requesting and supply of an item, whether it be via Item Order or the ILL protocol. Also, the system originating the request, regardless of protocol employed, will be referred to as the requester, and the system receiving the request will be referred to as the potential supplier or supplier.

1. Type of Service Required

Interlibrary Loan and document delivery can encompass a wide range of services and type of material. Services can range from the lending of books to the delivery of digitized pictures to the provision of cost estimates. Their provision depends on the business mandate of the supplier, costs that the requester is willing to bear, and related document provision issues such as copyright.

ILL Protocol

The ILL protocol is suitable for supporting traditional interlibrary loan services. The ILL REQUEST APDU supports five ILL/DD services: request for loan; request for a copy of an item; request for locations, i.e. holding libraries; request for a cost estimate for a service; and request to place an item on hold.

Requests for the loan or copy of an item may be filled through the transmission of only the ILL-REQUEST message. Other ILL protocol services relating to the request, such as SHIPPED, RECEIVED and CHECKED-IN, could be recorded in the local system without a corresponding message being sent to the transaction partner. However, these messages can be supplied if required for transaction management purposes.

The ILL/DD service for locations, estimate, and place-on-hold, however, always require a reply message. The ILL-ANSWER APDU is sent to supply location information, an estimate for the provision of the item or an indication that the item has been placed on hold.

Item Order

The ES for Item Order is most suitable for requesting a loan or a copy of an item where no additional messages are required by the transaction partners. Because Item Order does not support any additional protocol messages, it could not conveniently be used for ILL/DD services such as locations, estimates and place-on-hold, all which require response messages. While ES Item Order could be used to ask for these services, the response information would have to be supplied using a communications mechanism outside the Z39.50 protocol.

2. Follow-up Messages

Most ILL/DD requests are fairly straight forward and involve the request of a non-returnable item, such as an article, and its supply. Only the request message is transmitted. However, there are transactions, even for non-returnable items, that require the exchange of follow-up messages between the requester and the supplier. For example, the potential supplier may place certain conditions on the supply of an article which the requester must acknowledge before the transaction can progress any further. Or, the requester may need to send a message that the article has not been received or has been received in a damaged state. For returnable items, additional messages are required to renew or recall a book or notify the requester that the book is overdue.

ILL Protocol

The ILL protocol can be used for transactions that require only the transmission of the ILL-REQUEST APDU but it is particularly suitable for transactions that may require additional follow-up messages. As already indicated, the ILL protocol standard supports a complete range of messages that may need to be exchanged to complete any ILL transaction, whether it be for a loan or a non-returnable item.

Item Order

Item Order, on the other hand, does not support any messages beyond the initial request for the item. Any additional messages must be conveyed using other communication

means such as electronic mail or telephone. However, Item Order easily handles straight forward requests where no additional messaging is anticipated or required. Its strength lies in the ability to generate a request from within a Z39.50 search session for an item found as a result of a search. The ability to request an item while still in a search session greatly simplifies the order request process. Item Order is particularly useful when the request is placed with a commercial document supplier and there is no doubt about the supply of the item and no need for additional messages.

3. Source of Request

The source of the request can have a bearing on which standard to use to transmit an ILL/DD request. The originator of an ILL/DD request is no longer limited to libraries; there is growing interest in North America and Europe to enable the patron to electronically submit a request from his or her own workstation to any document supplier. For example, the ARL NAILDD Project is promoting the concept of patron initiated electronic requests and is working on standardizing the data elements about the patron that must be supplied in a patron generated request. Therefore, any discussion on choice of document ordering standard must consider both the patron and the library as the source of the request.

Patron as Source

A patron workstation developed for scholarly research needs to include a Z39.50 origin to search remote database systems but also an ordering facility to request an item from a supply agent, whether it be a library or a commercial document supplier. The ordering facility could be a mechanism such as a mutually accepted form (not addressed in this article), the ILL protocol for the requester role, or Z39.50 Extended Services for Item Order.

ILL Protocol

Use of the ILL protocol standard allows the patron to participate in single message transactions as well as transactions requiring a full suite of protocol services and messages, from the ILL-REQUEST to RENEW to the LOST notification. The patron's workstation would be capable of receiving protocol reply messages from the supplier and maintaining a database of all actions taken on the transaction. The ILL protocol also enables the patron to derive complete transaction management and tracking information for initiated requests and to check the local or remote system to discover the status of the request.

To allow the patron to move transparently from a search operation to an order operation, the workstation would have to automatically copy information from a record found in a Z39.50 search to an ILL-REQUEST form. Without a software link between the Z39.50 origin module and the ILL protocol module, the patron would have to rekey all the data

into the ILL form. Unfortunately, no standardized set of rules exists to support this function. The use of the ILL protocol by the patron, therefore, requires a very sophisticated workstation containing an application that implements not only two complex standards but also proprietary software that manages the interworking between the two.

The ILL protocol may not be suitable for patrons for another reason -- the high cost of an ILL system relative to the low volume of ILL requests generated by a patron. A patron or researcher does not need all the complexity embedded in the ILL protocol and the corresponding high overhead if he or she initiates only ten requests a week.

Item Order

The ES Item Order service enables the patron to have a system which incorporates a single standard for database searching and for document ordering. However, use of Item Order limits the patron to only the Item Order request message. Any follow-up messages would have to be transmitted by some other communication service.

Because the patron's work station does not contain an ILL protocol-based module, the patron would have to rely on informal means to monitor transactions and maintain status information, such as slips of paper and memory. This should not be too burdensome given the low volume of patron requests as compared to those which a library would handle. In addition, the patron can always perform a Z39.50 search to check the status of an order in the Item Order task package.

By supporting the Z39.50 origin for searching and only ES Item Order instead of the ILL protocol for ILL/DD, the cost and complexity of the patron workstation is considerably reduced.

Libraries as Source

Many libraries handle hundreds of requests a month and require an ordering facility capable of sending, receiving and managing a variety of ILL/DD messages involving different partners including libraries, patrons and commercial suppliers.

ILL Protocol

The ILL protocol standard supports many of the ILL/DD messaging and management requirement of a library. As a requester, the library needs to know if an item can be supplied, if it has been shipped, if it can be renewed, etc. As a supplier, a library needs to be able to record the success or failure of the request, send recall and overdue notices, indicate that the item has been damaged, etc. The ILL protocol's full suite of messages and ILL/DD services makes it suitable for both straight forward and complex transactions. In addition, the protocol enables the library to maintain a local database of all transactions initiated and received and to identify the status of each transaction. The ability to extract transaction management and tracking information is indispensable for a library's ILL/DD

operations especially when dealing with a high volume of requests. The requirements of traditional ILL services can be amply handled by the ILL protocol.

Item Order

If libraries wish to also order documents from commercial document suppliers that support Item Order, then library systems need to include Item Order as well as the ILL protocol. While the Item Order transaction would be limited to only the request message, Item Order would be appropriate to use when the supply of the item is assured or when there is urgency and the supply would be quicker via Item Order than through traditional ILL arrangements. Item Order would also have to be supported by libraries in order to receive requests from patron workstations that support Item Order.

If a library is to support both standards, a desirable feature of the library ILL/DD system would be the ability to integrate Item Order requests into the local database of ILL protocol transactions in order to have a complete and centralized record of all ILL/DD transaction activity. How this is accomplished is outside the scope of this discussion, but would add a degree of complexity over and above the inherent difficulty of implementing any one of these standards.

4. Mediated vs. Non-mediated Transactions

A factor closely related to the need for follow-up messages is whether the ILL transaction is mediated or non-mediated. A non-mediated transaction involves only two partners - the requester and the potential or actual supplier. The requester may be a library or an individual who generates a request; the supplier may be a library or a commercial document supply service who responds to and possibly fills the request.

A mediated transaction is one involving at least three partners: the requester, the supplier and one or more intermediaries. The intermediary acts on behalf of the requester to acquire the desired document, for example a regional library or bibliographic utility. The intermediary must also be capable of relaying messages so that at least one of the messages associated with the transaction will be shared by all the participants.

ILL Protocol

The ILL protocol is suitable for non-mediated transactions as well as mediated transactions involving multiple partners. The non-mediated transactions are called "Simple" transactions and may involve only the ILL-REQUEST APDU or several messages which pertain to the progress of the transaction. The mediated transactions supported by the ILL protocol are called "Chained" and "Partitioned" and have already been described. The ILL protocol intermediary, whether involved in a chained or partitioned transaction, can relay messages, such as the ILL request, between the requester and the supplier.

Item Order

Item Order is more than adequate as the standard for item requesting if the transaction involves only two parties, i.e. it is non-mediated, and neither follow-up messages nor tracking the progress of the transaction is required. It cannot be used for mediated transactions because it does not support relaying of messages to a third party. Any such communications would have to be performed outside the standard. If the receiving system chooses to pass the request on to a third party, it is acting as a requester itself, and not as an intermediary. Two distinct transactions would then be created, the first between the original requester and the ES Item Order recipient, and the second, between the Item Order recipient and the document supplier. However, the Item Order recipient could in fact be a gateway for systems that do not use the same standard for document ordering. By supporting both Item Order and the ILL protocol, the gateway could receive requests from client systems that only support Item Order, and passing them on to document suppliers that only support the ILL protocol and vice versa.

Item Order is therefore particularly suitable for patron workstations that combine Z39.50 searching and document ordering. It is also sufficient for commercial document suppliers who provide a document ordering service and do not need to relay messages to a third party or support additional messages. However, it may not be sufficient for libraries if more than two parties are expected to participate in the transaction.

5. Transaction Control and Management Information

One element that is present in many of the factors already described is transaction audit control and management information. The requirement for this type of information will determine the number and type of messages that need to be exchanged, the types of ILL/DD services supported and the amount of transaction information that needs to be maintained by the systems. The need for audit control and management information should be closely examined when selecting a standard for document ordering.

The ILL protocol through its support of multiple services and messages, states and mandatory retention of transaction information, provides the greatest degree of audit control and tracking information. It is therefore best suited for the management of library-to-library transactions where heavy traffic, complex transactions and business requirements demand detailed record keeping.

Item Order, on the other hand, provides minimal transaction control and tracking information except through status information supplied in the Item Order Task Package. This standard is more applicable to patron workstations and commercial supply systems whose transactions are not complex and there is no need for reply or follow-up messages.

6. Existing Implementations

A final influencing factor worthy noting is whether a Z39.50 or an ILL system has already been implemented. Developers who have produced Z39.50 systems may find it more pragmatic to build Extended Services for Item Order onto their existing systems than to develop a totally new application based on the ILL protocol. Expanding an existing Z39.50 implementation to include Item Order would require less of a learning curve and less risk and degree of investment than developing an ILL protocol-based system from scratch. For some developers, the decision to implement Item Order will be based on familiarity and experience with Z39.50 rather than the service related issues discussed above. Similarly, a developer who already has an ILL system may choose to enhance the existing system's capabilities by incorporating the ILL protocol rather than build a separate Z39.50 application. In both cases, the decision to implement one or the other of the standards for document ordering may be strongly influenced by that which is familiar, however, this decision needs to be tempered by business and service requirements.

Model for Using Item Order and ILL Protocol

At a joint meeting in January 1994 of the Z39.50 Implementors Group (ZIG) and the NAILDD project group, the application of the ILL protocol and Item Order to interlibrary loan and document delivery activity was discussed. A scenario emerged from the discussions which provides a high level model that encompasses the deployment of both standards.

A modified version of that model is illustrated in Figure 1. The model may include two or more partners and assumes the use of ordering standards by the transaction partners. One possible exception to the use of standards is the patron workstation which may only support a patron request template approved by the home library or document supplier. Although this discussion does not include this scenario, the use of an on-line request form maintained in the user's system or retrieved from a supplier's World Wide Web server, is a viable alternative to incorporating an ordering standard within the patron's workstation.

In addition, the model does not attempt to include all the possible ILL/DD scenarios such as those involving more than one intermediary. A comprehensive discussion of various ILL and document delivery scenarios is covered in "Interlending in the Emerging Networked Environment: Implications for the ILL Protocol Standard" by Joe Zeeman.

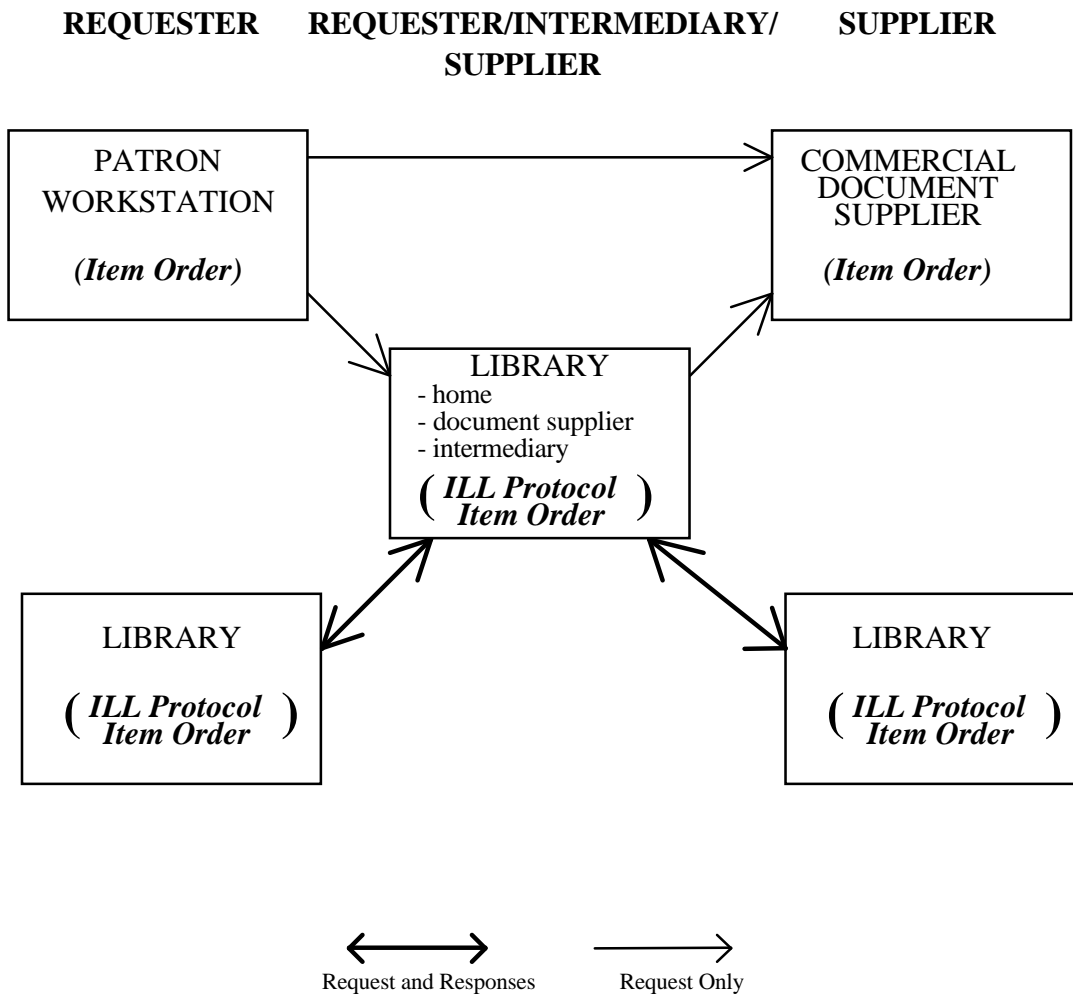


Figure 1: Model for Using ILL Protocol and Item Order

Patron Initiated Requests

In this model the patron is able to initiate a request for an item, from home or office, using a workstation that has a Z39.50 origin system for database searching and record retrieval. The request mechanism is Extended Services for Item Order, an integral part of the Z39.50 origin.

The patron performs a Z39.50 search on a remote database to identify the desired item and within the same Z39.50 association, invokes Item Order to request the document. For identified documents, the Item Order may be sent directly to the holding library, which may be a library other than the patron's home library, or directly to a commercial document supplier, bypassing the patron's home library entirely. This implies that the patron is willing to assume responsibility and charges associated with the order and is not concerned with any automated audit control or management information concerning the transaction. In this scenario the home library has no control or say about the orders placed with other libraries or commercial suppliers.

In a variation of this scenario, the Item Order is first sent to the home library which verifies that the item is not held in its own collection. If not held, the home library then generates either a new Item Order to be sent to the document supplier or an ILL Protocol request depending on what standard the document supplier's system supports and the audit trail the library needs to maintain.

Because Item Order supports the use of the ILL Request APDU to describe the desired item, Item Order may be also be used to request documents which have not been identified as a result of a Z39.50 search. These requests go directly to the patron's home library. The home library checks its own collection and supplies the item if owned or use the ILL protocol to initiate an ILL transaction with a potential document supplier.

The participation of the home library in a patron initiated Item Order request may result in two distinct transactions being created for the request. The first transaction is the Item Order request between the patron and the home library; the second is either an Item Order request or an ILL protocol request between the home library and the supplier. To facilitate the management of Item Order requests received from patrons, a desirable feature of the library's system is an interface between its Z39.50 module and ILL protocol module so that Item Order requests received can be integrated into a single ILL protocol based transaction management system.

Library Initiated Requests

For requests initiated by libraries, the model suggests the use of both the ILL protocol and Item Order. The ILL protocol is particularly applicable to traditional interlibrary loan transactions, either in a decentralized ILL messaging environment or a centralized one

using an automated utility such as OCLC. The ILL protocol can be used for all types of services -- loan, copies, estimates, locations.

The ILL request may be sent to a library that is known to hold the item or to an intermediary such as a bibliographic utility or regional library which is responsible for finding a supplier. The ILL protocol provides all the messaging and tracking support needed to manage simple transactions and complex mediated transactions.

Item Order is an alternative to the ILL protocol for libraries when the item is known to be available from a commercial supplier and cost is not an issue. Item Order would also be selected for orders that need to be expedited or when the ILL protocol system is not working or unavailable. As libraries expand their source of document supply to include commercial services that support Z39.50 and Item Order, their need to also support Item Order will increase. If libraries are to efficiently manage requests involving both the ILL protocol and Item Order, a mechanism is required to integrate all transactions within a single ILL management system.

Suppliers

Document suppliers who make information about their catalogues available through Z39.50 would implement Item Order to provide their customers with a facility for ordering items while still within a Z39.50 session. In providing this service, suppliers may wish to support not only the result set and record number to identify the item but also the ILL REQUEST APDU. This would allow the requester to elaborate on the item requested or provide delivery address information.

The implementation of the ILL protocol may be the next logical step if there is a requirement to supply a reply message, for example, to indicate that the document is not available or available if certain monetary, use or copyright conditions are met. The implementation of the ILL protocol would also permit libraries that only have protocol based systems to send requests to commercial suppliers.

Conclusion

While the adoption of the ILL Protocol Standard and Extended Services for Item Order are still at an early stage, now is the time for the major players in document supply to become knowledgeable of the strengths and liabilities of each. Moreover, a shared understanding is required of how these two standards are to be mapped to existing and future interlibrary loan and document delivery scenarios so that patrons, libraries and document suppliers will enjoy unimpeded communications in a heterogeneous and dispersed systems environment.

Despite their similarities, the ILL protocol and Item Order are not rival but rather complementary standards to be applied to different operational and management

situations. Each needs to be evaluated on its own merit for the intended application; the factors covered in this article are a starting point in this evaluation process. While the two standards share similar characteristics, they both have unique strengths to identify them with different ILL/DD scenarios and participants. The model discussed in this article proposes how these standards can be applied to meet the needs of patrons, libraries and document suppliers.

If patrons are to become more active in the ILL/DD process, they need the tools for searching, locating and requesting items. To achieve this, workstations must support as a minimum Z39.50 for searching and either a request form template or Item Order for document requesting. The inclusion of Item Order provides a convenient and efficient integration of database searching and document ordering activities.

Libraries are fortunate in that there are now two standards for document ordering -- the ILL protocol to support ILL messaging among different library systems including the bibliographic utilities, and Item Order for requesting document from suppliers from whom the receipt of the item is assured. Libraries will also need Item Order if their patrons are empowered to initiate their own requests via Item Order.

For document suppliers, Item Order is required to enable ordering of documents during a Z39.50 search session. Support for the ILL protocol would allow for the provision of enhanced services and would attract customers who may only have ILL-protocol-based systems.

The model proposed here presents a starting point in achieving a common understanding of the most opportune application of the ILL protocol and Item Order standards. As libraries and software developers gain familiarity and experience in their implementation and use, the model may evolve and the standards themselves may have to be modified in response to requirements that have not as yet been identified.

References

ANSI/NISO Z39.50-1992 (version 2) Information Retrieval Service and Protocol: American National Standard, Information Retrieval Application Service Definition and Protocol Specification for Open Systems Interconnection, 1992.

ANSI/NISO Z39.50-1994 (version 2 and 3) Post Ballot Draft. Information Retrieval: Application Service Definition and Protocol Specification, January 1992.

ISO 10160 Information and Documentation - Open Systems Interconnection - Interlibrary Loan Application Service Definition, 1993.

ISO 10161-1 Information and Documentation - Open Systems Interconnection - Interlibrary Loan Application Protocol Specification - Part 1: Protocol Specification, 1993.

Hinnebusch, Mark. "Integrated Library Systems; A Primer on Z39.50: Parts 1-8". *Academic and Library Computing* 9:2 - 9:9 (1992).

Lynch, Clifford A. "Information Retrieval as a Network Application." *Library Hi Tech* 8:4 consecutive issue 32, (1990): 57-72.

Lynch, Clifford A. "The Z39.50 Information Retrieval Protocol: An Overview and Status Report." *Computer Communications Review* 21:1 (1991): 58-70.

Jackson, Mary E. "Library to Library" ("The NAILDD Project"). *Wilson Library Bulletin* 68:3 (1993): 66-68.

Turner, Fay. "The Interlibrary Loan Protocol: an OSI Solution to ILL Messaging." *Library Hi Tech* 8:4, consecutive issue 32, (1990): 73-82.

Zeeman, Joe. *Interlending in the Emerging Networked Environment: Implications for the ILL Standard*. Prepared for the National Library of Canada by Software Kinetics Ltd., December 9, 1994.

Zeeman, Joe. "Report of the ZIG-DIG Meeting in Gainsville." *Information Standards Quarterly* 6:2 (1994): 8-9, 12.