

# THE INTERLIBRARY LOAN PROTOCOL: AN OSI SOLUTION TO ILL MESSAGING

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## **Introduction**

As interlibrary loan (ILL) becomes an increasingly used resource sharing mechanism for the exchange of books and periodicals, libraries have embraced new technologies to better manage ILL activities. While many efficiencies have been gained through the use of computers and telecommunication networks, the proliferation of telecommunication options, ILL systems and non-standard message formats have made the automated exchange of ILL messages between dissimilar systems very complex.

The need for efficient intersystem communication for interlending has been the impetus for the development of an interlibrary loan messaging standard. The ILL protocol, a standard being developed by the International Organization for Standardization, is based on the principles of the Open Systems Interconnection (OSI) reference model and will make it possible for different ILL systems to communicate regardless of the ILL software or hardware used. This article describes the ILL protocol and the benefits to be derived from protocol use, reviews the status of the protocol as an international standard and outlines the various steps being taken by the National Library of Canada to facilitate migration to an ILL protocol-based environment.

## **ILL Service Environment**

Significant improvements have occurred in ILL service provision as a result of automation. Technologies used to automate the messaging activities associated with the borrowing, lending and processing of ILL material include: ILL software to initiate and record ILL requests; electronic mail systems and telecommunication networks to transmit ILL messages; and bibliographic networks to transmit messages and manage the processing of initiated as well as received ILL requests. While these automated facilities have provided marked improvements over the manual procedures which have been used for ILL messaging, the growing number of options for ILL communications and the lack of a standard for ILL messages has created a number of barriers to ILL communications.

One of these barriers is the inability to send messages from one telecommunication network to another. Telecommunication networks used to support ILL messaging include electronic mail systems (ON-TYME II, ALANET), restricted networks based on subject, jurisdictional or geographic criteria (ILLINET, DOCLINE) and large bibliographic utilities (OCLC, RLIN).

Unfortunately, if an ILL message is sent by a library that subscribes to one of these networks, the message usually cannot be transmitted to a library that uses another network, because these systems cannot interconnect to exchange data. In today's tight

economy it is beyond the budgets of most libraries to subscribe to more than two or three networks in order to reach libraries that are potential lenders.

Another barrier is the different ILL message formats produced not only by each ILL network and bibliographic utility, but also by a growing number of ILL software packages such as FILLS and ILLRKS. Therefore, even if the telecommunication networks could connect, the target systems could not process the messages received. Messages produced by one ILL system cannot be automatically interpreted or processed by another system because the message formats are unique to the originating system. For example, a message produced on ALANET cannot be automatically received and processed by a library using OCLC or DOCLINE and vice versa. Nor can a unformatted message be processed by a library which requires that the ILL request be structured according to the requirements of its own system. Without universally recognized message formats the automated processing of received as well as transmitted requests is not possible.

The automated processing of ILL messages is also hindered if there is no agreement on a pre-defined set of messages pertaining to all aspects of interlibrary loan. While it may be relatively simple for libraries to agree on a format for the ILL request, there are several other messages that are also exchanged within the ILL process, e.g. shipped, received, returned, renewal requests, overdue notices, recalls, etc., which also require agreement. These various barriers to ILL communications in the present ILL environment are illustrated in Figure 1.

Unless a full repertoire of ILL messages and their formats are defined, full automation of the ILL messaging process cannot be achieved. The solution to the problem of multiple ILL messages and formats is to be found in the interlibrary loan protocol.

## The ILL Protocol

The ILL protocol defines a standard for computer communications which permits the exchange of ILL messages between bibliographic institutions that use dissimilar computers, systems and communication services. ILL systems that incorporate the ILL protocol can communicate with each other in a standard messaging format even when their ILL systems operate on different computer configurations. As the only common feature of these systems is the protocol module, libraries do not have to sacrifice local processing and operational requirements in order to exchange information.

The ILL protocol is based on the Open Systems Interconnection (OSI) Reference Model.<sup>1</sup> Standards developed using this conceptual framework make it possible for computers and networks to interwork in a multivendor environment. The ILL protocol is one of several standards being developed to enable effective communications among heterogeneous computers and systems used for library applications.

The development of the ILL protocol was initiated by the National Library of Canada in 1983 as part of a national networking initiative to facilitate resource sharing.<sup>2</sup> In developing its networking strategy, the National Library chose OSI as the basis of the technical infrastructure required for resource sharing. OSI would permit participants to share resources and exchange information while maintaining local autonomy and respecting local requirements.

Initial networking activities focused on the research and development of protocols to support a number of library services. The National Library worked closely with libraries and technical experts in OSI to define protocols for activities such as interlibrary loan, acquisitions, file transfer, information retrieval and directories. These OSI networking activities at the National Library paralleled those of the Linked Systems Project (LSP) in the U.S. where the principles of OSI were applied to the development of protocols for bibliographic record exchange and information retrieval.

Several drafts of the Canadian ILL protocol were prepared between 1983 and 1985 and in 1986 the protocol became the subject of review by the International Organization for Standardization. By undergoing a lengthy and laborious process of consultation, testing and review at both the national and international levels, the protocol has evolved to meet the needs of a wide range of libraries.

The ILL protocol formally standardizes four aspects of ILL communications:

1. **The number and type of messages to be exchanged in an ILL transaction.** In addition to the ILL request, the protocol identifies and defines a set of subsequent ILL messages to include those that are most frequently exchanged such as shipped, received and returned and messages that are less frequently used such as overdue notice, recall message and lost notification.
2. **The data elements contained within these messages.** These elements are optional or mandatory, structured or unstructured. For example, the date, time, ISBN (International Standard Book Number) and ISSN (International Standard Serial Number) when supplied must be in the pattern defined for them by other ISO standards.
3. **The correct sequence for the communication of protocol messages.** The protocol formalizes the logical sequence of message exchange. For example, it ensures that in an

automated environment it will not be possible for a borrowing library to send a renewal request before the item has been received.

**4. The transfer syntax.** Because the protocol is intended for computer-to-computer communication, a transfer syntax or encoding scheme is specified so that various parts of the ILL message can be identified by the receiving library's computer.

By using the ILL protocol a library can record in a consistent and structured manner the various stages of an ILL transaction, for example, recording the fact that an item has been requested, received and then returned. The protocol does not introduce new processes but merely formalizes activities that were previously handled by manual means such as check marks, codes and multi-part paper forms.

### **Network Interconnection**

Although the ILL protocol standardizes messaging for ILL, it does not address the problem of how a library which subscribes to one telecommunications network can send a message to a library which uses another network. The solution is to be found in other OSI-based standards which present two viable options for ILL intersystem communication - - connection-oriented mode and store-and-forward mode.

In connection-mode communication there is direct communication between two peer ILL systems, that is, both systems are engaged in a connection to each other to exchange data. Connection-mode implies the implementation of software supporting all seven layers of OSI functionality within each communicating system.

One advantage of using connection-oriented communications is the low probability of lost or out-of-sequence messages. The major disadvantage is the requirement that interactions be carried out in real time so that the recipient system is available at all times to receive incoming calls. This may be costly or operationally difficult for some libraries to support.

In the store-and-forward mode of communication, the ILL message is stored by an electronic mailbox service until the recipient is ready to receive it. This type of communication is commonly referred to as electronic mail. The OSI-based standard for store-and-forward message handling systems, X.400<sup>3</sup>, makes it possible to transfer messages from one electronic messaging network to another.

The principal advantage of the store-and-forward mode is the provision of a mailbox service that can store messages until the recipient is ready to receive them. This frees the recipient from the responsibility of always being available for message reception. Other advantages include reduced complexity of communication support needed within the systems of the communicating institutions, lower start-up costs because of reduced hardware/software requirements and support for other library operations such as interpersonal messaging and the delivery of facsimile-encoded documents. These factors will likely make the use of store-and-forward mode attractive to small- and medium-sized libraries. The drawbacks to using this mode of communication include the greater risk of messages being lost or received out of sequence.

Thus, two modes of communication are available to facilitate connectivity. However, partners in an ILL transaction must use the same mode of communication in order to achieve interoperability. The preferred mode seems to be based to date on the unique

experience and development patterns of different geographical areas. In Canada, for example, store-and-forward services are favoured as a result of heavy library use of public electronic mail services. A few groups in the United States, on the other hand, favour connection-mode because of the pervasive use of large bibliographic utilities such as OCLC which offer centralized management of ILL messaging and transaction recording.

Where ILL partners have dissimilar communication modes, gateways will be necessary to interface between those modes, or both modes of communication will have to be supported. These options will have to be considered by those institutions, particularly national ILL centers, that communicate regularly with libraries in other countries or regions where a different communication mode has been chosen for ILL messaging.

While OSI standards are likely to be used to convey ILL messages, it should be noted that ILL protocol messages can also be transmitted over telecommunication networks based on other standards such as TCP/IP. This assumes that the partners in an ILL transaction have access to the same network.

### **How the ILL Protocol Works**

The activities supported by the ILL protocol are represented in the protocol as services. These services formally embody actions that normally transpire in ILL operations to indicate the progress of the transaction. For example, the protocol services provided for the requesting library include: request to borrow (ILL-REQUEST), indications of receipt and return of the borrowed item (RECEIVED, RETURNED), request for renewal (RENEW), notification that the item is lost (LOST), cancellation of the request (CANCEL), etc. These activities, as reflected by the protocol services, are recorded in the local ILL system instead of indicated by some manual process. Each step relating to an ILL request is thus stored in a computerized database.

A service entered into the ILL system need not always cause a corresponding message to be sent. For example, when the lending library ships an item in response to an ILL-REQUEST, it invokes the SHIPPED service. This means that an action is taken at the lending library to ensure that its system is aware that the item has been shipped. In addition, the SHIPPED service may also result in a SHIPPED protocol message being sent to the borrowing library, but this is optional. Messages are also optional for the RETURNED, RECEIVED and CHECKED-IN services.

The provision of these optional messages is dependent on the capabilities of the local and remote systems and the requesting library's and borrowing library's need to receive the messages to meet operational requirements. Messages, of course, would be mandatory for services such as renewal requests, overdue notices, recalls, etc.

An ILL request and all subsequent activities relating to it constitute an ILL transaction. Within a transaction each processing stage is identified by a transaction state. 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 lending library the state of the transaction for that library is IN-PROCESS. The transition between one state and the next within a transaction is controlled by a state machine which embodies all the rules governing the sequence of services and messages permissible for a transaction. It provides a means of controlling the ILL transaction in terms of constraining allowable actions,

exchanging information, tracking a borrowed item and synchronizing the activity of the two or more sites involved in the ILL transaction.

Figure 2 illustrates how the protocol is used to request the loan of an item which is returnable. Each ILL action is identified, and the resulting state of the transaction for each library is shown in parentheses. A solid line between the ILL systems indicates messages which must be sent; the dotted line indicates messages which can be optionally provided.

The requesting library begins an ILL transaction by sending an ILL-REQUEST message to a potential lender. If the item is available and is supplied, the lending library indicates in its system that the item has been shipped. It may optionally send a SHIPPED message to the requesting library. When the item is received, the requesting library records the receipt of the item in its ILL system and a corresponding RECEIVED message may be sent to the lending library. When the item is no longer required, the requesting library returns it to the lender, records the information in its system and optionally sends a RETURNED message. Once the item is received back from loan, the lending library records that the item has been checked back into the library and optionally sends a CHECKED-IN message to the requesting library. The transaction has now been completed.

If the supplied item is one which does not have to be returned, e.g. a photocopy, the transaction is completed when the lender ships the item and when the borrower receives it.

Upon receipt of an ILL-REQUEST, the lending library may also respond with an ILL-ANSWER message containing one of the following values: Will-supply, Unfilled, Conditional, Estimate, Hold-placed, Locations-provided and Retry. The value Will-supply is not required but may be used when a delay is expected before the SHIPPED service is invoked. The value Unfilled terminates the transaction. Conditional states a condition that must be agreed to by the borrowing library before the request can be processed. The borrowing library must respond with a CONDITIONAL-REPLY answering YES or NO to the conditions. An ILL-ANSWER with the value Estimate states the cost of providing the requested service and the value Hold-placed indicates that the item will be supplied as soon as it becomes available. Locations-provided is a list of libraries which hold the requested item and Retry informs the borrowing library that the held item is not available and that the ILL-REQUEST may be resubmitted at a later date.

Other services supported by the ILL protocol include: CANCEL, CANCEL-REPLY, FORWARD-NOTIFICATION, OVERDUE, RENEW, RENEW-ANSWER, RECALL, LOST, DAMAGED, STATUS-QUERY, STATUS-OR-ERROR-REPORT and EXPIRED.

Another feature of the ILL protocol is that it allows a requesting library to indicate that its request may be forwarded from one institution to another if the first library that receives the request is unable to fill it. For each instance of forwarding the original requesting library receives a FORWARD-NOTIFICATION message. The protocol also supports the role of an intermediary institution, such as a regional library, that will try a sequence of potential suppliers until a lender is found. The requesting library can even specify a preferred list of libraries which should be tried and can provide a list of libraries which have already been approached. The extensive capabilities and options within the protocol make it possible for almost any library or ILL service provider to map the ILL protocol to its services.

## **Standardization**

To achieve standard status, a protocol must be reviewed and approved by national and international standards bodies. In February 1988, the ILL protocol was approved by the Canadian Standards Association (CSA) as a national preliminary standard.<sup>4</sup> Before it became a Canadian preliminary standard the draft protocol was submitted in 1986 to the International Organization for Standardization (ISO) for processing as an international standard.

The ISO group responsible for the ILL protocol is ISO Technical Committee 46, Subcommittee 4, Working Group 4 (TC46/SC4/WG4) which has overall responsibility for standards relating to the format and structure of bibliographic information interchanged in machine-readable format. The international standardization of a protocol is a multi-phased, highly formalized and lengthy process requiring consensus from a wide range of organizations representing numerous national standards bodies and interest groups.

In January 1990 the ILL protocol achieved Draft International Standard (DIS) status within ISO.<sup>5</sup> This is the last voting stage within the international review process before the protocol becomes an International Standard (IS). It is anticipated that the protocol will achieve IS status in 1991.

As a result of international review and consensus, additions and enhancements have been introduced in the ILL protocol to meet numerous national lending requirements and service environments. Over the past four years the Canadian ILL protocol has evolved to one which is very flexible, rich in features and internationally applicable. For example, enhancements providing more options for the movement of requests from one institution to the next were added as were additional data elements for describing requester requirements and lender responses.

At this advanced stage in the standardization process few technical changes are expected to be made before the protocol achieves international standard status. Once it becomes an international standard the protocol will be adopted by CSA as a Canadian national standard. Within the U.S., the National Information Standards Organization (NISO) has contributed to the development of the ILL protocol and will support the ISO ILL standard within the U.S.

## **Benefits**

The benefits of using the ILL protocol will become increasingly apparent as more and more ILL systems incorporating it are used. The fundamental benefit of an OSI-based ILL service is the ability of ILL systems to communicate with each other regardless of the design of the ILL software, the hardware used to run the system or the communication services selected to transmit the ILL protocol messages. In defining a standard for communication, the protocol imposes no requirements on the design of the local ILL system other than the incorporation of the protocol. Through use of protocol-based systems libraries will be able to interact more effectively while maintaining their own autonomy and preference in system design.

The second benefit, but equally important, is that the standardized structure and content of the protocol provides the foundation upon which to build a variety of ILL systems, all of

which are compatible. Systems can now be developed which automate not only borrowing activities but also lending activities.

The third benefit is the improvement in transaction control achieved through the use of the protocol. The standard sequence of messages and the protocol states assigned to each step in transaction processing result in improved tracking of ILL transactions and of borrowed material. By checking the local or remote system, a library can determine the status of a transaction in which it is a partner. In addition, as all messages, irrespective of source, have the same data fields it is possible to automatically sort and retrieve messages and manipulate data for statistics on traffic, service provision and other management concerns.

Apart from these fundamental benefits associated with the use of the ILL protocol, there are the practical advantages of automating ILL, such as the off-line preparation and storage of protocol messages and the elimination of time consuming clerical activities including manual filing, searching, sorting and counting. The ability to centralize all ILL message communicating and processing functions within a single system, such as an ILL workstation, will reduce the time and expense required to train library staff who will no longer have to cope with different terminals for different systems. The use of a single workstation will also result in more efficient use of space and more effective workflow.

The advantages of using the ILL protocol are further enhanced when the protocol is used in conjunction with protocols which address other aspects of ILL operations apart from transaction control and messaging. For example, an information retrieval protocol such as ANSI Z39.50 or the ISO Search and Retrieval (SR) protocol<sup>6</sup> standardize the procedures for searching bibliographic databases and retrieving required records. When implemented as part of an ILL workstation, a requesting or lending library can use Z39.50 or SR to search a designated number of databases, retrieve bibliographic citation or location information and incorporate the information in ILL messages such as ILL-REQUEST and ILL-ANSWER.

The ILL protocol thus becomes a powerful tool for resource sharing. By providing the technical infrastructure to support interlending, these protocols can be used as a backbone for the development of resource sharing strategies at the local, regional and national levels.

### **Protocol Support Activities**

The development of the ILL protocol is not the only initiative that must be pursued in order to foster an open systems environment for ILL communications. A variety of programs must be put in place to facilitate and coordinate the use of the protocol. These range from technical activities such as conformance testing to planning activities such as identifying resource sharing partners. These parallel support activities, which the National Library of Canada has been actively engaged in, are described below.

### *Protocol Implementation*

The existence of the ILL standard is of little benefit unless there are products incorporating it available. The more wide-spread the use of those products the greater are the benefits to using that standard. Libraries, however, are hesitant to spend scarce resources on unfamiliar technology and software developers are equally hesitant to develop products for an uncertain market. To encourage the implementation of the ILL protocol, the National Library in 1987 launched the ILL Protocol Implementation Program. The purpose of this program is to encourage software developers and the bibliographic community to adopt the protocol and incorporate it into ILL systems. The program is also intended to acquire essential information on protocol implementation, conformance testing and related issues based on initial implementations of the protocol.

To meet these requirements, The National Library used the competitive process to contract with a number of commercial firms and one library to produce a series of reports based on various stages of ILL protocol systems development and testing. In the course of preparing these reports, the contractors will be producing a variety of protocol-based ILL systems. Systems development was delayed when the National Library, in conjunction with the contractors, decided that it would be more expedient to implement the ISO version of the protocol rather than the interim Canadian version. Products based on the ISO ILL protocol will be commercially available in the first half of 1991.

The installation and use of these systems in libraries will significantly contribute to realizing the benefits of protocol-based messaging and improving access to library resources. However, Canadian efforts to ensure the availability of products are primarily limited to the Canadian library environment. Other countries or national groups will have to determine the appropriate strategies for encouraging the implementation of the ILL protocol within their own countries.

The National Library has already developed an ILL system which conforms to the CSA version of the ILL protocol. This system has been in operation since April 1987 and is designed to meet the unique requirements of the National Library as a major lending institution. This system is now being upgraded to conform to the ISO protocol and will be operational in 1991.

### *Protocol Testing*

Testing programs are an essential component to the successful promotion and adoption of a standard. Potential purchasers require assurances that products based on a standard can communicate with similar protocol-based systems. Each ILL system developed in Canada will be tested for conformance to the ILL protocol and its ability to interwork with other ILL protocol-based systems before it is released into the marketplace.

Conformance testing in this context is the systematic test of a product's conformance to a particular OSI protocol and is essential in order to increase the probability that different implementations of the same protocol are able to interwork. In conformance testing a collection of test message exchanges known as a test suite is used with a conformance test system to evaluate how accurately an implementation of a protocol meets the requirements of that protocol.

The National Library of Canada is developing a test suite for the ILL protocol which will be submitted to ISO for standardization. The test suite and an ILL test system developed by the National Library will be used to test the implementations of the ISO ILL protocol being developed by the contractors in the ILL Protocol Implementation Program. The National Library will make its test tools and testing software available to the international bibliographic community to aid other institutions in developing their own ILL testing service.

Conformance testing, no matter how rigorous, does not provide fail-safe assurance that a given protocol implementation will interwork with other implementations. Another type of testing - interoperability testing - determines the ability of implementations to interwork in an operational environment. Interoperability testing for ILL will involve a set of tests executed between two or more implementations of the ILL protocol, rather than with a conformance tester, to ensure that real systems interoperability is possible.

### *Bridging Mechanisms*

As with the introduction of any new standard or technology, it will be several years before the protocol is widely used and the critical mass of user libraries established to create a standardized protocol messaging environment. In a transition period of five to ten years, a variety of technologies, including terminals, computers and protocol-based ILL systems, will be used to communicate ILL messages. A number of options derived from the protocol are available that will enable communication between libraries.

To facilitate communication between libraries having only terminals and libraries that are protocol sites, the National Library has developed a set of standard electronic mail messages which conform to the ILL protocol message formats. These messages can be created by working interactively with scripts (prompting routines) on ENVOY 100, a Canadian public electronic mail system. Because the messages created using the scripts are protocol conformant, they can be received by protocol-based systems with only minor additional processing.<sup>7</sup> However, the control and recording of the transaction states and the tracking of the requested item must still have to be handled manually.

In some cases, it may be possible to modify existing ILL software to support the local preparation of protocol formatted messages thereby eliminating the need to work interactively with a communications network to provide the correct message formats. This modification of existing ILL software would provide the same functionality as the electronic script mechanism without assuming the overhead cost of using a telecommunication network's value-added services. It should be noted that local message preparation by an ILL system does not provide the same capabilities as a protocol-based ILL system. The latter has the advantage of a state machine which, as described earlier, provides a means of controlling in an automated environment all the steps involved in an ILL transaction, from request processing to item tracking.

However, script-based messaging and local message preparation permits the co-existence and limited interworking among protocol and non-protocol based systems and illustrates two means of accommodating a range of technical sophistication.

When communicating among themselves, protocol-based systems will produce machine readable messages. However, when a protocol site wishes to communicate with a non-protocol site the message should be in a format which the staff can interpret. The ILL systems being developed by the contractors in the ILL Protocol Implementation Program will generate not only protocol formatted messages but also eye-readable messages which can easily be processed by the receiver at a non-protocol site. Similarly, during this period of transition where existing ILL systems use proprietary message formats, protocol-based systems may have to emulate several other formats in order to communicate with target libraries.

### *Planning for Resource Sharing*

Ideally, the adoption and use of the ILL protocol should not be viewed in isolation but should be considered as part of an integrated resource sharing strategy which supports the interlending requirements of libraries at the local, regional and national levels. The ILL protocol, as well as other standards such as Z39.50 and X.400, offer enhanced networking support which can provide the technical backbone for cooperative and rationalized library resource sharing.

A recent summary report by the National Library of Canada proposes a plan that sets the stage for cooperative resource sharing in Canada.<sup>8</sup> The program will promote national self-sufficiencies and will facilitate the optimal use of local and regional resources. In doing so it will respect existing service traditions; identify the roles for participants at the local, regional and national levels to meet the information needs of patrons; and exploit evolving technologies to provide the technical framework for service provision.

For ILL, this program will allow requests to be passed automatically through a hierarchy of institutions until the patron's information needs are met. The many optional features within the ILL protocol will provide the technical vehicle to support identified service requirements at each level in the hierarchy. The consultation required to reach agreement on services to be supported and protocol options to implemented constitute a major activity in the planning process for cooperative resource sharing.

Similar planning should be undertaken by organizations responsible for library service development to ensure that resource sharing is achieved through coordination and cooperation at all levels of service delivery and the optimum use of standards.

### **International ILL Protocol Activities**

The ILL protocol has generated considerable support and interest in North America and Europe and is currently the subject of a number of projects.

Within IFLA, the International Federation of Library Associations and Institutions, the Universal Dataflow and Telecommunications (UDT) Core Programme, completed in May 1989 a study which indicated that a joint pilot project between the National Library of Canada and the British Library Document Supply Centre (BLDSC) was feasible.<sup>9</sup> The project would examine the use of the ILL protocol for the international exchange of ILL messages. The Library of Congress has now joined the National Library and the British Library in the planning phase of an ILL demonstration project involving the three organizations.

A similar international ILL project is being funded by the Commission of the European Communities (CEC) and is intended to provide experience with the ISO ILL protocol and an information retrieval protocol. The project will involve libraries in Great Britain, the Netherlands and France.<sup>10</sup>

This growing international interest in the ILL protocol and the need to examine implementation issues pertinent to its use in an international context resulted in the creation of the International Forum on Open Bibliographic Systems (IFOBS).<sup>11</sup> The group, composed of bibliographic institutions from Canada, the U.S., Great Britain and Europe, are examining a number of issues relating to the use of protocols for international bibliographic communication.<sup>12</sup>

One of these issues is the development of an international standardized profile (ISP) for the ILL protocol. An ISP is a combination of one or more functional profiles which have been harmonized internationally and approved by ISO. A functional profile specifies which options and values within a protocol used for a specific application are to be implemented. When implementations are built to the same profile they are more likely to interwork than if software developers made independent decisions on what protocol features to implement.

### **Conclusion**

The original impetus for the development of an ILL protocol has been reinforced by the proliferation of ILL system producing non-standard message sets and formats. The development of an open communications environment for ILL requires action on a number of fronts, from the development of a messaging protocol to the provision of testing services.

Activities that libraries can undertake immediately include promoting OSI for libraries and working with software developers to produce ILL protocol-based systems. Rather than passively waiting for software developers to come up with products which may or may not meet their specific needs, libraries can take the initiative by defining their own system

requirements. By discussing with software developers the ILL communication barriers caused by multiple message sets and formats and by encouraging them to implement the international ILL messaging standard, librarians will be able to forge a partnership with the commercial sector to ensure the development of ILL systems that meet their ILL operational needs.

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