# EUROPAGATE

European SR-Z39.50 Gateway

# Background Study

## Part III

## Current Developments and Future Trends

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# Preface

The EUROPAGATE Background Study is primarily aimed at providing the necessary background information for the EUROPAGATE project participants. However, as it might be of interest to others studying or implementing the ISO SR or Z39.50 standards, it is made publicly available.

The study is divided into three parts:

I. Current Implementations of Z39.50 and ISO SR
II. Z39.50 and ISO SR Servers in Operation
III. Current Developments and Future Trends

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# 1 Introduction

This part of the EUROPAGATE Background Study focuses on the work currently in progress which may affect the project and its results, and also serves to set out the context in which the work of the project must be understood. It begins with a summary of relevant issues in the broader networking environment and the developments in OSI and TCP/IP (Section 2). The ongoing work on SR and Z39.50 is presented in Sections 3 and 4. The important issue of profiles, which determine interoperability, is discussed in Section 5. Section 6 considers the integration of the search and retrieve functions with document delivery, in particular the interaction with Inter-Library Loan developments. There is considerable interest in, and potential for, the use of search and retrieve functionality in non-bibliographic contexts; this is considered in Section 7. Finally, Section 8 examines existing work in the area of gatewaying and interoperation with other systems.

# 2 The Networking Environment

The future of library automation will be greatly influenced by the continuing growth of networking. The purpose of this section is to outline the main trends in the networking environment which will influence the development and implementation of distributed search and retrieve facilities, inter-library lending, electronic document delivery, etc.

The growth of networks will continue into the foreseeable future, with increasing numbers of users around the world having access to global data networks. The type of access will also change with a move from low-speed access (typified by dial-up modem links) to broadband systems suited to multimedia applications (e.g. ATM as part of the broadband ISDN). Improved services and entirely new types of service will be available through these networks. Increased use of electronic communications and multimedia technology will mean that new types of document will have to be handled by libraries.

Research networks are likely to be leaders in the introduction and exploitation of new technologies, and this is especially true in the case of library systems as researchers are a major element of the user base. In the next two sections we review the developments in TCP/IP networking and OSI, which are of particular importance for research networks. The TCP/IP protocols (more precisely, the Internet suite of protocols) have come to dominate the research networks for a number of reasons, mainly their ready availability and simplicity compared to the internationally standardised OSI protocols. The take-up of OSI has been slow and limited. However, it is clear that the OSI protocols offer a number of advantages in key areas and interest in their use continues. It appears that the most likely future course is not the replacement of one suite with the other, but rather a coexistence of the two with an interchange of concepts. A detailed comparison of the Internet protocols and the OSI protocols at several levels may be found in (NIST, 1994).

An important element in the future development of networks will be the availability of directories and other tools for resource location. There have already been a number of pilot services for X.500 directories. As library databases accessible to a broad user community proliferate it will become essential to provide a directory infrastructure to allow users to locate them. This is an area which at present is severely underdeveloped.

## 2.1 OSI developments

The main problems with the OSI protocols have been due to their complexity. They have been judged to incur too heavy an overhead for acceptable performance of applications if the whole of the OSI functionality is supported. The fact that Z39.50 is defined as an OSI protocol, but used directly over TCP, is a good example of the effect of unacceptable impact on performance and the additional implementation complexity. On the other hand, OSI offers great advantages in terms of modularity and comprehensiveness and addresses areas which the Internet suite neglects. This is

particularly the case for the upper layers, where OSI protocols provide a structure entirely lacking in the Internet suite and offer solutions for problems only now being encountered by the Internet. For example, the Internet suite lacks any equivalent of ACSE, and as a result each application must incorporate a mechanism for the creation and destruction of associations. That this is recognised as a problem can be seen from the increasing use of OSI technologies on the Internet, e.g. ASN.1 in the specification of new protocols and X.500 to provide directory services.

In order to take advantage of the good elements of OSI while exploiting the strengths of the Internet suite, an effort is underway in the IETF to define a series of profiles for specific applications (or types of application with similar needs) to allow them to use OSI upper layer functionality, but only to the extent required, thus avoiding unnecessary overheads. This approach is based on the fact that only a limited part of the OSI functionality is required to support most applications, and the protocol elements required can be expressed more simply. These efforts have been termed "ThinOSI". The objective is to specify the necessary OSI protocol elements for application protocols (either Internet or OSI). An application built in this way would be able to interoperate with a full OSI implementation because it will never invoke functionality outside the restricted specification. A number of documents have been produced, including specifications for minimal implementations of protocols such as the Directory Access Protocol of X.500. These are now Internet Drafts and are intended to become standards. There are also efforts to implement these specifications. The following are identified in (Jørgensen, 1994):

- TOSI — Florida Center for Library Automation. It is designed to support applications requiring basic communication with multiple presentation contexts. There is work to implement Z39.50 over this stack.

- LiteOSI — the ISODE interface (see below) over the TOSI stack.

- XTI/mOSI — Hewlett-Packard. An implementation of the X/Open API over a ThinOSI stack.

The ThinOSI developments are potentially very important to library automation, because they offer the possibility of developing lightweight clients for protocols such as Z39.50 and ISO SR which can interoperate with servers based on full OSI stacks. This would allow greater numbers of users to have clients based on personal computers with access through public networks (e.g. X.25) without requiring them to obtain either full Internet access or a system supporting a full OSI stack.

The most widely used implementation of the OSI protocols to date has been the ISO Development Environment (ISODE). It was originally developed at the Northrop Research and Technology Center starting in 1986, and has since been sponsored by a number of organisations as well as incorporating contributions from a substantial user community. It was made openly available, i.e. the source code was distributed free of charge and without any requirement for licensing. This non-proprietary nature resulted in ISODE being used as the basis for several OSI pilot projects and commercial

developments. As a response to the success of ISODE, the ISODE Consortium was established in early 1992 to continue development and distribution of the environment. The intention is to continue the development of ISODE with revenue obtained from membership fees and product licences. It is not yet clear what, if any, effect this will have on the use of ISODE.

ISODE is a toolkit for the development of OSI applications which is suitable for use with most versions of the UNIX operating system. It implements a large part of the OSI upper layers (session, presentation and application) and provides tools for the development of OSI applications. Of particular importance is that it supports the use of the OSI upper layers over both OSI and TCP/IP-based networks. Together with its support for UNIX, this has made it possible for it to be used over the Internet and thus be of interest to a very large user community. ISODE is the basis for implementations of other OSI systems, e.g. the PP mail system (supporting X.400), the QUIPU directory system (X.500) and the OSIMIS management system (implementing the OSI management framework).

## 2.2 TCP/IP developments

The most important development for the TCP/IP protocols is the impending exhaustion of the IP address space due to the rapid growth of the Internet. The IETF is working on a number of proposals to deal with this, including the use of the OSI Connectionless Network Protocol (CLNP). It is important to note that there will be no single point at which a switch is made to a new IP. Instead, the Internet will undergo a gradual transition to the new protocol. It is intended that the new protocol will help to overcome difficulties with routing which have also arisen because of Internet growth. The gradual replacement of IP may affect implementations of Z39.50 which are built directly on TCP/IP (the majority at present).

Another trend of relevance to library automation is the move to Internet commercialisation, with a number of organisations now providing Internet access as a service. This will increase the potential user base for libraries by making their servers accessible to a wider community. It will also give access to commercial organisations which will wish to make use of library resources.

# 3 Z39.50 Developments

The next version of Z39.50 is projected to be approved at the end of 1994 or early in 1995; the ballot period will commence in September 1994. It will be known as Z39.50-1994, and defines protocol versions 2 (as in Z39.50-1992) and 3. Z39.50-1994 is a compatible superset of Z39.50-1992. The description of the most important new features in the following section is based on the ninth draft of the standard (V3D9 January 1994). The ballot draft was made available in June and August 1994.

## 3.1 Z39.50 Version 3

Z39.50 version 3 enhancements to version 2 include five new services and four new facilities. The whole set of Facilities and Services is presented in the table below. Services and Facilities marked with an asterisk are unique (new) to version 3.

| **Facilities** | **Services** |
|---|---|
| Initialization | Init |
| Search | Search |
| Retrieval | Present |
| | **Segment*** |
| Result-set-delete | Delete |
| **Browse*** | **Scan*** |
| **Sort*** | **Sort*** |
| Access Control | Access-control |
| Accounting/Resource Control | Resource-control |
| | Trigger-resource-control |
| | Resource-report |
| **Explain*** | (search/present) |
| **Extended Services*** | **Extended-services*** |
| Termination | **Close*** |
| | IR-abort |
| | IR-release |

Z39.50 version 3 - Facilities/Services

### 3.1.1 Segment service

The Segment service pertains to the Retrieval facility of Z39.50. It is an unconfirmed service used by the target system to return fragments of records to the origin.

In the usual (version 2) retrieval procedure the origin sends a Present request and the target responds by sending a Present response, containing the requested records. In Z39.50 version 3, if segmentation is in effect and the requested records will not fit within the Present response message, the target may segment the response by sending one or more Segment requests before the Present response, which contains the last portion of the records. In that sense, the Segment request is more like a "response" to the corresponding Present request and the two services together are referred to as the "aggregate present response".

There are two levels of segmentation and they are subject to negotiation during the Initialization phase. If *level 1* segmentation is agreed upon by the communicating systems, the target response to a Present request may consist of multiple segments (Segment requests followed by a Present response), and each segment must contain an integral number of records, i.e. records may not span segments. If *level 2* segmentation is in effect, the target response to a Present request may consist of multiple segments, and records may span segments.

### 3.1.2 Sort service

The Sort service is a confirmed service that allows an origin to send a request to the target to sort a specified result set, according to a specified sort sequence. The sorted result set can have a different name in order for the original result set to remain unchanged.

### 3.1.3 Scan service

The Scan service pertains to the Browse facility of Z39.50. It is used to scan an ordered term-list (subject terms, names, titles, etc.). The ordering of the term-list is target defined. The origin specifies a term-list to scan and starting term (implicitly, by specifying an attribute/term combination and a database-id), the size of the scanning steps, and the desired number of entries and position of the starting term in the response.

### 3.1.4 Explain (service)

The Explain facility allows an origin to obtain details of the nature of the implementation of a target system, including the databases available for searching and features supported. The Explain facility does not consist of any services, but it uses the services of the Search and Retrieval facilities against a pre-defined "explain" database. This database is maintained by the target and contains information about various aspects of the target implementation, such as:

- available databases
- attribute sets
- diagnostic sets
- record syntaxes
- element specifications

This "explain" database appears to the origin as any other database supported by the target, but it has a well-known name and a pre-defined record syntax. Also, certain search terms, corresponding to information categories, are predefined in order to allow a semantic level of interoperability. Each information category has its own record layout, and all are included in the Explain syntax.

### 3.1.5 Extended Services service

A class of services recognised by version 3 of this standard, but which are not Z39.50 services, are referred to as extended services. The Extended Services (ES) service, is a Z39.50 service; an ES operation, results in the initiation of an extended services task. The task is not considered part of the Z39.50 ES operation. An ES operation is initiated by the origin, via an ES request; the ES response, which completes the operation, does not (necessarily) signal completion of the task (it may indicate for example whether the task has started or has been queued). An ES task may have a lifetime beyond the Z-association.

The extended services defined in this standard are:

- Save a result set for later use
- Save a Query for later use
- Define a periodic search schedule
- Order a document
- Create an export specification
- Invoke a previously created export specification
- Send a usage accounting report

For each extended service an abstract data structure is defined. Each ES task is represented by a database record, called a task package, maintained in a special database by the target. This "extended services database" may be searched, and records retrieved, by the Z39.50 Search and Retrieve facilities. The origin may search for packages of a particular type, or created by a particular user, or of a particular status (i.e. pending, active, or complete), or according to various other criteria. In particular, the origin may search the database for a resulting task package after submitting an ES request (during the same of a subsequent Z-association), to determine status information pertaining to the task, for example, to determine if the task has started.

The origin, via an ES request, may *create*, *delete*, or *modify* a task package. When it creates a task package, it specifies a user-id, to be associated with the package, as well as permissions for other user-ids. Permissions include *create*, *delete*, and *modify*, as well as *present*, and *invoke*. For example, when a user creates a task package of type SaveResultSet a (persistent) result set is created, represented by the created task package. When that package is "presented" (either in the same or a subsequent Z-association), a copy of that persistent result set is made available to that Z-association as a Z39.50 result set (a result set name, for use during the Z-association, is included within the task package). When a user deleted the task package, the persistent result set is deleted.

### 3.1.6 Close service

The Close service is a confirmed service initiated by the origin or target, and it pertains to the Z39.50 Termination facility. It allows an origin or target to abruptly terminate all active operations and to initiate termination of the Z-association. Following termination of the Z-Association the origin may subsequently attempt to initialize another Z-Association within the same A-Association, using the Init service.

### 3.1.7 Concurrent operations

Z39.50 version 3 introduces the concept of *operations* to identify a class of services that cannot be interrupted by any other service in that class, when the serial operations mode (i.e. one operation at a time) is in effect. For example, the origin cannot request a Search or a Delete service while a previous Search request is being processed by the target. On the other hand, if *concurrent operations* is in effect, the origin can request an operation even if there is already one in progress.

There are eight different operations types described within the standard:

1. Init
2. Search
3. Present
4. Delete
5. Scan
6. Sort
7. Resource-report
8. Extended-services

A request from the origin of a particular operation type initiates an operation of that type (for example a Search request initiates a Search operation) which is terminated by the respective response from the target. Only the origin may initiate an operation, and not all origin requests initiate an operation. More precisely, each origin request type corresponds to an operation type with the exception of the following request types: Trigger-resource-control and Close.

A request that initiates an operation is called an *initiating request* and a response that terminates an operation is called a *terminating response*. An operation consists of the initiating request and the terminating response, along with any intervening Access-control and Resource-control requests and responses, Trigger-resource-control requests, and Segment requests.

An operation is assigned a Reference-id by the origin. The origin includes the Reference-id within the initiating request, and this id must be included within each subsequent message related to that operation, so that both origin and target can distinguish between different operations.

## 3.2 Z39.50 Take-up

In general, those involved (or at least interested) in the development and implementation of the Z39.50 protocol can be (arbitrarily) divided in three categories:

1. Companies (manufacturers, vendors, information providers) which are already in the library and/or database business, offering their own proprietary solutions to library catalogues and search systems. Use of a Z39.50 interface (or a gateway) to their search engines will allow their servers to communicate with an increasing number of clients, thus offering the possibility to expand their consumer base.

2. Companies (and other organisations) implementing Z39.50 client software for the end-user. A major consideration for an application of this type is to have a user-friendly interface. Therefore, origin software is usually built on various graphical platforms, including the X Window system, Microsoft Windows, Apple Macintosh, etc. However, there is still a large number of clients running under UNIX and MS-DOS.

3. Universities (and other organisations), which closely cooperate in order to extend, develop and promote the protocol. They incorporate and test new features, implement and release APIs for client and servers to the public domain, design gateways to other search and retrieve protocols (e.g. WWW). They also offer consultation and advice on implementing Z39.50.

An implementor usually belongs to more than one of the above categories. The first two categories focus on commercial implementations of the standard. According to the Z39.50 Register of Implementors, most of them reside in the United States and Canada, while there are a few in the UK, France, Denmark and Switzerland. The IRIS project in Ireland is a notable implementation and is described in Part II of this Background Study.

Most target systems (constructed by implementors in the first category), support Z39.50 version 2 (as well as version 1). Not all services of version 2 are usually supported, although Search and Present services are present in all cases. There is also a preference for Access and Accounting/Resource control services, so that target implementations can be economically justified. Additionally, database providers are interested in offering access to features specific to their products through the use of Z39.50 services. The most popular Z39.50 version 3 services are Explain, Scan, Sort and Extended-services.

Most of the commercial client software supports Z39.50 version 2 in full (i.e. all seven facilities). Although development of Z39.50 version 3 is still in progress, many implementors are trying to follow the developments by incorporating and testing the new features on their clients.

The wide acceptance of Z39.50 compared to ISO-SR is due to a number of reasons:

The first version of Z39.50 was developed between 1983-87 and approved by ANSI in 1988. The development of the ISO Search and Retrieve protocol took a parallel path,

having various drafts published between 1984 and 1991 when it was finally approved. Although ISO-SR was better, Z39.50 was in place three years earlier, thus offering the only possible solution available at that time. For example, version 1 of Z39.50 has successfully been used as the basis of WAIS (Wide Area Information Service) on the Internet with several hundred servers in operation. WAIS development began in October 1989 with the first Internet release occurring in April 1991. When the ISO standard finally came into view in 1991, implementors (who were already using Z39.50) were waiting for the forthcoming second version of Z39.50 (1992) which was expected to offer full compatibility to SR, plus some very useful facilities required by most information providers (i.e. Access and Accounting/Resource control).

Although Z39.50 is an application layer protocol within the OSI reference model, many institutions implementing Z39.50 chose to layer the protocol directly over TCP/IP rather than to implement it in an OSI environment or to use the existing techniques that provide full OSI services at and above the OSI Transport layer on top of TCP connections (e.g. as implemented in ISODE). The complexity introduced by the OSI upper layers, combined with the lack of availability of mature OSI software for the full range of computing environments in use, constrained considerably the development of SR software. On the other hand, the simplicity and stability of TCP/IP applications, together with the ever increasing number of hosts comprising the Internet, promoted the widespread use of Z39.50.

# 4 SR Developments

## 4.1 Amendments

Within ISO there has been ongoing development of the SR standard. The amendments are prepared by the working group TC46/SC4/WG4. These tend to be closely related to the services in Z39.50 version 2 which are not present in the first version of SR, as well as services proposed for Z39.50 version 3. The amendments for the new services and the associated documents, with their status at the time of writing, are shown below.

| *Amendment* | *Service* | *Documents* | *Status* |
|---|---|---|---|
| 1 | Scan | ISO 10162 DAM1,<br>ISO 10163 DAM1 | DIS ballot completed May 1994 |
| 2 | Suspend/Resume | ISO 10162 DAM2,<br>ISO 10163 DAM2 | DIS ballot to be completed |
| 3 | Multiple Concurrent Operations | ISO 10162 DAM2,<br>ISO 10163 DAM2 | DIS ballot to be completed |
| 4 | Access Control and Resource Control | ISO 10162 DAM2,<br>ISO 10163 DAM2 | DIS ballot to be completed |
| 5 | Proximity Searches | ISO 10162 pDAM t5,<br>ISO 10163 pDAM t5 | Ready for DIS ballot |
| 6 | Segmentation | ISO 10162 pDAM t6,<br>ISO 10163 pDAM t6 | Ready for DIS ballot |
| 7 | Sort | ISO 10162 pDAM t7,<br>ISO 10163 pDAM t7 | Ready for DIS ballot |

In addition to the documents above, an SR PICS Pro forma (ISO DIS 10163-2) was balloted ending in May 1994.

The future progression of these amendments depends on the result of the recommendation to replace the existing SR standard with Z39.50 Version 3 (see 4.2.1.1 below).

### 4.1.1 Scan

The Scan service is used to scan or browse an ordered term-list/index (subject terms, names, titles, etc.). The origin specifies an index to scan and starting term (implicitly, by specifying an attribute/term combination and a database-id), the size of the scanning steps, and the desired number of entries and position of the starting term in the response.

Scan is also proposed for version 3 of Z39.50.

### 4.1.2 Suspend/Resume

With Suspend/Resume services an origin and a target can suspend their operations and release the network association. Each peer entity maintains all state information relating to the suspended association. During initialisation, the peer entities negotiate a minimum time (time-out) that the target should maintain state information about suspended associations. A Resume request from the origin prior to the time-out should succeed.

Suspend/Resume is proposed as an Extended Service for Z39.50 version 3.

### 4.1.3 Multiple Concurrent Operations

The purpose of multiple concurrent operations is to allow the execution of more than one operation (e.g. Search, Present etc.) concurrently in a single association. During initialisation, the peer entities negotiate the maximum number of concurrent operations allowed.

Multiple Concurrent Operations is proposed for version 3 of Z39.50.

### 4.1.4 Access Control and Resource Control

The Access Control service allows a target to challenge an origin during execution of a request, e.g. an Initialise request. The Access-control mechanism can be used to support password challenges, public key cryptosystems etc.

The Resource-control service permits the target to send a Resource-report, notifying the origin when either actual or predicted resource consumption will exceed agreed limits. In addition, the target can inform the origin about the current status of a result set which is being generated.

Access Control and Resource Control are both in version 2 of Z39.50.

### 4.1.5 Proximity searches

The Proximity search amendment is an addition to the RPN query language defined in the protocol. The addition consists of the operator “Prox”. With proximity it is possible to search on the distance between the two operands. The proximity operator has a Distance, a Relation and a Unit value. An example: *find all records where cat is within 5 words of hat*. *Cat* and *hat* are operands, the distance is *5*, the relation is *less than or equal to*, and the unit is *words*.

### 4.1.6 Segmentation

Segmentation is proposed as a new service. The purpose of segmentation is to handle large data units. If the records requested by a Present request will not fit in a single PDU the target can return multiple segments, each of which contains a portion of the records. The segmentation service has two levels. At level one, the segments contain only

complete records. At level two, the segments can also hold fragments of data records, i.e. a record may be split across several consecutive segments.

Segmentation is proposed for version 3 of Z39.50.

### 4.1.7 Sort

The sort service permits an origin to request a target to order a result set. The elements in a result set to be used for sorting, the direction of the sort (ascending or descending), case sensitivity and the action to be taken for missing elements may all be specified.

Sort is proposed for version 3 of Z39.50.

### 4.1.8 Other SR Extensions

Working Draft proposals for changes to SR was discussed at the ISO/TC46/SC4/WG4 meeting in Oslo, 9–10 March 1994. This work is at a very early stage. The services covered include Explain, Resource Limits, Update, and Extended Services.

## 4.2 Relevant Organisations

### 4.2.1 ISO TC46/SC4/WG4

Within ISO there is a working group called TC46/SC4/WG4 which prepares amendments to the ISO TC46 protocols. One of the recent outputs of the work in this working group is a model for OSI protocol developments. The model gives an overview of the whole area of work related to the TC46 protocols ISO SR and ISO ILL. It describes

- all the proposed amendments to the SR protocol,
- co-operation between SR and ILL,
- ASN.1, BER and MARC.

The “Model for OSI Protocol Development” report by Liv Holm has been published by IFLA and is available from them.

#### 4.2.1.1 Recent ISO TC46/SC4/WG4 meeting

The most recent (at the time of writing) ISO TC46/SC4/WG4 meeting was held in Oslo on 9–10 March 1994. The significant news from that meeting is that it was generally agreed by implementors in Europe and the USA that SR should in future be closely based upon the Z39.50 standard. The working group proposed that the two standards should be identical, i.e. European implementors should influence the development of the final drafts of Z39.50 and as soon as it is submitted and approved by NISO it should be submitted to the ISO fast track ballot period. This would involve changing to a single document instead of separate service and protocol standards as are used for SR at present. In general, ballots on SR amendments with DIS status will be completed but

publication of the documents will be delayed until a decision is reached on the adoption of Z39.50. Items ready for DIS ballot will be held until the outcome of the merger is determined. Comments on the SR documents will be applied to the Z39.50 standard as appropriate.

If this proposal is agreed upon, the amendments described above are overtaken by all the features of Z39.50.

### 4.2.2 IFOBS

IFOBS is the International Forum on Open Bibliographic Systems. The purpose of IFOBS is to facilitate the international use of OSI and other open protocols for bibliographic applications. According to the mandate of IFOBS, the objectives of the forum shall be accomplished by *"review and resolution of issues relating to the implementation and use of OSI and other open protocols for bibliographic applications and their associated profiles"*. The mandate and minutes from meetings are available via anonymous ftp from the host atlas.bibhs.no in the directory /ifobs.

## 4.3 SR take-up

SR development has primarily taken place in European libraries and library organisations. Two major projects have successfully implemented the SR standard, namely the Nordic SR Net project and the ION project. Both these projects are implemented on top of the ISODE tool kit. The National Library of Canada Z39.50 project has also made a TCP/IP based implementation. All the systems support Search and Present services. None of the projects implement the draft amendments as previously described.

Compared to current implementations of Z39.50, the number of SR implementations is very small. The Z39.50 projects mainly originate in the US because Z39.50 is an American standard (NISO) and therefore is the natural choice for any American project needing an information retrieval protocol. SR has mainly been implemented based on the relatively complex ISODE toolkit, whereas Z39.50 is mainly implemented on TCP/IP alone. Another reason for the limited use of SR is that TCP/IP Z39.50 applications are in principle portable to any machine with a TCP/IP implementation, whereas SR+ISODE applications are restricted to UNIX machines (unless ISODE is ported to the target machine, a non-trivial task). One of the objectives of an information retrieval must be interoperability, and TCP/IP provides the greatest world-wide interoperability at present.

# 5 Profile Developments

## 5.1 Introduction

Together ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of international standards through technical committees established to deal with particular fields of technical activity. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC1. In addition to developing international standards this committee has created a Special Group on Functional Standards (SGFS) for the elaboration of International Standardized Profiles (ISPs).

The need for profiles arises because of the desire to achieve interoperability. It is not sufficient to have systems conform to the same set of protocol standards to achieve this: they must also use compatible sets of options and parameters associated with the protocols. Many such options and parameters are deliberately not specified by the base standards in order to ensure that they will have the widest possible applicability, but appropriate values must be chosen for each application domain. A profile is a set of one or more base standards and the identification of subsets, options and parameters of those standards necessary to accomplish a particular function. An ISP document includes the specification of one or more profiles.

Feeding in to the process of international standardisation are a number of Regional Workshops (RWS) which exist to ensure that standards are developed and conformed to on a regional basis. These RWS liaise closely with each other to ensure international harmonization of any standards, profiles etc. that do emerge. In the area of open systems there are a number of RWS. In turn these organizations have established special interest groups which focus on the standardization and harmonisation of profiles for library applications.

This report focuses on the activities of four such groups:

**EWOS EG-LIB** European Workshop for Open Systems—Expert Group on Libraries

EWOS was established in 1987 to develop OSI profiles where the term profile refers to the development of International Standard Profiles.

**AOW** Asia and Oceanic Workshop

The AOW was established with a similar brief for the Asia and Oceanic region. However, at present there is no work in the field of library applications in this workshop.

**IFOBS** International Forum on Bibliographic Standards

IFOBS was established in 1988 with a mandate to develop ISPs for bibliographic OSI protocols. This group liaises closely with EWOS EG-LIB on the co-operative development and harmonization of ISPs for library applications.

**OIW SIG** Open Systems Environment Implementors Group, Special Interest Group on Library Applications

This the newest forum. It was established in 1993 to play a liaison role supporting the work of EWOS EG-LIB and IFOBS in the development of profiles.

These groups liaise closely on the development and harmonization of profiles for the use of open systems standards in library applications. Once harmonised, agreed and ratified these profiles acquire the status of International Standardized Profile.

From the point of view of this document, it is important to note that the OIW SIG LIB was only established formally in Summer 1994. There had been considerable debate over the need for a OIW special libraries group since it was believed that the profile interests of the US were fully represented by IFOBS. However, it was later decided to establish the OIW SIG LIB and in the future they will be more formally involved in profile development and harmonisation. Much of this document focuses on the liaison and harmonization between IFOBS and EWOS EG-LIB.

## 5.2 International Standardized Profiles (ISPs)

An approved ISO standard or Technical Report, or a CCITT (now ITU-T) Recommendation, is referred to as a base standard. A base standard may be inadequate for the creation of interoperable systems because:

- it needs an implementor to make choices among options and parameter values;
- a standard or protocol may be used in combination with others, e.g. SR over ACSE.

It is beyond the scope of an individual base standard to specify details of how it is to be used in combination with other standards. Certain parts of the standards are left undefined to allow the standard to meet a range of similar but not identical requirements. As a result, it is possible to construct systems which are entirely based on OSI standards but which cannot interoperate. This problem is complicated by the fact that users are

interested in a full 7-layer stack to support applications, so that a very large number of choices have to be made in a given implementation.

The solution to this has been to develop functional standards, i.e. documents which specify the preferred combinations of standards and options for the standards to be used in a particular application domain. Such a combination of standards and options is referred to as a profile.

In 1982 the Special Group on Functional Standardization was established within ISO to consider issues surrounding functional standards. The SGFS developed the concept of the International Standardized Profile (ISP) which has the status of an ISO international standard. An ISP document includes the specification of one or more profiles. An ISP is an internationally agreed, harmonised document which identifies a standard or group of standards, together with options and parameters, necessary to accomplish a function or set of functions. The intention behind the development of ISPs is to promote real system interoperability and not merely to legitimise any one choice. Profiles also form a basis for procurement specifications and conformance testing.

ISPs have a number of specific objectives:

- To have a worldwide approved set of functional standards or profiles.
- To realize worldwide interoperability based on these profiles.
- To serve as the basis for the development of internationally recognised tests and test centres.

Underpinning the development of ISPs are a number of guiding principles which require that inter-regional harmonization be carried out such that subsequent regional additional requirements are not needed. This means that all regional requirements should be taken into account during the ISP development process and be included in the ISP as options. Unique regional requirements should be written directly into the ISP text and harmonised as such if subsequent regional additions cannot be avoided for technical purposes. This means that there would be a common core set of functions (mandatory or optional) in the ISP together with clearly identified regional requirements which would not impact on world-wide interoperability.

Draft ISPs (DISPs) are circulated to national bodies for voting. Publication as an ISP requires approval of 75% of the national bodies casting a vote.

ISO published TR10000, *Framework and Taxonomy of International Standardized Profiles*, in 1990 and has since developed and published several ISPs, with many more in progress. TR10000 established a taxonomy for ISPs, i.e. a labelling system which gives a hierarchical structure for describing and naming ISPs. At the top level, ISPs are divided into six classes; each class represents a category of functionality, as follows:

F: interchange format and representation profiles

A: application profiles requiring the connection-mode transport service
B: application profiles requiring the connectionless-mode transport service
T: transport profiles that provide the connection-mode transport service
U: transport profiles that provide the connectionless-mode transport service
R: relay profiles that define relay functions between T or U profiles

Classes A and B define the use of standards for OSI layers 5–7 for the transfer of information between end systems, and it is into these classes that search and retrieve protocols fall. For applications, only class A profiles have been defined to date. Application profiles are designated with a label of the form

CDDn

where C is the class (A or B), DD is a two-letter designator for the application function category and n is a numerical identifier. Application function categories include:

FT: file transfer
MH: message handling
VT: virtual terminal
TP: transaction processing
RD: remote database access
OM: OSI management
DI: directory
LD: library and documentation

Search and retrieve application profiles are thus designated ALDn. Those developed to date, or in progress at the time of writing, are discussed in Section 5.3 below.

### 5.2.1 Common Upper Layer Requirements

Guidelines have been issued to ensure that profiles and ISPs developed for library applications adhere to broader profiles and developments in the general OSI area. Therefore profile developments in the library area which include upper layer issues should also consider developments in the status of Common Upper Layer Requirements (CULR), ISP 11188-1. If an ISP is at the draft stage (DISP) and CULR is at ISP then the profile should align on ISP 11188-1. Progression on the profile should be dictated by progression on the CULR ISP. In July 1993 Version 14 of pDISP 11188-1 was submitted to as pDISP CULR Pt. 1—Basic Connection Oriented Requirements. This document was harmonised between the three regional OSI workshops, AOW, EWOS and OIW.

Work is also continuing on :

pDISP 11188-2 CULR Pt. 2 Basic connection-oriented requirements for ROSE based profiles.

pDISP 11188-3 CULR Pt. 3 Minimal OSI upper layer facilities.

## 5.3 Taxonomy of Library and Documentation Profiles

In May 1993, EWOS EG-LIB prepared a taxonomy of profiles for library and document applications. The taxonomy identified a number of profiles for development which would be based on two standards, ISO 10163 Search and Retrieve (SR) and ISO 10161 (ILL).

**Taxonomy for Library and Document Applications**

| | |
|---|---|
| SR | ALD 1 |
| SR ACSE | ALD 11 |
| | |
| ILL | ALD 2 |
| ILL ACSE | ALD 21 |
| ILL Store-Forward | ALD 22 |

### 5.3.1 ALD 1 Search and Retrieve (SR)

The SR protocol (ISO 10163) is intended for use by systems supporting information retrieval services. It provides capabilities for a system to search a database in another open system for records and receive a result set of records in response.

### 5.3.2 ALD 11 SR using ACSE

This profile describes the use of the SR protocol directly over ACSE as defined in the CULR (ISO/DISP 11188). It covers SR between two systems using connection-oriented ACSE and Presentation service, using CULR (pDISP 11188-1). This profile specifies how the OSI session layer, presentation layer and application layer standards are used to provide the function.

### 5.3.3 ALD 2 Interlibrary Loan (ILL)

The ILL protocol (ISO 10161) is intended for use by systems supporting ILL services. These systems may act as requesters, responders or intermediaries.

### 5.3.4 ALD 21 ILL Using ACSE

This profile is one of a class of application profiles covering ILL using connection-oriented ACSE as defined in CULR (DISP 11188). As a result of the application processing, the Responder may communicate with another system which then becomes the Responder. This process may be repeated many times before the transaction is complete.

This profile specifies how the OSI session layer, presentation layer and application layer standards are used to provide those functions.

### 5.3.5 ALD 22 ILL Using Store and Forward (IPMS)

This profile is one of a class of application profiles covering ILL between two systems using store and forward services (X.400/ISO 10021). It specifies how the OSI application layer standard is used to provide these functions.

## 5.4 ISP Document Structure

Each ISP in the taxonomy covers a set of profiles and consists of multi-parts.

### 5.4.1 ALD 1n

Part 1. This part contains the specification of ACSE, Presentation and Session protocols for use by ALD n1 to provide the required OSI upper layer functions as far as possible by reference to CULR.

Part 2. This part contains the SR generic for ALD 1n, the overall functional description and specification of SR service support and functionality.

Part 3. This part focuses on SR using ACSE. It provides the functional description and specification of SR support and functionality as required by the ALD 11 profile by reference to parts 1 and 2.

### 5.4.2 ALD 2n

Part 1. This part specifies the Store and Forward protocols for use by ALD n2. It specifies how the standards shall be used to provide the required OSI upper layer functions for the ALD n2 applications. This is done as far as possible by reference to the message handling system (IPMS) AMH 2n pDISP.

Part 2. This part outlines the ILL generic for ALD 2n with an overall description of ILL service support as covered by ALD 2n profiles.

Part 3. This contains a functional description of ALD 21, ILL using ACSE. It specifies and describes the ILL service support and associated functionality as required by the ALD 21 by reference to common specifications in ALD 1n and ALD 2n Part 2.

Part 4. This part contains the functional description and specification of Store and forward and the associated functionality as required by the ALD 22 profile.

### 5.4.3 ALD 12

In the original taxonomy a profile for ALD 12 was identified. This was aimed at developing a profile for SR using Store and Forward. Following a suggestion from IFOBS this profile was removed from the taxonomy. It was believed that it could be

included at a later date and that since the standards did not yet exist to support it, it should not be included in the taxonomy.

EWOS EG-LIB accepted this revision and following submission the taxonomy as outlined above was approved EWOS Technical Assembly (TA).

## 5.5 Current Profile Development

Deriving from the taxonomy outlined above, during 1994 EWOS EG-Lib focused on the preparation of the following profiles:

### 5.5.1 ALD 1n SR—Part 1: Specification of ACSE, Presentation and Session Protocols for use by ALD Profiles

This is the generic part of the ISP for libraries for use of connection-oriented ACSE and is based on CULR (pDISP 11188-1). The model used in that of two end-systems running an end-to-end association using the ACSE, presentation and session layer protocols.

### 5.5.2 ALD 2n ILL—Part 2: Interlibrary Loan Generic

This part of ISP ALD2n specifies constraints on implementations of the ILL protocol (ISO 10162) in order to facilitate interworking. This part is independent of the underlying communications services which will be described in other parts of this or other ISPs. The model used in the ISP is that of asynchronous information transfer between two or more systems using the ILL services as specified in ISO 10160.

### 5.5.3 ALD 21 ILL—Part 3: Interlibrary Loan using ACSE

This profile is one of a class of application profiles covering ILL (request handling and loan management) between two systems either of which might be a Requester, a Responder or an Intermediary. These roles are fully defined in ISO 10160. This profile is intended to be used when the ILL protocol (ISO 10161) is to be used with connection-oriented ACSE and the presentation services. The model used in this part is that of asynchronous message transfer between two or more application systems using the ILL services (ISO 10160) and using the profile for ACSE, presentation and session.

Following receipt of comments from IFOBS and harmonization these profiles were submitted to the EWOS TA. The TA ratified these profiles and they have now been forwarded to ISO/IEC JTC1/SGFS for pDISP processing.

### 5.5.4 ALD 11 Working Draft ISP for SR—Part 1: Generic Bibliographic Search and Retrieve

IFOBS have been involved in the preparation of profiles of specific relevance to bibliographic applications. In November 1993 a working draft ISP for SR Part 1: Generic Bibliographic Search and Retrieve was prepared.

This part of this ISP (ALD 11) is based on ISO DIS 10163 and covers the use of the SR protocol for accessing bibliographic information using the Type 1 RPN query in a connection-oriented environment.

The working draft was circulated to EWOS EG-LIB in January 1994 and has given rise to a number of issues, including that of MARC formats, which await resolution. The ISP states that support for MARC records is optional. Since MARC is widely used by the library community it would seem desirable to have mandatory support of MARC. However, the problem lies in the variety of MARC formats available. As long as the SR protocol does not define its own record syntaxes there is a need to use MARC formats. In consequence there is much debate about the need to nominate one of these as the format to be supported mandatorily e.g. UNIMARC, UKMARC. As of January, 1994 EWOS EG-LIB were indicating preference for the mandatory support of a MARC format. Based on the IFLA agreement they are further recommending that UNIMARC is made mandatory. In the meantime EWOS EG-Lib have agreed that there is a need to prepare a Technical Report (TR) on MARC conversions and this proposal is being considered for work items to be completed in 1994.

### 5.5.5 ALD 2n Working Draft ISP for ILL—Part 1: Use of Store and Forward (IPM)

IFOBS are currently working on the above profile which describes how library applications in store and forward environments will use the facilities of Interpersonal Messaging (IPM) as defined in ISO 10021. The model being used is one of two or more end-systems communicating for library and documentation information transfer purposes through the services of an IPM user agent at each system. The user agents engage in the direct exchange of interpersonal messages via an intermediate Message Transfer System (MTS). The provision of, and access to, the MTS will be outside the scope of this profile.

### 5.5.6 ALD 22 Working Draft ISP for ILL—Part 4: ILL using Store and Forward (IPM)

IFOBS are also working on a further deliverable, ALD 22 Inter Library Loan - Part 4: ILL using Store and Forward (IPM). This profile should have been completed and harmonised by end 1993 but is expected to be completed shortly. This profile specifies how the OSI interpersonal messaging service (IPM) will be used in combination with the OSI ILL service to provide the complete set of communication services to the ILL service users of two or more end-systems, one acting as the requester, one as the responder and possibly one or more acting as intermediaries. This profile specifies requirements for the transfer of individual messages only. However, all combinations of simple messaging, forwarding, partitioning and chaining as defined in ISO 10160 can be provided through use of this ISP.

## 5.6 Future Profile Development

### 5.6.1 EWOS EG-LIB

A programme of new work items is now being prepared by EWOS EG-LIB. The following areas have been identified as requiring priority action and will be put to the EWOS TA for approval as New Work Items.

#### 5.6.1.1 SR connection-oriented

At it last meeting in January 1994, EWOS EG-LIB agreed to extend their work programme to include the harmonization of SR and ACSE. Work would be progressed through liaison with IFOBS.

#### 5.6.1.2 Document Delivery

A work item has been submitted to the EWOS TA identifying a pressing need to define and develop profiles for the use of the standards for electronic delivery of documents in various forms over various communication media including X.400 and FTAM. Five specific areas for work have been identified:

- Transport mechanisms
  X400, FTAM, SMTP-MIME

- Document formats
  SGML, ODA, TIFF, PS

- Information provided with the document
  In this area it is intended to use the recommendations of GEDI as a work model.

- Directory services
  X.500 i.e. the use of directory services for describing systems, origins and targets.

At present a proposed draft amendment to the ISO 10161 (ILL) protocol has been submitted to ISO. This amendment discusses issues surrounding the use of the ILL protocol to support the electronic delivery of requested items and proposes several enhancements to the service definition and protocol specification to support document delivery. EWOS EG-LIB are watching the progress of this amendment with interest and propose to profile the amended standard.

#### 5.6.1.3 Application of minimal OSI (mOSI)

In October 1993 a special EWOS TA session was held on TCP/IP-OSI convergence/co-existence. Specifically the objective of the meeting was to identify activities which EWOS should undertake in this domain. Currently OSI and TCP/IP compete at the

product, procurement and operational level. There is also competition at the application layer between standards such as X.400 and SMTP, FTAM and FTP etc. The requirement exists for a global lower layer service with a well-defined supporting API. Support is also required for new lower layer technologies such as ISDN and for a multiplicity of applications which fulfil a range of functional requirements.

Although long-term solutions must be considered, a number of possible short term solutions were identified at this meeting including the development of profiles for TCP/IP, mOSI, application converters and lower layer system profiles offering an API platform for applications. It was agreed that EWOS could do much to contribute to the area of profiling.

Arising from this meeting EWOS EG-LIB have put forward a proposal to demonstrate the possibilities of using mOSI APIs in combination with the ALD profile for Search and Retrieve.

The objectives of this project are to:

- demonstrate whether the current version of mOSI can support the library application standard SR and to determine if any further requirements to mOSI are identified;
- to specify how SR applications may utilize mOSI;
- to compare the current library standard profiles to mOSI and specify any necessary revisions to the profiles or to the profile taxonomy;
- to draft the revised taxonomy and profiles.

#### 5.6.1.4 Exploration of combined SR and ILL

EWOS are currently exploring the need to create a single new profile or to examine the technical issue of using the two existing profiles in a combined system.

#### 5.6.1.5 Expansion of the taxonomy

The taxonomy will be expanded to include:

- SR over TCP/IP
- ILL over TCP/IP
- ILL over SMTP
- Directory investigation (X.500)

### 5.6.2 IFOBS

It is unclear what profile activities IFOBS will pursue in the future. They are currently reviewing their role in the area of profile development and it has been suggested that EWOS EG-LIB be asked to assume full responsibility for the preparation of ISPs for the ILL and SR standards. A desire has been expressed that they refocus on issues relating to

international bibliographic interworking. At present, however, IFOBS are a liaison partner to EWOS EG-LIB on all aspects of their work programme and have a very close link to the OIW SIG.

### 5.6.3 OIW SIG

The OIW SIG have now drawn up a priority list of items to be addressed in the coming months. This has also resulted in a clarification of their role in the international harmonization of profiles.

The SIG will play a liaison role supporting the work of EWOS EG-LIB and IFOBS in the development of ISPs for SR or ILL.

However, they will be more active in the development of profiles for Z39.50 and to this end are currently working on a draft profile for Z39.50 over TCP/IP.

## 5.7 Z39.50 Profiling Activities

### 5.7.1 Z39.50 over TCP/IP

Since most Z39.50 implementations run over the Internet, and most implementors in the US have chosen to layer Z39.50 directly over TCP, the OIW SIGLA believe that it is necessary to develop a profile for this function. This profiles addresses Z39.50 layered directly over TCP without the use of ACSE, presentation or session layer protocols. At present it is based on Z39.50–1992, but extensions will be developed as version 3 stabilizes. The profile codifies the existing practices. A draft has been prepared (Lynch, 1994) and is to be submitted to the Internet standardization process.

### 5.7.2 WAIS and Z39.50

The OIW SIGLA has developed a specification of the use of Z39.50-1988 in WAIS. This has been standardized as RFC1625. Work is in progress to produce a specification for WAIS and Z39.50-1992, and a draft has been prepared (OIW SIGLA, 1994).

### 5.7.3 GILS

The Government Information Locator Service is a U.S. Government project to develop a system for the electronic dissemination of public information (Christian, 1993). Initial work was undertaken by the U.S. Geological Survey and Syracuse University. This aimed at increasing development of the required systems and specifying the GILS profile for the use of Z39.50 and other standards in the Internet environment. Z39.50 will be used for the search and retrieval aspects of the system. The results of this work are available in (McClure and Moen, 1994a) and (McClure and Moen, 1994b).

# 6 Document Delivery

## 6.1 Introduction

Electronic document delivery represents the most recent and significant development in the field of document delivery. There are roughly 6 stages in the current process of electronic document delivery.

(1) Identifying and locating desired documents.

(2) Ordering the relevant document. The central issue here is integration with ILL standards and procedures.

(3) Digitization of documents. This stage involves transforming a hard-copy into an electronic image.

(4) Interchange of electronic documents. The problem here concerns the best means of transferring a document.

(5) Hard-copy reproduction. No real issue surrounds the straightforward printing of documents.

(6) Administrative and financial procedures. The key issue here is copyright.

The substance for each of the issues is supplied by the many pilot projects in progress throughout the world.

With regard to future trends, the GEDI report (GEDI, 1991) considers the direction document delivery will most likely take. The basic explicit indications refer to the preferred method of document interchange, FTAM. Implicitly there are indications that uniformity in future developments will only take place in specific fields (e.g. interchange) leaving the future of the other fields subject to practical and financial considerations.

Zeeman (Zeeman 1994) has described a number of document delivery scenarios with special reference to the use of the ISO ILL protocol.

## 6.2 Current Developments

The transformation of an existing hard-copy document into an electronic image is done using some method of scanning. There is however a problem here concerning the suitability of input technology. When scanning involves an Optical Character Recognition (OCR) mechanism, the printed document is usually transformed to ASCII text for the

purpose of efficient transfer (Mercury project, DDTP, RIDDLE, etc.). The problem is that in conversion to ASCII text symbols, equations, images etc. cannot be properly represented. When these elements appear on a page that page may be set aside and scanned as an image. This requires the use of a delivery mechanism capable of supporting image data as well as text. Although significant progress has been made recently in the development of such systems, e.g. X.400 and the MIME standards for multi-media e-mail, widespread deployment of this technology by end-users is still some years in the future. Standardisation of data formats is also essential to allow the interchange of documents.

There is an increasing trend towards the direct creation and distribution of documents in electronic form without the production of a printed version by the supplier before delivery to the user. This method has clear advantages in terms of quality, production costs and delivery speed and is likely to continue to increase in future. A number of additional complex issues arise, especially in relation to copyright, as well as the ones indicated above for electronic delivery of existing documents.

## 6.3 Delivery Methods

There are three main types of electronic interchange in use in the pilot projects:

(i) File Transfer [TULIP, DDTP, FOUDRE, ARIEL (projected use in RIDDLE and RAPDOC)],
(ii) E-mail [BLDSC, PROJECT MERCURY],
(iii) Group III fax [INIST, OCLC, UNCOVER 2].

In terms of future developments it is not clear whether file transfer or e-mail will emerge as the preferred method of interchange. File transfer does not suffer from the difficulties with the types of data which present e-mail systems can support (e.g. big binary files may have to be encoded in a special representation and split into several parts for transfer). E-mail does offer a number of significant advantages:

- All the required steps in document delivery can be carried out in one system.
- The store and forward mechanism means that direct connection with the document supply centre is not necessary.
- Linking across different networks is possible.

The recommendations of GEDI, discussed in Section 6.5 below, indicate that e-mail is not suitable for electronic delivery. Whatever the pros and cons of e-mail this recommendation may in itself rule it out in the minds of many suppliers (e.g. EDIL, FOUDRE, RAPDOC).

Fax delivery of documents is significant because of the very widespread availability of the necessary technology and its familiarity to the majority of users. It does suffer from poorer quality and slower delivery than either e-mail or file transfer delivery mechanisms. Increasing use of PC-based faxing is reducing the distinction between this method and file transfer, with users able to store documents in electronic form and suppliers able to produce an electronic form directly, thus avoiding the need to scan documents.

In future, the deployment of ISDN may encourage the use of the more sophisticated Group IV fax with higher quality and faster delivery. However, ISDN would also make possible more sophisticated delivery by e-mail or file transfer so the future of fax delivery is uncertain.

## 6.4 Copyright

Even within the limited framework of the various pilot projects there is a great variety of approaches being adopted on the copyright issue. Among document suppliers there is a split into three main groups. Those who have:

(1) Centralised permanent storage (INIST, UNCOVER).[1] Agreements made with Copyright Clearance centres cover royalties and often add stipulations regarding delivery. No agreements are then necessary with publishers.

(2) Decentralised permanent storage (FOUDRE, ARIEL). Individual end-users or libraries must deal with the copyright issue. Payment of royalties is in accordance with the number of articles ordered. The supplier does not deal with copyright because storage is impermanent at their centre.

(3) Impermanent storage [RAPDOC, DDTP, (FOUDRE, ARIEL)]. Impermanent storage means copyright is not dealt with. The pilot nature of the projects (e.g. FOUDRE) also encourages the overlooking of the copyright issue.

Clearly electronic delivery will be a very difficult area to control from the publishing perspective. How can publishers control excessive reproduction of a document?

Compounding this problem is the diversity of approaches adopted by document suppliers. Such diversity makes legislating very difficult and thus ultimately further reduces the power and control of the copyright holder.

Perhaps in an attempt to combat this last problem, many publishers have started up pilot delivery projects of their own (e.g. TULIP, RED, SAGE). However figures from the FOUDRE project indicate that this may not be a profitable business. Less than 10% of articles scanned and delivered were requested again. Only about 1% of the articles ordered in traditional journal fashion were ordered electronically. A factor here may be that traditional journals are often brought with the intention of only reading a small percentage of the articles in any one journal. The unwanted articles are lost in the world of electronic delivery. This financial worry for publishers may be offset by:

[1] Only 10% of the UnCover database is permanently stored at the moment. Storage is possible here only after agreements are made with the Copyright Clearance Center.

(1) extension of the market into uncharted territories
(2) increased capacity to target marketing owing to information received from the supplying centre
(3) cheap replication
(4) cheap distribution

These plus and minus factors for the publisher cannot really be weighed until electronic document delivery becomes widespread.

## 6.5 Future Trends

The Group on Electronic Document Interchange (GEDI), in an attempt to standardize electronic document delivery as it progresses and develops, have made recommendations concerning only one of the six areas of document delivery mentioned in Section 6.1 above. Document interchange is for GEDI the key area in which a common ground must be developed. The implication here is that the other main areas will be allowed to develop in accordance with particular and often specialised requirements. Thus the nature of the articles involved might determine the scanning method, the demand for electronic documents over traditional ones might determine publishers involvement in electronic delivery. The aim of GEDI is to make recommendations that will promote electronic document delivery as a technological reality. They recommend FTAM as a means of transmission, the use of CCITT Group IV fax for compression and TIFF version 5 for image data.

## 6.6 Integration with ILL

This section will consider the increasing demand for integration of interlibrary loan services as defined by the ILL protocol (ISO 10160) and document delivery mechanisms.

At present the ILL service model assumes that requested documents are to be delivered by some mechanism separate from the communications channel used by the ILL protocol. The delivery most often involves physical delivery of the requested material (using the postal services, courier services etc.). However, as more and more library application services become automated, the demand to automate this service is likely to increase.

A number of projects are currently in progress which are experimenting with the use of Group III and Group IV fax to deliver documents in association with ILL requests. In addition, RLG has developed an electronic delivery workstation, Ariel, for use over the Internet, that is growing in popularity for the delivery of ILL documents.

However, all these activities remain based on the notion of a separate delivery channel for the requested material. In order to be able to build automated or even partially automated delivery systems, it will be necessary to support an explicit, machine-processable association between the ILL transaction and the document being delivered.

### 6.6.1 ILL Protocol Amendments

With this in mind, a draft amendment to the ILL protocol, ISO 10160 *ILL Service Definition Support for Electronic Document Delivery* has been proposed. An amendment to the protocol specification, ISO 10161 *ILL Protocol Specification Support for Electronic Document Delivery*, has also been proposed. Together, these amendments specifically address the issues surrounding the use of the ILL protocol to support the electronic delivery of requested items and propose several enhancements to the service definition and protocol specification to support document delivery. While the immediate interest is in the use of X.400 electronic mail to transfer facsimile images of printed documents, the amendment documents are sufficiently broad as to encompass most document types and delivery services.

In order to be able to support electronic document delivery in association with the ILL protocol a number of abilities are required:

- the requester must be able to indicate that document delivery is required
- the requester must be able to specify what electronic delivery services and what document exchange formats are supported
- the requester must be able to specify the electronic address to which the document is to be sent
- the responder must be able to indicate that a document can or cannot be sent electronically
- the responder must be able to indicate what delivery service is being used
- the responder must provide some means of correlating the document with the request
- the requester or the responder must be able to initiate retransmission if necessary

The issue is further complicated by the fact that it must be possible to support the transfer of a variety of document types, SGML, ODA, PostScript etc.

Equally there are a number of potential delivery services including X.400, FTAM, CCITT T.30 for Group III fax, etc. The delivery service parameter as currently specified in ISO 10161 does not provide for a machine-readable specification of the desired delivery service. It is recommended that it be extended to enable choice of either physical or electronic delivery in such a way that the requester can specify a list of supported electronic delivery services in order of preference.

### 6.6.2 Linking Shipped Document to Delivery Service

Two approaches to electronic document delivery in conjunction with ILL have been identified:

- Delivery synchronous with the SHIPPED service.
- Delivery asynchronous to the SHIPPED service.

Synchronous delivery may be either through the association of the document with a SHIPPED message on the same communication service, or by the immediate use of a separate communications service. In an X.400 environment, for example, a SHIPPED APDU could occupy one part of an Interpersonal Message (IPM), with the document in the subsequent body part. In a connection-mode environment, a SHIPPED APDU could be immediately followed by the calling of a bulk data transfer service such as FTAM.

Asynchronous delivery requires that the document be explicitly related to the ILL transaction it fulfils through some form of delivery note.

Developments with the proposed amendment to the protocol are being closely watched, particularly by EWOS. Depending on the outcome, the EWOS Expert Group for Libraries plan to identify standards and develop a series of profiles for transport mechanisms, document formats and document information.

# 7 Non-Bibliographic Usage

Although not designed exclusively for that purpose, the Z39.50 protocol has largely been adopted by the library community and therefore for bibliographic implementations. However, there are two non-bibliographic implementations of Z39.50 which are worthy of consideration.

## 7.1 WAIS

The development of the network publishing system, Wide Area Information Servers (WAIS), began in October 1989. From the beginning WAIS was committed to using the Z39.50 standard as the information retrieval protocol between WAIS clients and servers. To this end the WAIS developers worked closely with the Z39.50 Implementor's Group (ZIG) and used a recommended subset of Z39.50 Version 1 with a recommended approach for extensions to fulfil its requirements. An Internet RFC describing the use of WAIS over Z39.50-1988 has recently been published (RFC1625).

WAIS was designed to serve primarily non-bibliographic data, such as full-text and images. This is not to say, however, that bibliographic data could not also be used. Since a non-bibliographic document may exist in multiple formats, WAIS was also designed to handle multiple document formats. WAIS queries are formulated in pseudo natural language and refined using relevance feedback. Relevance feedback is the ability to select a document, or portion of a document, and find a set of documents similar to the selection. The need to support relevance feedback is the main reason for differences between the WAIS protocol and Z39.50.

WAIS developers are now anxious to improve the functionality of the system, which now reaches over 50,000 users, but wish also to maintain conformance with the Z39.50 standard. To achieve this developers are currently working to establish a migration path for WAIS from Z39.50 Version 1 to Z39.50 Version 2 and then to Version 3. The OIW SIGLA are developing a profile for WAIS and Z39.50 V2 (OIW SIGLA, 1994).

## 7.2 GILS

Another example of a non-bibliographic implementation of Z39.50 is the Government Information Locator Service (GILS). This is a co-operative research project between the United States Geological Survey and Syracuse University. According to William Moen (a principal investigator for the project) a number of objectives have been identified including:

1. To expand research and development of Z39.50 to facilitate public access to federal information resources.

2. To develop an application profile for networked-based GILS implementations which references Z39.50 and other standards for use in the Internet environment .

The federal agencies have already outlined the functionality needed for the GILS. The basic premise behind the development is that constructing a standards-based GILS, based on a widely accepted application profile, will ensure interoperability and interworking of agency implementations. This in turn will ensure wider public access to federal information resources.

# 8 Gateways and Other Cross-Protocol Initiatives

A gateway is a way to allow two different systems using different protocols to interoperate. This can generally be made without a tremendous amount of difficulty. Sometimes functionality is lost depending on how well the gateway is constructed.

Another way to get access to information from several different systems through a single user interface is to create an application that talks to the different applications through the use of different protocols; one example of this approach is NCSA Mosaic. The aim is one user interface which can operate natively with multiple protocols because it is essentially a collection of clients in one package. The advantage is that everything looks the same to the user, with a single client application providing access to all of the different systems. The disadvantage is that the client may be very large and may be difficult to keep up to date with a number of changing services.

The advantage of a gateway is that if something changes only the gateway must be changed, and all tools that utilize it benefit from the change.

Today we have well developed gateway functions between WAIS (Z39.50-1988) and both gopher and WWW. The gateways do not yet provide the full WAIS functionality as some of the more advanced features like relevance feedback and the possibility of searching several WAIS databases simultaneously are missing. The gateways are constantly refined.

For WWW several groups are working on developing the gateway functionality. One of the most advanced projects is the Nordic WAIS/World Wide Web project by DTB and Lund University Library, UB2 in Sweden, which already are testing a functionally complete gateway from WWW to WAIS. The project also intends to investigate a reverse gateway, i.e. being able to search (using WAIS) all the WWW pages that can be found on the network.

Both WWW and gopher provide a feature called forms which allows interactive feedback from a user to a WWW or gopher server. This feature is essential for building good gateways from these systems to Z39.50 systems. This has already been tested for WWW.

## 8.1 Nordic SR

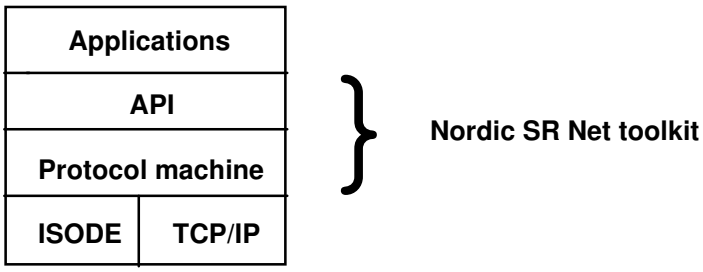
The Nordic SR Net project selected the ISODE as their basis for the development of an SR toolkit. This way servers and clients, based on the toolkit, are not able to communicate with SR/Z39.50 resources in the Internet other than the ones using ISODE. There have been two proposals to overcome this limitation:

- Create a gateway like EUROPAGATE.

- Create direct TCP/IP access for the servers and clients using a dual-stack setup.

The gateway solution was considered too time consuming whereas the dual stack setup, for the target side only, is being implemented.

The basic idea for the dual stack solution is to allow origins from both the ISODE stack and the TCP/IP stack to request the SR targets :




This feature would be especially useful if the SR target could receive requests from a TCP/IP based Z39.50 origin using services also in SR, but this has not been confirmed.

## 8.2 World Wide Web

A simple yet powerful way of implementing a gateway from WWW to other systems is through so called cgi-scripts. These allow a WWW client to start a program at a WWW server. This program can perform various actions on behalf of the WWW client, for example function as a Z39.50 client. When the cgi-script is finished it returns its results to the WWW client. Of course this makes a simple minded gateway that lacks a lot of the complete Z39.50 functionality. For one thing it has obvious problems with keeping status across a search session.

The functionality of these kinds of gateways will improve considerably.

At least two experimental WWW to Z39.50 gateways using this technique are already available for testing. These are described below.

### 8.2.1 AT&T

AT&T operate a gateway (URL=http://www.research.att.com/cgi-wald/dbaccess) which allows access to the following databases:

- books – Books in the AT&T Library Network
- netlib – Mathematical and Statistical Software (netlib)
- ls-lr – ls-lR for research.att.com
- cic – Customer Information Center Database
- z39dbs – Z39.50-1992 databases
- factbook – CIA World Factbook

So far this gateway only provides search of one database at a time using simple terms or in some cases combinations (AND) of simple terms and a few field specific searches. The

most advanced interface is the “books – Books in the AT&T Library Network” database which provides the following searchable fields in addition to the General search terms:

- Title words
- Author name
- Subject words
- Date (e.g. 1992)
- Publisher

### 8.2.2 CNIDR

CNIDR is experimenting (URL=http://cnidr.org/libraries.html) with a Z39.50 gateway to various on-line libraries. The gateway was designed as a test point for the freeWAIS 1.0 server but it is now a generic Z39.50 gateway. The most interesting part is that one can create WWW pages that point to Z39.50 servers through this gateway. The gateway supports Boolean expressions and multiterm queries. CNIDR provides two example pages that points to Melvyl and AT&T servers respectively.

## 8.3 Gopher

At present there are no gateways from gopher to Z39.50 but this will surely change soon. There is already a gopher gateway to a traditional library system, BIBSYS in Norway. Through this gateway almost all standard online terminal based functions can be used. Exceptions include browsing, special output formats and loan requests.

There have been some initial contacts between the ZIG and the gopher team at University of Minnesota, but so far they have not produced any results.

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Closed LISTSERV conference for registered users of Z39.50 Public Domain Software from National Library of Canada.

PIG list at aston.ac.uk. To join, send email with subject ‘subscribe’ to z39pig-request@aston.ac.uk. Send postings to z39pig@aston.ac.uk.

ESRIG list at net-cs.ucd.ie. To join, send email with subject ‘subscribe’ to esrig-request@net-cs.ucd.ie. Send postings to esrig@net-cs.ucd.ie.

## 9.5 Miscellaneous information sources

There is a WWW page on Z39.50 resources at http://ds.internic.net/z3950/z3950.html. This includes pointers to many other information sources.

# 10 Glossary

| | |
|---|---|
| **ANSI** | American National Standards Institute |
| **ACSE** | Association Control Service Element |
| **APDU** | Application Protocol Data Unit |
| **API** | Application Programming Interface |
| **ASE** | Application Service Element |
| **ASN.1** | Abstract Syntax Notation One (ISO 8824) |
| **ATM** | Asynchronous Transfer Mode |
| **BER** | Basic Encoding Rules (ISO 8825, ASN.1) |
| **BLDSC** | British Library Document Supply Centre |
| **CCF** | Common Communication Format |
| **CCL** | Common Command Language |
| **CD-ROM** | Compact Disc Read Only Memory |
| **CLNP** | Connectionless Network Protocol |
| **CNI** | Coalition for Networked Information |
| **CNIDR** | Clearinghouse for Networked Information Discovery and Retrieval |
| **CULR** | Common Upper Layer Requirements |
| **DIS** | Draft International Standard |
| **DISP** | Draft International Standardized Profile |
| **DLL** | Dynamic Link Library |
| **EG-LIB** | Expert Group on Libraries (EWOS) |
| **ES** | Extended Services |
| **ESRIG** | European SR Implementors Group |
| **ETSI** | European Telecommunications Standards Institute |
| **EWOS** | European Workshop for Open Systems |
| **FTAM** | File Transfer, Access and Management |
| **GEDI** | Group on Electronic Document Interchange |
| **GILS** | Government Information Locator System |
| **IEC** | International Electrotechnical Commission |

| | |
|---|---|
| **IESG** | Internet Engineering Steering Group |
| **IETF** | Internet Engineering Task Force |
| **IFLA** | International Federation for Library Automation |
| **IFOBS** | International Federation for Open Bibliographic Systems |
| **ILL** | Inter-Library Loan |
| **IP** | Internet Protocol |
| **IR** | Information Retrieval |
| **ISDN** | Integrated Services Digital Network |
| **ISO** | International Organization for Standardization |
| **ISODE** | ISO Development Environment |
| **ISP** | International Standardized Profile |
| **ITU-T** | International Telecommunications Union—Telecommunications Standardisation Sector |
| **LC** | Library of Congress (USA) |
| **MARC** | MAchine Readable Catalogue |
| **MIME** | Multipurpose Internet Mail Extensions |
| **MTA** | Message Transfer Agent |
| **MTS** | Message Transfer System |
| **NCSA** | National Centre for Supercomputer Applications |
| **NISO** | National Information Standards Organization |
| **NLC** | National Library of Canada |
| **OCLC** | Online Computer Library Center |
| **ODA** | Office Document Architecture |
| **OID** | Object identifier |
| **OIW** | Open Systems Environment Implementors Workshop |
| **OPAC** | Online Public Access Catalogue |
| **OSI** | Open Systems Interconnection |
| **P-context** | Presentation context |
| **PDU** | Protocol Data Unit |
| **PIG** | Z39.50 Pre-Implementors' Group |
| **POSIX** | Portable Operating System Interface (IEEE) |
| **RFC** | Request For Comment |
| **RLG** | Research Libraries Group |

| | |
|---|---|
| **RLIN** | Research Libraries Information Network |
| **RPN** | Reverse Polish Notation |
| **SGML** | Standard Generalised Markup Language |
| **SMTP** | Simple Mail Transfer Protocol |
| **SR** | Search and Retrieve |
| **TA** | Technical Assembly (EWOS) |
| **TC** | Technical Committee (ISO) |
| **TCP** | Transmission Control Protocol |
| **TIFF** | Tagged Image File Format |
| **TSAP** | Transport Service Access Point |
| **TSCP** | Transport Service Convergence Protocol |
| **UNISIST** | UNESCO Intergovernmental Programme for Cooperation in Scientific and Technological Information |
| **URL** | Uniform Resource Locator |
| **VT** | Virtual Terminal |
| **WAIS** | Wide Area Information Service |
| **Winsock** | Windows Sockets |
| **WWW** | World Wide Web |
| **XTI** | X/Open Transport Interface |
| **Z-association** | Z39.50-association |
| **ZIG** | Z39.50 Implementors' Group |
| **ZIT** | Z39.50 Interoperability Testbed |