# THE OPEN URL LINKING MECHANISM FOR EFFECTIVE USE OF DISTRIBUTED ELECTRONIC RESOURCES IN LIBRARIES

Rajender Singh Bist          V Patnaik Mohanty

## Abstract

*The libraries have adapted themselves to a new challenge of information integration and presentation in order to enhance access to the widely dispersed and distributed electronic information and publications. The open URL standard is a breakthrough for achieving the means to integrate electronic resources of the library. Open URL mechanism transports metadata of electronic resources from one resource to another and provides dynamic links from metadata to full content of the resource described by the metadata. This paper describes the concept underlying the Open URL mechanism, explains the Open URL structure and the link resolvers as the linking component for the resource integration in the libraries.*

**Keywords:** Open URL linking, Link resolvers, Electronic resource integration, DOI, CrossRef

## 1. Introduction

In the recent years the web-based service environment have paved way for various standards that are often mentioned in relation to linking functionality. In order for linking to work across resources, there must be agreement between the various information providers on how information should be transformed. Initiatives such as the DOI, cross-reference and the Open URL help to define how and what information should be transformed from resource to resource.

Open URL is an emerging standard for transporting information within a URL to a 'resolution server' that can accept the URL syntax and provide context-sensitive services based on the information in the URL [1]. The metadata in the URL describes the resource that is being requested by the user. The Open URL is a standardized way to pass information in the URL between different resources. Some common elements that are passed are ISSN, ISBN, title, volume, issue, author, date etc. When this Open URL is passed to the resource, the resource can deliver the appropriate information. For e.g. a link from a journal in the Web OPAC can deliver information pointing to the full-text of the journal in one of the library's licensed full-text database.

The Open URL can be used to link to a variety of things. It can be used to submit a request to an Inter Library loan system or to add citations to a citation management tool. It can also link users to unique collections that a library owns and help users figure out where they can get a copy, physical or digital by reducing the number of clicks a user has to make to figure out the required information. The Open URL linking mechanism is realized through a link server or link resolver such as SFX to process the information requested and creates one or more than one links to the resources for the users.

By implementing the open URL information providers have the opportunity to fully integrate their information resource into their customers overall information services. "By creating the hooks that link back to individual libraries, information providers allow libraries to add customized linking services based on the library's local resource and environment" [2]. The Open URL concept was initiated and researched by van de sompel at the University of Ghent, Belgium and then followed further experimentation at Los Alamos National University in the US. In 2000 it was submitted to NISO (National Information Standard Organization)

for approval. [3]. The Open URL framework for context-sensitive services (ANSI/NISO Z39.88-2004) has received approval as an American National Standard. The standard has been in trial use since June 2003 and is now deployed in Google Scholar. It was approved by ANSI on 15th April 2005 [4]

## 2. Libraries and Linking Environment

Libraries today subscribe to increasing number of information resources from a range of different information providers and use diverse technologies for electronic service delivery. Moreover valuable and relevant resources now available on the web have impacted the libraries to attempt incorporation of these resources into their collections so that they can be readily available to their users.

" A citation in an article reference or abstracting and indexing database may have its full-text counterpart available in an electronic journal subscribed to by the library, via a aggregator database, or in a bound volume available in the library stocks. The authors of one article may be cited in other related articles of potential use to a library user. A document delivery service may be available for information not specifically held by the library. Book table of contents, book reviews, book jackets picture etc may be available for book records in the library catalog" [5].  It is difficult to organize and present these materials to users under one common interface. Therefore efforts are being made to integrate the access to library collection, library catalogs, publishers databases and access to free information available on the Internet for enhancing the value of library and information systems, through the various linking initiatives. Thus reference linking is one of the most innovative and revolutionary library services in the Internet era.

Reference linking is necessary because library users today expect to move seamlessly between library content and information on the Internet [6].  Reference linking is a general term for links from one information object to another. The hyperlinks of the web using URL often perform as surrogates for reference links [7]. In the conventional linking environment electronic database vendors / aggregators have their own linking systems which are controlled by their specific source database and are not interoperable. Each system has its own user interface and do not offer any local control over what links are to be presented to users and how such links resolve i.e. libraries where the links are to be used has no, or few means to control the link. Such linking frameworks have been called or referred to as non content-sensitive and closed linking.

To overcome the limitations of conventional linking the web environment has made a considerable progress in the field of linking which resulted in open linking concept. Open linking helps the library users to move from an abstract from one publisher to the full text document into another publisher or aggregator database, from a bibliography in an article to the library catalogue, from one database to another, or from a journal article to a web site. The Open URL standard has revolutionized linking for librarians, by providing the linking control in the hands of the librarians. The library can determine what links should be offered to the users as the means of easy navigation between the many and varied electronic information resources. Today the "Libraries are constrained by their budgets and so have a big interest in getting their people to the content they pay for. Hence the libraries' interest in Open URL. Publishers will include linking if the libraries want it" [8]. In a library running the link resolver, the user just clicks on the link and gets their required resource.

Through the dynamic Open URL technology a library can offer links to electronic publications at various levels. The library database of e-journals can be added with information about the increasing number of scholarly e-journals that are freely accessible through the web, e.g. linking to DOAJ. The description of a book in the online catalogue of the library can be enriched and enlarged by linking this with more information about the book, such as contents, summary, reviews through the internet bookstores, etc.

e.g. linking to Amazon.com. The description of journal article that is found by a user but is not available in the library, can be directed in the form of a query to a web search engine for locating the full-text there, e.g. links to Google Scholar etc.[9]

## 3. Open URLs Defined and Explained

The Open URLs are defined as an interoperability model that facilitates context-sensitive reference linking in distributed libraries. [10]. Powell, A (2001) defines it as 'a mechanism for encoding a citation for an information resource, typically a bibliographic resource, as a URL. The open URL is, in effect, an actionable URL that transponds metadata, or keys to access metadata, for the object for which the Open URL is provided [11]. It is syntax to create web-transportable packages of metadata and/or identifiers about the information object. Such packages are at the core of context-sensitive or open linking technology [12].

A URL is a www address of a resource on the Internet, [e.g. www. Infolibrarian.com]. This is a static URL and directly points to a specific page on the web. On the other hand a dynamic URL links to a dynamically generated web page. Dynamic URLs searches databases for a query sent over. Open URL is thus a dynamic URL that carries metadata (instead of the address of specific web page) as a representation of information of a bibliographic resource. It consists of metadata representing a citation, which can be moved from one system to another.

While delivering metadata descriptions for users, information providers introduce an Open URL for each such description or source (i.e. journal article) and send them to the link resolver specified in the URL. Link resolvers are configured by their hosting institution to display a set of web services available to the institution's library users. Through the process of Context-sensitive linking, the resolver matches metadata contained in open URLs to appropriate web services. Depending on the web services that the institution supports, the resolver may link a user directly to electronic full content, or provides them with a service menu containing links to various resources and services.

A standard Open URL consists of a Base URL and a description of query. The Base URL provides the location of the Open URL service (i.e. the institution or the library) whereas the description is an identifier of the resource like author, title, issue, ISSN etc. Base URL is assigned dynamically by the service that generates the Open URL based on knowledge about a user's preference.

### 3.1 Linking Metadata

The citation which a user comes across while searching the ISI web of knowledge in the illustration depicted in figure 1 as example [13] is " Collections and acquisition research online" – Gibbs, N.J. in Library Collection Acquisition and Technical Services 26(3) 193-194 fall 2002.

The citation can be built into an Open URL as:

http://www.sfx.lib.uchicago.edu/sfx.local?Sid=ISI:WOS&ISSN=1464-9055&title=collections%20and%20acquisition%20research%20online&jtitle=library%20collection%20qcquisition%20and%20technical%20services&vol26&issue=3&spage=193&epage= 194&date=2002&au= gibbs,n.j&id =doi.10_603/J123v26no.3_10

The underlined part is the base URL that is specific to institution whereas rest of the URL contains metadata about the article i.e. open part. A URL in this form can be used by anyone employing Open URL technology. The link resolver accepts the Open URL as input and provides the metadata of the bibliographic resource as:

**Figure 1**



The citation can be built into an Open URL as:

ISSN = 1465-9055
Tittle = Collection and acquisition resources online
Journal = Library collection acquisition and technical service
Volume =26
Issue =3
Start Page =193
End page =194
Date =2002
Author = Gibbs, N.J.

The Open URL also supplies identifiers e.g. the last line underlined is the DOI (Digital Object Identifier). The metadata can be transported to a local link resolver (e.g. SFX) and used by the link resolver to supply links to records, which the library has created. The few examples are:

• The ISSN, year, vol., issue etc. can be used to create a link from the citation to the cited article in a aggregators database.

• The Journal name or ISSN can be used to check for print holdings in the library OPAC.

• The Author name can be used to look up the citation database for any other articles the author has written.

• Subject terms from the original citation can be used in other related databases or to link to web sites that are useful for users.

## 4.     The Open URL LInking Components

The Open URL concept is based on following components (Figure 2)

1.     Source- where the user starts his search, usually an Abstracting & Indexing tool, the library catalogue or similar bibliographical services and where there are link to other related resources. Though Source databases are typically bibliographic databases but full text articles with HTML references can also be source databases. They can also be bibliographic records in an OPAC. Actually they can be anything that can produce structured metadata in the Open URL format [14]

2.     Target- where the links presented by a source will take the users i.e. the places where the desired item of information reside and where the users search is completed.

**Figure 2**



There can be two different categories of target databases.

- An electronic journal where the primary goal of Open URL linking system is to generate links to full text articles of electronic journals.

- Extended services- Like links to local OPAC to search for print holdings, link to interlibrary loan requests or document delivery services, links to internet search engines, or any other services for which a URL can be constructed by using the Open URL parameters. "Extended service provides alternative ways of obtaining information related to the source documents and are especially helpful when no electronic journals are available" [15]. There may be more than one link to different targets, depending on the information as depicted in figure 2.

3.     Open URL link resolver - The Open URL linking is achieved through the link resolver or the link server which resolves the Open URL for links to various library resources.

## 5.     Linking Mechanism : The Link Resolver

Link resolver mechanism maintains a profile of full-text available to the users and provides instructions on how to link into target. They attempt to connect the users to the materials available to them within the context of the locally available information. Each time a user requests information, a local database is searched and the user is presented with customized list of available resources. This list is created using the knowledge database. For a library to start using Open URL technology, it is necessary to implement an Open URL link resolver. Librarians can determine what types of links their users should see and ensure that the links are accurate and effective. There are various types of link resolvers available from different vendors and have different capabilities and features and management options.

The link resolvers works with the source and target as follows:

User usually start by searching an Open URL enabled bibliographic database (e.g. Pub Med.) to find a citation (Link Source). The citation presents links to additional resources. Once the link or the link button is clicked on the citation page, a separate window is presented (Link server Menu such as SFX menu) that offers a list of links such as full-text of the article and other external services defined by the library (Link Target). This process is depicted in figure 3. [16]

**Figure 3**



# The Open Linking Flow (basic)
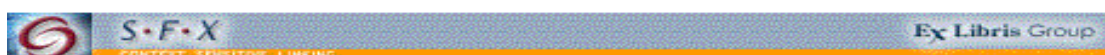
## 6.    Knowledge Repository

The heart of any link resolver is the completeness and accuracy of the knowledge base on which it depends [17]. For the link resolver to work efficiently, it must have access to information about the library's subscription and should be configured in such a way that the library wishes to present the service. The condition for presentation depends on the knowledge base, which is held under the resolver. Knowledge base is a database, where a library's collections are defined with information about potential services, collections, rules of access and is composed of several parts like:

- Information on what print journals the library subscribes to with standard identifier information like their call numbers, ISSN numbers etc.

- Information on what online, listing of full-text journals or books the library has access to through its own subscription, through publishers and aggregators and through accesses permissions to web sites etc. and to which of these the links can be made to.

- In-depth information about where online publisher have loaded the electronic full text of their journals or online publication.

The currency and accuracy of the data in the knowledge base affects the link server or resolver performance. It is necessary to manage the online resources of the library and keep the knowledge base updated with completeness of the data otherwise the link server may not provide the available full-text resource information. Librarians can localize the knowledge base by activating the items that match their local subscriptions. For e.g. if a library subscribes to some of the journals from EBSCO, it can activate those journals in their link resolver knowledge base. The knowledge base should regularly be updated with changes in aggregator / vendor content, journal back files added, new information added etc.

## 7.    Open URL Process Flow
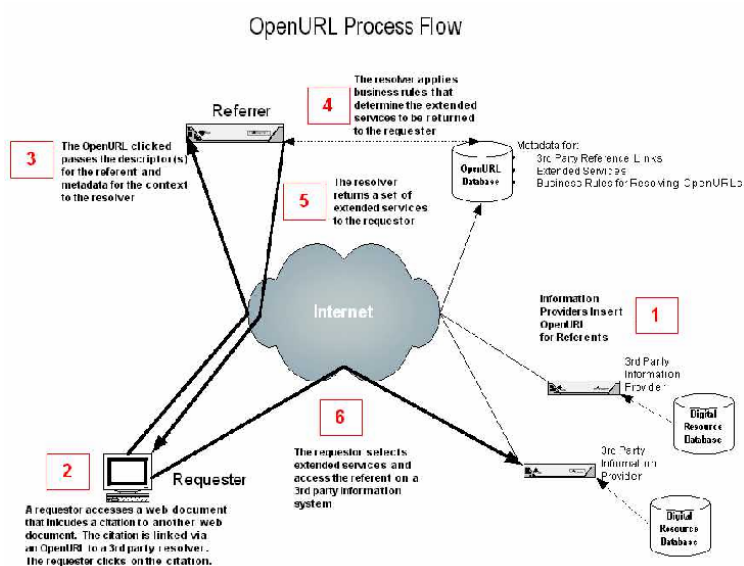


**Figure**

The information providers or publishers of the databases insert the open URL for the referents (i.e. items, subject, and article). When the requester of information or user starts the search in Open URL enabled database source to find a citation, a list of citations is received. The user may be presented with a link resolver button for a particular citation or bibliographic reference. On clicking the link or the link resolver button, the database source prepares a structured and formatted Open URL string that is the fetched metadata and corresponds to the citation. The Open URL string is sent to the link resolver. The link resolver's first task is to parse the incoming Open URL string and determine how many different fields of identifying data have been received and what are they (e.g. title, author, article title, volume etc). "Once the Open URL string has been parsed and elements identified, the next step is to see if the link resolver can match any information in the Open URL strings data elements to titles it knows about the knowledge base" [18]. The link resolver identifies the full-text resources and the end product of the Open

URL link resolution is the screen that lists the resources to which the user has access. "Open URL is not a federated search engine that searches multiple online resources and services simultaneously. It does not display the found items from different resources. Instead, it displays link to resources based on the bibliographic information of an item" [19]. The complete Open URL workflow system is represented in the figure 4 [20]

## 8.    Link Resolver : Products and Vendors

Link resolver services simplify and facilitate access to full text library resources. The creation of electronic resources holdings knowledge base using Open URL standard provides linking across the library's databases and electronic resource providers (who are Open URL compliant) and other extended services. Link resolvers are available commercially from several sources. Some content publishers and aggregators also provide their products. Various Content providers have Open URL built into their database interfaces. The institutions can develop the resolvers locally using open source software. A few link resolver systems and products are outlined and discussed below.

- **SFX from Ex-Libris** [www.sfxit.com]: One of the most prominent resolver services provides Open URL reference linking from retrieved records to related resources and services and seamlessly links heterogeneous sources of scholarly information. With SFX libraries can define rules that allow SFX to dynamically create links that fully integrate their information resources regardless of who hosts them i.e. the library itself or external information provider.

- **Link finder plus from Endeaver** [www.endinfosys.com/prods/linkfinderplus.htm]: Provides the users with links to full-text of articles from a citation on a publisher or database web site using Open URL. It can also link to relate e-resources, such as search engines, online bookseller etc.

- **1cate from openly** [www.openly.com/1cate/]: It is an e-journals access and linking system including cross-ref, Open URL and Journal seek linker, title search and alphabetical title lists.

- **Sirsi** [www.sirsi.com/sirsiproducts/openurl.html]: makes available citation information by providing full text of the articles, professional reviews, author information and other related information free or licensed to which the library has access.

- **Webbridge from Innovative Interfaces** [www.iii.com/products/millenniam/digitalcollections.html]: It can include content enrichment such as book-jacket images and book reviews. Links are dynamic, contextual and library defined. It is compatible with Open URL, cross-ref and DOI.

- **Link Source from EBSCO** [www.linkresolver.com]: Its Open URL resolver is designed specifically with the needs of research oriented institutions. With its simple menu-driven interface, libraries can add specific item level linking to a wide variety of online information resources.

- **Article linker from serials solution** [www.serialssolutions.com/home.asp]: It is Open URL link resolver that can link all the library resources and supplies navigation path to the contents of library collections.

Some of the other resolvers are outlined below:

- Open Resolver UKOLN [http://www.ukoln.ac.uk/] from UK office for library and information networking.

- Link management from ISI [www.isinet.com]

- Fretwell-Downing's OL [http://www.fdusa.com/products/olt.html]

- Link Solver from Ovid [www.ovid.com]

- Ulrich resource links [www.resourcelinker.com]

- Vlink [www.vub.ac.be]

- Journal finder from University of North Carolina-Green Sbro

- Goldrush from CARL

Some link resolver vendors offer local host as well as remote host solutions. In local host solutions library has the total control over the resolver, whereas in a remote host solution the library will have certain amount of restrictions. One advantage of remote host solution through the vendor is that the vendors are responsible for updating the knowledge base and keeping it accurate. Whereas with local resolver system, the library has the responsibility for maintaining the hardware, software, updating the knowledge base and providing the link resolver with current and accurate data.

## 9.    Integrating The Open URL With DOI/Cross-Reflinking

Other standards that are often mentioned in relation to linking functionality are the DOI and cross-reference. An important discussion of the Open URL linking framework today is its integration with the DOI / Cross-ref linking solution. Cross-reference and DOI provide persistent identification of scholarly content and centralized linking to full text and other resources designated by the publisher.

Cross-reference is an open linking system designed for identifying and linking to journal full text articles provided by publishers. It does not contain full text contents of articles, but enables the publishers and other organizations to create links using Digital Object Identifier (DOI). A DOI is an alphanumeric name that identifies digital content, such as books or journal article and point to the content on the publisher's web site and to publisher designated resources. DOI's are tagged to object / resources metadata supplied by the participating publishers and are paired with the object's electronic address or URL. They provide persistent links even if the URL for the content site is changed. For e.g. The publisher migrate content from one production system to another or the contents move from one publisher to another etc, the links to that content keep functioning by simply updating the DOI directory.

But the cross-reference DOI system does not indicate whether the library has access to the full text of a publisher's work. "Although cross-reference is designed for linking to publishers and Open URL is designed for linking to libraries, when put together the two technologies become incredibly powerful. Open URL can embed cross-reference and cross reference DOI's can be used to send Open URL to libraries" [21].

Cross-reference provides a single source for linking reliably to hundreds of publishers, without the need to track varied metadata-based linking schemes. Therefore, link resolvers benefit from using the DOI wherever linking to publisher designated resources is appropriate [22]. Link resolvers can use the cross-ref system to retrieve the DOI as Open URL and cross-ref systems are compatible and work together. The DOI directory where link resolution occurs in the cross-ref system is Open URL enabled. When a user clicks on a DOI, the cross-ref system redirects that DOI to the users Open URL link resolver and allows the DOI to be used as a key to pull metadata out of the cross-ref database. As a result through cross-ref DOI's persistent links to appropriate resource is provided. Since hundreds of publishers use DOI, it will expand full-text access to the resources through the local Open URL link resolver.

**10.    Advantages for Libraries**

The various advantages that Open URL provides for the libraries are outlined below.

- This technology can maximize the value and usage of available electronic journal subscriptions.

- Users can send the Inter library loan or document delivery request of the bibliographic item, which the library professionals provide, to requester through document delivery system services.

- It allows users to gain fully integrated access to articles contained with full-text databases of electronic journals, library catalogues etc.

- Users are provided easier access to valuable, quality information without having to search individual subsets separately.

- Libraries can include local databases and services in the Open URL link server e.g. local news database etc.

- From the link menu on the link server services, users may find some resources, which they did not know about i.e. hidden resources, can be made more visible.

- Users can be accorded a link to the electronic full-text from an aggregator or from the publisher directly, in addition to library catalogues, for details of the physical copy.

- As Open URLs are context-sensitive because they know the user's context, therefore the appropriate copy problem is dealt with. The library has control over the contents of database, the links system can present only links that are relevant and accessible to the user.

- Users can have access to the resources of the library as well as the external resources through the link service even when the library is closed.

- Saves the library professionals time as users can go straight to the article without need for staff intervention.

- Helps to promote electronic resources usage and proper utilization.

**11.    Conclusion**

The Open URL standard has brought about enormous improvements in linking bibliographic services to full text, document delivery and library holdings. The Open URL mechanism is an efficient way for libraries to automatically offer their users a wide range of pinpointed and exhaustive electronic resource services at the exact moment that the users need the service. This technology change the way user finds, navigate and use the electronic resources at a library. They provide a way to use available digital resources effectively and also provide a better means of collection development, electronic resource management and library administration through the usage statistics reports generated by link resolver systems. While Open URL has typically been used for the article citation, it can also be used to link to many web-accessible items, from audio and video films, virtual reference service, inter library loan forms, Document delivery systems etc.

The interest in the information industry is growing steadily and many vendors are currently evaluating how they could deploy the Open URL for providing better information services. Information resource providers are increasingly making their systems Open URL compatible. This includes content aggregators, content providers, publishers etc. Leading information providers like EBSCO publishing, ISI, Silver platter, Institute of Physics, Bell & Howell, Proquest, Igenta, H.W. Wilson, Swets, Blackwell publishing, Cambridge Scientific Abstract, and many more have made their resources Open URL complaint. Finally it can be concluded in the words of Crawford Walt "If properly implemented, Open URL is a win-win situation. Good abstracting and indexing services become valuable by linking to local resources. Licensed resources and print holdings see more use because link from the identification to holdings is fast and easy. None of this requires fancy new numbers. The information is already there- ISSN, journal and article titles, year, volume and so on"[23]. Thus the future of Open URL technology in digital libraries is promising and secure at least until a substitute technology comes along to replace it.

## 12.    References

1.      [http://www.librarywebchic.net/wordpress/2005/06/13/google-and-openurl-resolvers]

2.      Walker, Jermy (2001). Open Linking for libraries: The Open URL framework. New Library World. Vol 102 (1163/1164) 2001. Pp. 127-133.

3.      Sompel, Vande H & Biet-Arie, Oren (2001). Generalizing the Open URL framework beyond references to scholarly works: The Biston-Fute' model. [http://www.dlib.org/dlib/july01/vandesompel/07vandesompel.html]

4.      NISO Newsline.[Http://www.niso.org/news/newsline/NISOnewsline-may 2005.html]

5.      Walker, Jenny (2003). Open URL and SFX Linking. The Serials Librarian, 45 (3), pp. 87-100.

6.      Mcdonald, John & Velde, Eric F Vande (2004). The lure of linking [http://www.libraryjournal.com]

7.      Caplan, Priscilla & Arms, W.Y. (1999). Reference linking for journal articles. D-lib magazine Jul/Aug 1999, 5(7/8) [http://www.dlib.org/dlib/july99/caplan/07caplan.html]

8.      The Open URL & Open URL framework: Demystifying link resolution. Ariadne, No. 38 Jan 2004. [http://www.ariadne.ac.uk/issue38/apps-rpt/]

9.      Nieuwenhuysen, Paul [Et. Al] (2005). A new role of Libraries and Information centers: Integrating access to distributed electronic publication. [http://www.vab.ac.be/BIBLIO/nieuwenhuysen/presentations/2005-06-elupub-leuven/209elpub2005.content.pdf]

10.     Sompel, Vande H & Beit-Arie, Oren (2001). Open linking in the scholarly information environment using Open URL framework. [http://www.dlib.org/dlib/march01/vandesompel/03vandesompel.html]

11.     Powell, A (2001). Open resolver: A simple open URL resolver, Ariadne, No. 28. [http://www.ariadne.ac.uk/issue28/resolver/]

12.     The Open URL framework for context-sensitive services: Standards committee AX [http://www.niso.org/committees/committee_ax.html]

13.     Mouw, James. Linking patrons to online materials. [http://home.uchicago.edu/~mouw/linking%20SSP%202003.ppt]

14.     Open Linking technology for libraries. [http://www.stic.gov.tw/fdb/tr/2002/c14-SDOS.presentation-E.doc]

15.     Ibid

16.    [http://library.Caltech.edu]

17.    Standards in Libraries: What's ahead (2004). [http://www.TLCdelivers.com]

18.    Ibid

19.    Zhu, Qin (2004). Understanding Open URL Standard and Electronic Resources: effective use of available resources. Program: Electronic library and Information system. 38 (4) 2004, pp. 251-256

20.    [http://library.caltech.edu/openurl/talks/oven&eric_CNI_2001.ppt]

21.    Open URL and link server basics [http://www.openly.com/1cate/basics.html]

22.    Pentz, Ed (2001). CrossRef: A collaborative linking network [http://www.library.ucsb.edu/ist1/01_winter/article.html]

23.    Walt, Crawford (2002). Open URL: Standards can be Fun!. American Libraries. 33(7), Aug 2002 [http://www.ala.org/alaonline/crawford/cf802.html]

**About Authors**

**Shri Rajender Singh** Bist is a Senior Library & Information Assistant at Lal Bahadur Shastri National Academy of Administration, Mussoorie
**Email:** rsbisht@lbsnaa.ernet.in

**Mrs. V Patnaik Mohanty** is a Assistant Library & Information Officer in Lal Bahadur Shastri National Academy of Administration, Mussoorie
**Email:** vpatnaik@lbsnaa.ernet.in