

## Leveraging Access to E-resources through Gateway: A Case Study at St. Stephen's College, Delhi

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### ABSTRACT

The advancement of meta-searching of electronic resources (e-resources) has now become possible with the help of gateway, a communications network technology, resulting in greater control over the resources presentation to the users. This paper describes the importance of gateway in managing the e-resources in college's library system. This paper also highlights the objectives, scope and interdisciplinary relevance of gateway in academic libraries. The paper explains the steps involved in building gateway, such as preliminary preparation, planning and designing, development of online gateway, testing and implementation. Besides this, open archive initiative and protocol metadata initiatives (OAI-PMH) and Z39.50 standards, architecture and features of the knowledge gateway have been discussed in this paper.

**Keywords:** Gateway, electronic resources, college library, open archive initiative, OAI-PMH

### 1. INTRODUCTION

In this digital age, information occupies an important place in our decision making process. Traditional mode of information has been partially replaced with digital information. The libraries are providing information and communication technology (ICT)-enabled services and developing the gateway, portals, institutional repositories, etc., for their clientele. The major purpose of building the gateway is to make it convenient for users to access the relevant material. It enables the users to initiate the searches more quickly with precise results. Knowledge gateway has categorised its resources in five categories, i.e., e-books, college magazine, course contents, videos, and reference sources. Users can start quickly with the help of basic search window; further the results can be filtered to get the desired hits. Knowledge Gateway at St. Stephen's College is an attempt to construct a single search service to save the time of users. Therefore, advancement of a gateway, adding meta searching and other tools into it have resulted in greater control over the way resources are presented to the user community<sup>1</sup>.

### 2. GATEWAY

Gateway is a network node in which different e-resources from numerous databases can be searched through a single window on the computer. Gateway is a service to deliver resources to the

end user through a single search interface. The general purpose of a gateway is to allow the users to find the cross-references information from different sources by searching and browsing. Lakos<sup>2</sup> explained that gateway is a customised transactional web environment, designed to enable an individual user to 'personalise' the contents and look of the website as per his/her own preferences. People are aware of the fact that electronic information sources can be developed and maintained through its own native interface. Information can be made available to users through a single window interface and many institutions have moved towards such service by expanding intranet based access of e-resources to remote access of e-resources. Anderson<sup>3</sup> stated that library and resource centers build the gateway because they contribute to organisational strategies, meet the needs of target user groups and benefits outweigh the costs.

### 3. NEED OF KNOWLEDGE GATEWAY

Library and information resource centers have been benefited with the application of ICT to preserve the printed material in digital form. Students and teachers need all the relevant information at a single place. The need arose to archive all the publication of the college so that it gives the users access to the inter-disciplinary research at a single place and relevant material could be harvested and a single interface could be provided to the

users. Knowledge gateway is the natural outcome of these efforts and is mainly based on concepts of 'sharing' the online material with users spread across the globe.

#### 4. OBJECTIVES

Gateway at St. Stephen's college was initiated with the following objectives:

- To develop a mechanism for collection, storage, and preservation of relevant study materials for students and teachers
- To bring together significant resources for education and research on a single platform for easy access to various study materials like course material, question papers, syllabus, college magazine, research papers, etc.
- To facilitate easy availability of content to students and teachers encouraging interdisciplinary learning and research, and
- To enable both the student and teacher communities to share scholarly information.

#### 5. SCOPE OF GATEWAY AT ST. STEPHEN COLLEGE

The first aim of the project was to establish an institutional repository (IR) and second to develop a mechanism to access the harvested course contents through single window. It was decided to use DSpace on Centos (Linux) for the purpose and used PHP (Hypertext Preprocessor), AJAX (Asynchronous JavaScript and XML), MySql technologies to build knowledge gateway. The five aspects of a gateway defined are as follows:

- Organisation of information sources in single window service
- Aggregating information services and web-based tools
- Personalising as a digital environment
- Integrating data in the gateway service, and
- Construct a digital space.

Figure 1 shows the homepage of the knowledge gateway that contains link of many open access (OA) journals portals, forums, institutional repository and latest news for the benefits of end users.

**Table 1. Types of documents added in knowledge gateway**

S. No.	Module	Items	Format
1.	Course contents	700	MS-Word, PDF (Harvested)
2.	Course videos	250	MOV, AVI (Harvested)
3.	Question papers and syllabi	200	PDF
4.	e-books	1217	PDF
5.	Stephanian magazine	259	PDF
6.	Kooler talk	22	PDF
7.	Ask (Science newsletter)	3	PDF
8.	SOUL	2	PDF
9.	Research papers	363	MS- WORD, PDF
10.	Rare photographs	133	JPEG,PNG PNG
11.	E-reference Sources	60	Open access
12.	News clipping	285	PDF
13.	Misc.	50	PDF, MS-Word

**Figure 1. Screenshot to browse the collection subject-wise (www.kgateway.net).**

Knowledge gateway was built up to enhance the inter disciplinary and cross departmental research. The subject area in its fold has thus imbibed applications from diverse subjects like; Psychology, Statistics, Linguistics, Management Science, Computer and Communication Technology, and also from many others. It contains e-books, course contents, videos, question papers, syllabi, etc., from diverse subject areas. Various OA reference sources, journals, etc., have been identified under the project from diversified information sources.

Table 1 shows the documents contains in knowledge gateway. ASK (Ask seek Knock) is science newsletter of St. Stephen's College), SOUL (Stephanians on Universal Life) are the publications of the students' societies in St. Stephen's College.

## 6. LITERATURE REVIEW

Several studies have been carried out in various organisations around the world on gateway. Caswell & Wynstra<sup>1</sup> stated that using the JAVA script and HTML search forms can be created for databases and catalogues. This search interface is very useful to inexperienced users. Jefcoate<sup>4</sup> described that the project was launched with the aim of providing a well-founded service and building up exposure of British Library services and collections by adding home pages for directorates and departments. Caswell & Wynstra<sup>1</sup> shared their experience about library gateway and elaborated that the gateway is all about providing new opportunities and extends the functionality of library systems. Achieving simplicity among the complex array of bibliographic and full-text resources is critical. Besides this, the key features of library gateway are quick searches, A-Z list of database and categorisation by subject. The processes include mainly the query formulation, submitting the search terms, evaluating the hits and refining, and resubmitting the search terms. Tiefel<sup>5</sup> elaborated the gateway goals as being: to find, evaluate, and select materials that meet their needs regardless of format; and to apply information-seeking and critical thinking skills with a high degree of independence.

Jefcoate<sup>4</sup> expressed his opinion about the Gabriel project initiative to access the European national libraries represented in the Conference of European National Librarians (CENL), providing a single point of access, resulting in for the retrieval of information about their services and collections. Warwick<sup>6</sup>, *et al.* found that the university library website was considered to be the most important resource, even compared to popular search engines. Reference sources are more significant compared to the primary sources of information. Munshi<sup>7</sup> elaborated on the subject of gateway that emphasised on interoperability of digital repositories help to build subject gateways to facilitate one-stop shop and

easy access to the galore of resources contained in these digital repositories, to improve the access to scholarly digital resources on world wide web. Ward<sup>8</sup> discussed the gateway, which was built up to provide the electronic resources to nurses, midwives, and allied health professionals in UK. It provides speedy access to resources that have been quality filtered. Usage data for the gateway are incorporated, which validates the need for the service and that it is well used. Kotulaa<sup>9</sup> described that Web 2.0 tools play a significant role to share and access the information on the web and subject gateway must use these techniques to make the web bibliographic resources more useful. Krishnamurthy<sup>10</sup> described that despite the diversity of search engines in use and the creation of search tools, there is still a need for human intervention to direct the search process by adding a subject gateway. He addressed the issues of metadata integration while developing the subject gateway for users.

Noh<sup>11</sup> recognised five elements: Contributor, source, data, format, and relation as necessary input elements. It was also found that the most chosen elements when searching for reference resources were found to be title, subject, description, and creator, in order of frequency. Besides this, researcher described that the users' satisfaction was relatively high in system usefulness, ease of system use, ease of understanding information, and sufficiency of metadata elements. A unique system was developed by Kim<sup>12</sup>, *et al.* which integrated digital library (DL) system using the interoperability as well as harvesting method which integrates the federated search of non-OAI and OAI repositories, it leverages the access to digital resources using an intelligent system. This system is very useful for the users to get timely and easy access of the digital resources.

Sial<sup>13</sup> stated that many experts were interviewed before developing a theoretical framework and a simplified software-based prototype system was constructed. Study found that the distributed resources are on the web, and stated in order to provide cross-browsing service a middleware service is essential to integrate technically and semantically the different terminology resources. Back & Bailey<sup>14</sup> shared their experience that various techniques for integration are based on HTML, AJAX, etc. This technology can be implemented without any programming skills or expensive hosting charges.

## 7. METHODOLOGY

System analysis is the study of a set of interacting entities, including computer systems analysis. It is a process of collecting information from various sources, identifying problems and providing reasonable suggestions to improve the system's functioning. This method also involves understanding the business

processes, gathering operational data, finding out bottlenecks and evolving solutions to surmount the weaknesses of the system so as to achieve the organisational goals. The system analysis and design (SAD) is used in this project for designing an online knowledge gateway. Furthermore, the methodology is divided into four phases:

(a) Preliminary Preparation

This is first phase which focus on the preliminary preparatory aspects which includes the study of the target audience. Identify the useful websites and the relevant videos, news, college magazines, and various publications of college, research publication of staff and out-of-copyrights books.

(b) Planning and Designing

This step covers the various aspects, such as: selection of programming language, relational database for backend and searching techniques/procedures/models, data security, network security, and web 2.0/3.0 tools to incorporate in the gateway.

(c) Development of Online Knowledge Gateway

This section includes the preparation of software, data structures metadata, search form, datasheet, and retrieval of information. An institutional repository (IR) was created using open source software, DSpace.

(d) Testing and Implementation

The testing of proposed gateway related to search strategy and techniques, bugs and implementation of designed knowledge gateway for searching on the internet (as an open access) was taken up in this phase.

## 8. GATEWAY DEVELOPMENT

### 8.1 Design Tool Used

Based on the first phase, i.e., preliminary preparation and keeping in view the technology requirements of the end-users in accessing the database, the knowledge gateway was developed. The software tools used for designing and developing the knowledge gateway are as follows:

- Dreamweaver
- RDBMS MySQL
- JAVA
- PHP
- AJAX
- DSpace (DL Software)

### 8.2 Knowledge Gateway Architecture

The knowledge gateway of St. Stephen's College included various pieces of functionality, such as: account creation and user registration, collection

harvesting, metadata editing and linking the full-text documents. Metadata entry of question papers and syllabi, course contents, video contents are complex processes. Course contents were based on the undergraduate syllabi of the University of Delhi. Contents of the gateway can be browsed subject-wise as indicated in the Fig. 1.

### 8.3 Standards

In designing a gateway, a vital issue is to maintain the standards, whether it is bibliographic standard or citation standard, as this will lead to cross reference search among various databases. Numerous available metadata schemas are being used as suitable baseline. To build a cross-gateway searching, there are standards such as Z39.50, for data export or import, and proxies which query repositories simultaneously across multiple servers<sup>7</sup>.

Z39.50 enables computers to communicate to other computers and helps to retrieve information from other databases. Z39.50-compliant database contents can be imported directly and modified. Many requests can be made to the Z39.50 gateway such as ExecSearch, GetState, Exec Present, and Stop Search.

A format of XML-based query is:

```
<Request Type="ExecSearch">
<Query>someQuery</Query>
<RecordSyntax>xml</RecordSyntax>
<ElementSet>S</ElementSet>
<Targets>
<Target>
<ID>5</ID>
<Host></Host>
<dbName></dbName>
<Port></Port>
</Target>
</Targets></Request>
```

Z39.50 has a function for search management, e.g., results sets, sorting results sets, opening closing connections. Attribute sets can be used to describe the access points and record syntax are used to transfer records. Lynch<sup>15</sup> defined the three approaches of making the client server interoperable are:

- (i) Extend the client to know about the characteristics of the new logical class of information
- (ii) Automatically mapping the semantics of attribute set already known to the client to the logical access points relevant for the new class of information, and
- (iii) Have the client obtain automatic configuration information from the server or a third party which allows similar mappings to be performed at the client. In the server side, the abstract system is mapped onto the interface and communication between client and server is well defined<sup>16</sup>.

**8.4 Interoperability**

Caplan<sup>17</sup> has defined interoperability as the ability to perform a search over different databases and obtain meaningful results. It helps to connect the incompatible systems. Paepcke<sup>18</sup>, *et al.* classified the approaches of interoperable system as:

- (i) Standardisation (e.g., schema definition, data models, protocols)
- (ii) Distributed object request architectures (e.g., CORBA)
- (iii) Remote procedure calls
- (iv) Mediation (e.g., gateways, wrappers), and
- (v) Mobile computing (e.g., Java applets).

As far as the interoperable metadata is concern, Dublin Core metadata elements were defined to search information on the web in networked environment. It has attracted a cross section of resource description communities and support high degree of interoperability among communities<sup>19</sup>.

**8.5 Metadata Harvesting Protocols**

Metadata harvesting protocol is a set of rules for harvesting metadata from different sources. Specified set of protocol guides and helps to harvest metadata to start service to search it at single place and guide the users to access the full-text from individual repository. The major need of metadata harvesting protocols is to finding means to discover easily the already existing electronic contents.

Open archive initiative-protocol metadata harvesting (OAI-PMH) is widely adopted interoperability standard in metadata harvesting to build gateways. OAI-PMH is widely received, and has mainly been applied to make Dublin Core metadata about scholarly objects contained in distributed repositories and make them searchable. Maly<sup>20</sup> defined OAI as standard, open interface between data providers and service providers to implement digital library interoperability based on the harvesting approach. Data provider needs to be open in as far as it needs to support the OAI metadata harvesting protocol. OAI has its roots to enhance access to e-print. OAI-PMH can successfully be used as an apparatus to maintain state in scattered systems repositories as a means of increasing the availability of scholarly communication.

OAI-PMH metadata formats outcome in a consistent and attractive approach for incremental harvesting of resources and used to make the usage information harvestable. It yields a robust and general solution to the resource harvesting problem<sup>21</sup>.

The use of OAI-PMH has simplistic and convenient features compared to Z39.50. Its centralised search mechanism makes it apart from other distributed search protocols. It only centered on the set of

rules to move metadata rather than contents of one digital repository from another<sup>7</sup>.

**8.6 Gateway Workflow**

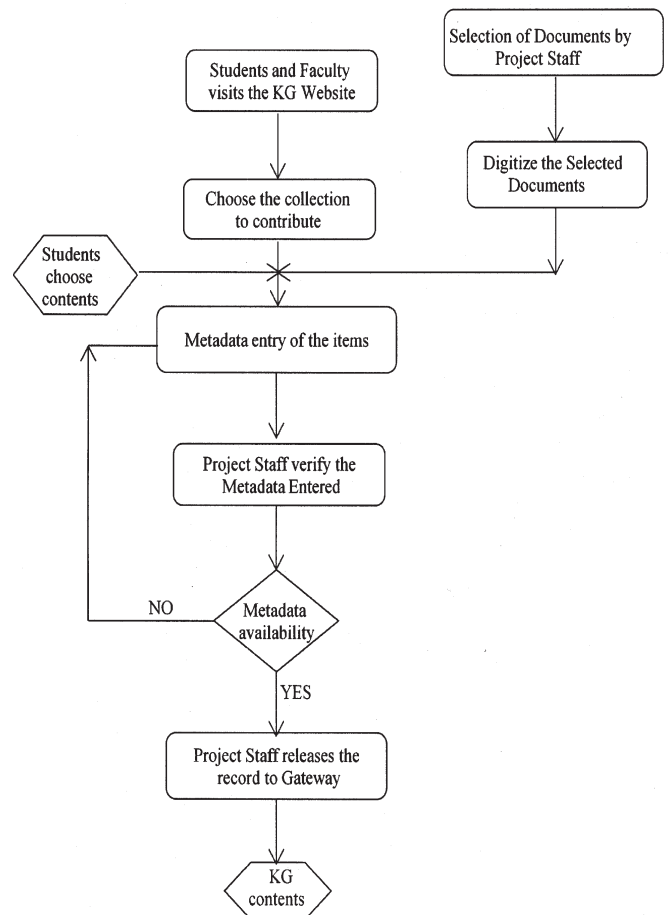
The workflow of the gateway includes several steps such as:

- (i) Selection of documents, including of copyrights and out-of-copy-rights documents and e-contents need to harvest
- (ii) Digitise the selected documents
- (iii) Metadata entry
- (iv) Verification of metadata
- (v) Metadata availability, and
- (vi) Publish the contents on the knowledge gateway.

Each step in the workflow has significant impact on each other for successful design of knowledge gateway (Fig. 2).

**9. FEATURES OF KNOWLEDGE GATEWAY**

In view of the students and faculty information needs, many gateway services were started in



**Figure 2. Workflow of knowledge gateway.**

western countries but with the advancement of ICT, this service needs to be updated periodically. The knowledge gateway developed at St. Stephen's College has some general features such as:

#### **(a) Interactive Interface**

Gateway has interactive interface and assist the users to search, retrieve and display the contents of knowledge gateway. GUI helps the users to interact with the system and alter search methods and optimise the search. Users can login with account name and password to make it convenient to save the searches and further strengthen the contents handling during the use of this gateway.

#### **(b) Method of Searches**

Gateway offers basic as well as the advance searches. Basic search facilitate the users to search the collection using the keyword, phrase or any indicated bibliographic field. Besides this, advance search empower the users to use the Boolean operators, i.e., AND, OR, NOT, Wild card operator, Proximity operator. Users can broaden and widen their searches using these operators. Users can filter the search results by course contents, video, question papers, etc. Users can browse the collection subject wise and further under the classified subject headings.

#### **(c) Access Points**

Gateway enables users to search the contents in a variety of ways to conveniently get the desirous items. Gateway has given access to title, author, keyword, subject, etc. Collection of IR can be searched individually with title, creator, subject, and keyword. Abstract can be searched through the common interface of the collection. Controlled vocabulary of IR is assigned using the Sears List of Subject Headings. Citation is indicated in each item using the MLA 7 style of standard.

#### **(d) External Links**

Using the hypertext several external resources are linked on the gateway including the open access reference sources such as dictionaries, almanac, statistical source of information, geographical sources of information, encyclopedias including subject and general, patents and standards and current information sources.

Knowledge gateway is a comprehensive source of information for undergraduate students of University of Delhi, wherein many open access electronic books websites such as:

- (i) Techbooks
- (ii) Project Gutenberg
- (iii) PDF e-books archive, and
- (iv) Google e-books etc are linked.

E-thesis and dissertations websites NDTLD (Networked digital library of theses and dissertations), ERIC (Education Resources Information Center), UMI database, ProQuest dissertations are also linked on kgateway.net.

#### **(e) Discussion Forums**

Many discussion forums are created to provide the platform to discuss their area of interests. Virtual discussion platform help the users to widen their knowledge horizons and develop their skills. The alert of forum can be harvested using rich site summary (RSS) web 2.0 tools. These forums' archive can be searched using various descriptors.

#### **(f) Question Papers and Syllabi Retrieval**

In the first phase of developing the retrieval mechanism of question papers and syllabi module, the collection of question papers and syllabi was digitised. An administrative interface to enter the metadata was developed and a combo-box helped to search and retrieve information from the collection of question papers and syllabi simultaneously.

#### **(g) Social Networking Tools Applications**

Social networking tools has changed the functioning of gateway, knowledge gateway is fully compliant with social networking tools such as face book, twitter, disques, etc. Each content can be shared on these SN tools using the utility. Individual contents can be discussed on Disques' virtual platform. Users can also access the discussion on individual content through the RSS.

### **10. HARVESTERS**

A harvester works as a service provider to collect metadata from a variety of repositories; it processes the OAI-PMH requests in the scheduled manner<sup>7</sup>. Harvesters include resource, item and record to the repositories. One of the popular harvesting open access software is Public Knowledge Project (PKP); it is open source, released under the GNU General Public License.

Open Harvester System is a open source metadata indexing system; it was developed by PKP. It can harvest the different schemas and using cross walked basic and advanced search can be performed. PKP harvester has the ability to do granular harvesting. It can execute the post harvest and pre-indexing filtering. The interface can be highly customisable using cascading style sheets and HTML templates. Searching is highly scalable and site can be navigated easily. OAI harvester has two additional fields, OAI-base URL and Meta data format. It is based on the concepts of archives, records, entries, and schemas, fields, and highly structured for maintainability, flexibility, and robustness.

Using the plug-in many features such as filtering harvested data and extending metadata handling can be added in the harvester. With the help of harvester a common search interface of various repositories can be created. OAISTER (<http://www.oaister.org>) is a perfect example of such service; it is the collection of harvested open access resources. Presently, it provides more than 25 million records representing more than 1100 repositories including a variety of material including digitised books, journal articles, newspapers, manuscripts, audio files, video files, images, data-sets, theses, and research papers, etc.

Open Harvester System (<http://drtc.isibang.ac.in/sdl/index.php/browse>) at DRTC (Documents Research Training Centre) has targeted the four digital repositories namely:

- (i) E-LIS: E-Print in Library and Information Science
- (ii) Librarian's Digital Library
- (iii) Cranfield CERES, and
- (iv) DLIST (Digital library of information science and technology).

It has more than 25000 records. It is a subject based harvesting service for library and information science professionals. It can be searched with the help of title, contributor, coverage, collection, description, publisher, relation, rights, source and date wise.

## 11. CONCLUSIONS

The feedback received from staff and students reveal their appreciation of the quick searches to find the relevant contents, as it saves a lot of users' time that they otherwise spend visiting different databases. Besides this, the use of social networking tools empowers users to share and comment on individual e-contents. This facilitates to discuss particular course contents on a virtual platform. The basic and advanced search features were incorporated in the knowledge gateway interface, it was also realised that the concept search and filtering of results have made the search more precise and powerful. Abundance of information created with the help of ICT has put the LIS professionals under tremendous pressure to teach the users accessing of resources efficiently and effectively. Knowledge gateway features demonstrate themselves as marvelous tools to guide the students and teachers to get the relevant information expeditiously in the shortest time.

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