

Full Length Research Paper

An evaluative study on the open source digital library softwares for institutional repository: Special reference to Dspace and greenstone digital library

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The Dspace and Greenstone Digital Library Software have helped spread the practical impact of digital library technology throughout the world, with particular emphasis on developing countries. As Dspace and Greenstone enters its second decade, this article takes a retrospective look at its development, the challenges that have been faced, and the lessons that have been learned in developing and deploying a comprehensive open-source system for the construction of digital libraries internationally. Open source digital library packages are gaining popularity nowadays. To build a digital library under economical conditions open source software is preferable. This paper tries to identify the extent of adoption of open source digital library software packages in various organizations through an online survey. In this paper an on line survey has been done to find out the usability of these open source digital library software. It lays down the findings from the survey. In this paper also try to compare with the features of this popular OSS digital library software.

Key words: Open source software, digital library, greenstone digital library, Dspace.

INTRODUCTION

Open-source software (OSS) is software for which the source code is freely available for anyone to see and manipulate. There are various licensing models to which the OSS label has been applied, but the basic idea is that the software's "license may not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs" and the working software must either be distributed along with its source code or have a "well-publicized means of downloading the source code, without charge, via the Internet." That is, anyone can access and manipulate the code that was used to write a program, as long as anything that person comes up with using that code is also offered to the public as OSS. This allows those who use the software to contribute to its further development fix bugs and tinker with it as they please. This is contrasted with proprietary software, which is distributed as compiled object code or machine code, leaving the

source code solely under the control of the individual software vendor. Open source software has become a trendsetter in the arena of software development and distribution. The development of open source software was a reaction to the existing legal instrument on software copyright from the software developer's community. Open source softwares are available free of cost and users have the freedom to run and distribute the software without any restriction. Normally small and medium size libraries feel automation of house keeping operations as a financial burden due to the high price of Library Management Systems (ILS). Development of open source software gives effective way to create digital library operations without financial investment (Lee, 2009).

OBJECTIVE OF THE STUDY

The objective of the present study is to look into the technologies and tools available in the open source world that can be used in improving the services within the

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libraries.

OPEN SOURCE SOFTWARE MOVEMENT

The history of open source software began with the early stages of computer and software development. At that, time programmers and developers frequently shared their software freely. Advent of companies in software development with the aim of profit making restricted the culture of sharing source code of software. Milestones in the history of open source Software is:

- 1983 - Richard Stallman formed GNU project.
- 1985 – Creation of Free Software Foundation.
- 1991 – Development of Linux kernel by Linus Torvalds.
- 1998 – Open Source Initiative (OSI) formed by Eric Raymond.

The two terms, “free” and “open source” has used synonymous for free distribution of softwares. Popular licenses used for this purpose are the GNU General Public License (GPL), BSD license, GNU Lesser General Public License, MIT License, Mozilla Public License and Apache License. All these licenses have some differences in their terms and conditions; they ensure users freedom to use, copying, distribution and improvement of software. Fundamentals of these licenses are similar to the philosophy of Free Software Foundation. “Free software is matters of the users’ freedom to run, copy, distributes, study, change and improve the software” (Kumar, 2008).

REASONS FOR CHOOSING OPEN SOURCE SOFTWARE

Price of the library software is very high; most of the libraries are not in a position to buy high priced commercial software due to severe budget constraints. Biswas et al. (2008) has mentioned various advantages of open source like unrestricted use; free of cost; community involvement in development and maintenance of software; competence compared to other commercial softwares; and the issues of copyright etc. The obvious recognized reason for the organizations like libraries to choose open source software for automation purposes is ‘no cost’. There is no restriction but everyone can use, study, modify and distribute the open source software, regardless of a person’s position, wealth, social conditions etc. The social aspect of the open source software is tremendous. The development and maintenance of this type of software can be done with community-based activities. Anybody can contribute the social group engaged in its development. “Open source software projects encourage innovation and collaboration of community members.” Peer group members are very

much involved in these activities. It is also the reason in favour of open source software as it is interoperable, customizable according to the needs and standards. The most judicious reason in favour of the use of open source software is the legal aspect. The licenses are committed to users’ freedom of use, modify and redistribution of the programme.

DEFINITION

According to Wikipedia A digital library is a library in which collections are stored in digital formats (as opposed to print, microform, or other media) and accessible by computers. The digital content may be stored locally, or accessed remotely via computer networks. A digital library is a type of information retrieval system. The first use of the term *digital library* in print may have been in a 1988 report to the Corporation for National Research Initiatives The term *digital libraries* was first popularized by the NSF/DARPA/NASA Digital Libraries Initiative in 1994. The older names electronic library or virtual library are also occasionally used, though *electronic library* nowadays more often refers to portals, often provided by government agencies, as in the case of the Florida Electronic Library. The *DELOS Digital Library Reference Model*/defines a digital library as:

An organization, which might be virtual, that comprehensively collects, manages and preserves for the long term rich digital content, and offers to its user communities specialized functionality on that content, of measurable quality and according to codified policies.

Advantage of digital library

Digital library has certain characteristics, which make them different from traditional library. It has expansive and accurate system of searching with large volumes of text, image and audio-video resources. Digital libraries do not need physical space to build collection and it can be accessed from anywhere, any time. Different people can access same source at the same time. The advantages of digital libraries are mentioned herein below:

- Preserve the valuable documents, rare and special collections of libraries, archives and museums.
- Provide faster access to the holding of libraries world wide through automated catalogues.
- Help to locate both physical and digitized versions of scholarly articles and books through single interface.
- Search optimization, simultaneous searches of the Internet make possible, preparing commercial databases and library collections.
- Offering online learning environment.

- Making short the chain from author to user.
- Save preparation/ conservation cost, space and money.
- Digital technology affords multiple, simultaneous user from a single original which are not possible for materials stored in any other forms

DSPACE DIGITAL LIBRARY SYSTEM

The Dspace is a joint project of the MIT Libraries and HP labs. Dspace is a digital asset management system. It helps create, index and retrieve various forms digital content. Dspace is adaptable to different community needs. Interoperability between systems is built-in and it adheres to international standards for metadata format. There are various reasons to choose this software: Dspace is an open source technology platform which can be customized or extend its capabilities.

- Dspace is a service model for open access and/or digital archiving for perpetual access.
- Dspace is a platform to build an Institutional Repository and the collections are searchable and retrievable by the Web.
- To make available institution-based scholarly material in digital formats. The collections will be open and interoperable.

Institutional repository is a set of services that a research institution/ organization/ University offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members

Major features of Dspace

The following sections describe the three major features of Dspace:

- 1) Lucene search engine and query language
- 2) Handle system
- 3) OAI-PMH

Lucene Search Engine: Dspace uses Lucene Search Engine, which is a part of Apache Jakarta Project (6). The syntax of the queries is given below.

Exact term: The search term can be a word or a phrase. One can use a search word, e.g. "Information" or a phrase "information retrieval".

Fielded search: One can search for a term in a particular field. e.g.: author: jaba title: web keyword: ocr Abstract: digital.

Wild cards: The symbol '?' is used for a single character, as in 'te?%' that matches words like 'test', 'text' etc. The

symbol '*' is used for multiple characters matching, as in "inf*" matches with information, informatics, etc.

Fuzzy search: One of the popular fuzzy search algorithms is Levenshtein distance algorithm named after the Russian scientist Vladimir Levenshtein, who devised the algorithm in 1965. It is also called 'Edit Distance algorithm'. Levenshtein Distance (LD) is a measure of the similarity between two strings, which we will refer to as the source string (s) and the target string (t). The distance is the number of deletions, insertions, or substitutions required to transform s into t. For example, • If s is "test" and t is "test", then LD(s,t) = 0, because no transformations are needed. The strings are already identical. • If s is "test" and t is "tent", then LD(s,t) = 1, because one substitution (change "s" to "n") is sufficient to transform s into t. The Levenshtein distance algorithm has been used in:

- Spell checking
- Speech recognition
- DNA analysis
- Plagiarism detection

In Dspace implementation, one can use in the following way: Example: author: sanker~Can match Shankar. It can notice, the search word has 'sa' not 'sha' and also 'ker' not 'kar'.

Proximity search: Proximity search is used in a query to retrieve documents that have two words or phrases in proximity that is those that appear near to each other. "Information system"~3 Retrieves records where the words 'information' and 'system' are within the three words distance. Thus the above search retrieves the following titles.

Range search: If the search query is: author: [prasad to rao] Then the system retrieves documents authored by names that fall between 'prasad' and 'rao'. Whereas, the query 'author: {prasad to rao}' excludes Prasad and Rao

Boosting a term: Lucene provides the relevance level of matching documents based on the terms found. To Boost a term use the caret, "^", symbol with a boost factor (a number) at the end of the term some one is searching. The higher the boost factor, the more relevant the term will be. Boosting allows you to control the relevance of a document by boosting its term. For example, if some one is searching for Internet web and he want the term "internet" to be more relevant, boost it using the ^ symbol along with the boost factor next to the term. You would type: Internet^5 web by default, the boost factor is 1. Although the boost factor must be positive, it can be less than 1 (e.g. 0.2)

Boolean search: Boolean 'AND', 'OR', 'NOT' are used for Boolean combinations. Boolean operators should be caps.

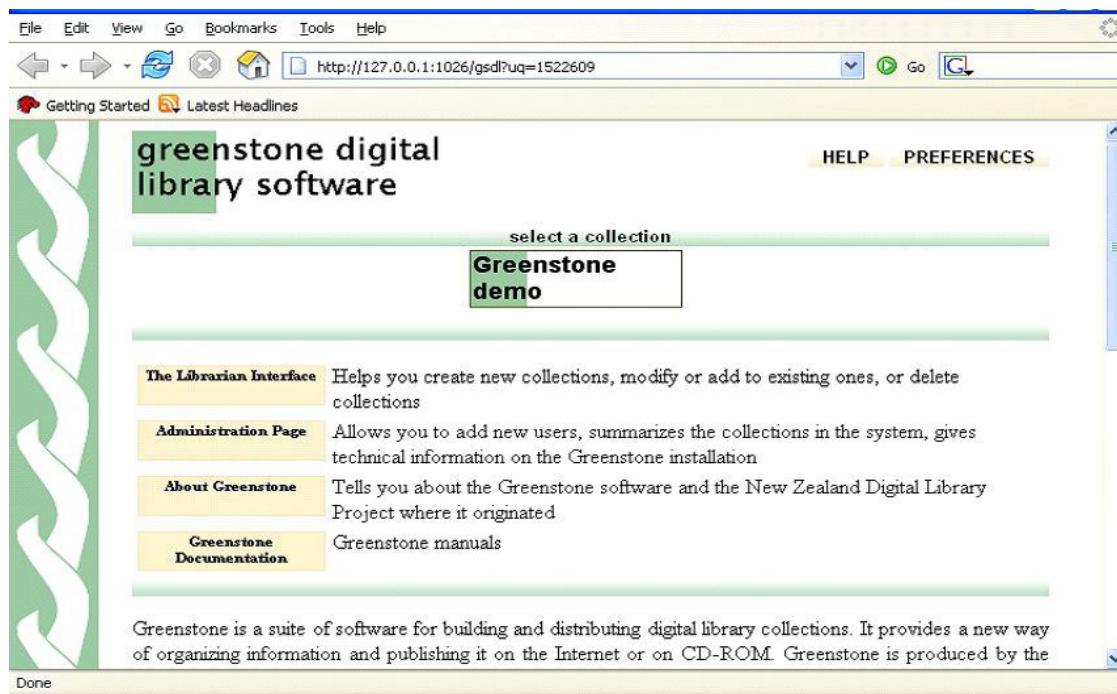


Figure 1. Module of green stone digital library software.

caps.

- 'OR' is the default conjunction operator. One can use '||' instead of 'OR'.
- Either 'AND' or '&' can be used for Boolean 'AND'.
- Either 'NOT' or '!' can be used for Boolean 'NOT'.

Handle system

Dspace makes use of Handle system's global resolution feature; you will also need to set up a Handle server, which is obtained from the central CNRI Handle site. A Handle server runs as a separate process that receives TCP requests from other Handle servers, and issues resolution requests to a global server or servers if a Handle entered locally does not correspond to some local content. The Handle protocol is based on TCP, so it will need to be installed on a server that can broadcast and receive TCP on port 2641. Note that since the Dspace code manages individual Handles, administrative operations such as Handle creation and modification are not supported by Dspace Handle server.

OAI-PMH

The Open Archives Initiative-Protocol for Metadata Harvesting has become the de facto standard for metadata harvesting. Thus service providers of digital libraries can collect metadata, index them and provide better search results. The section is meant for

demonstration of OAI-PMH verbs that may normally be used by service providers. The examples of OAI verbs display output in XML. Though they are not meant for the end user, trying the following verbs give a better understanding of the harvesting protocol.

One can try some of the following OAI-PMH verbs to see the Dspace's output. Identify: Returns general information about the archive and its policies (e.g., dates stamp granularity)

Example:

<http://drtc.isibang.ac.in/oai/?verb=Identify> List Sets: Provide a listing of sets in which records may be organized (may be hierarchical, overlapping, or flat)

Example: <http://drtc.isibang.ac.in/oai/?verb>ListSets>.

GREENSTONE DIGITAL LIBRARY SOFTWARE

The Greenstone Digital Library Software from the New Zealand Digital Library project provides a new way of organizing information and making it available over the Internet. Collections of information comprise large numbers of documents (typically several thousand to several million), and a uniform interface is provided to them. Libraries include many collections, individually organized -- though bearing a strong family resemblance. A configuration file determines the structure of a collection. Existing collections range from newspaper articles to technical documents, from educational journals to oral history, from visual art to videos, from MIDI pop music collections to ethnic folksongs (Figure 1) (Ian et al., 2001).

Special feature

It suits both Windows and Unix (Linux Sun OS) any of these systems can be used as a web server.

- The administration function build in it enables the items to authorize new users to build collection, protect documents so that registered users on presentation of password can only access them.
- It builds collection with effective full-text searching and metadata-based browsing facilities. Collection containing millions of documents up to several gigabytes can be built. Full-text searching is fast because compression is used to reduce the size of the indexes and text users can browse the list of authors, titles, date, class no., etc.
- Plug Ins can be written to accommodate new document types. The collection can contain pictures, music, audio, video clips, etc. It also supports multilingual documents.
- Collection can be updated and new one brought online any time without bringing down the system (Sonkar et al., 2005).

There is also so many open source digital library software available like:

E-PRINTS

ePrints is free software developed by the University of Southampton, England. ePrints@IISc repository collects preserves and disseminates in digital format the research output created by the IISc research community. It enables the Institute community to deposit their preprints; post prints and other scholarly publications using a web interface, and organizes

FEDORA

Fedora is a center for innovation in free and open source software, and creates a community where developers and open source enthusiasts come together to advance free and open source software. The Fedora community contributes everything it builds back to the free and open source world and continues to make advances of significance to the broader community. Fedora is a Linux based operating system that provides users with access to the latest free and open source software, in a stable, secure and easy to manage form members of its community for the management and dissemination of digital material created by the institution and its community members. It is most essentially an organizational commitment to the stewardship of the digital materials including long term preservation. An effective digital preservation and institutional repository of necessity represents collaboration among libraries, information technologies, archives and record managers, faculty and University administrators and policy makers (Wikipedia, Available at <http://fedoraproject.org/wiki/Overview>, 2009).

PRACTICAL IMPLICATION OF DSPACE IN KALYANI UNIVERSITY, WEST BENGAL, INDIA

A workshop organised Department of library and information science of the Kalyani University with the help of Inflibnet. The objective of the workshop was developed knowledge about repository. An IBM server already purchased by the Department. Soon another repository on social science will develop by the department.

COMPARATIVE STUDY OF FEATURE OF GSDL, DSPACE

The features of both digital library software compared by the above table. It is stated that both software are free of cost. In Dspace supported qualified Dublin Core but GSDL supported Dublin Core. Dspace and GSDL both supported MS-Word, PDF, PPTs, JPEG, GIF and GSDL supported MS-Word, PDF, HTML, PostScript, JPEG, GIF etc (Table 1).

ANALYSIS OF ONLINE SURVEY

Distribution of software packages

A search in the Internet for the availability of different digital libraries and digital library software packages retrieved numerous subject oriented, institution oriented and mission oriented digital library projects and a large variety of software packages for digital object management. As an exhaustive study of all them was not possible due to time constraints, two most popular digital library software packages have selected for the study. The selected software packages are Dspace Greenstone [GSDL]. An on line survey has conducted using Google search engine to find out the user or installation Institute of OSS digital library software. In survey www.opendoar.org has also helped. It is the directory of open access repository. It has found that open source digital library software packages in various different parts of the world especially in India Institute like DRTC; Inflibnet Dspace has successful installation and running.

In web survey it has found 72 Institute has installation the repository software various part of the world. It has also found that 7 Installation of GSDL. We have taken only those Institutes which has found on-line. Dspace with 42 installations seems to be the most popular choice among the digital library software packages and Greenstone has seven installations. The other software package it include software like E-Print. Here we have mainly highlighted popular open source repository building software Dspace and GSDL (Tables 2 - 8 and Figures 2 - 5).

It has found 35 educational institutions have installed Dspace software and 5 GSDL. On the other hand 13

Table 1. Comparative study of GSDL, Dspace.

	Dspace	GSDL
Creator	MIT libraries and Hewlett-Packard	University of Waikato
Open Source and Free	Yes	Yes
Operating System	Unices, Linux	Unices, Linux
Language	Windows	Windows
Database	J2SDK v.1.4	Perl
Resource Identifier	Postures 7.3	Its own
Dublin Core	CNRI Handles	No
METS	Qualified Dublin Core	Dublin Core
OAI-PMH V 2.0	Implemented in Version 1.2	No
Subscription	Yes	No
Supported File formats	No	No
	MS-Word, PDF, PPTs, JPEG, GIF.	MS-Word, PDF, HTML, PostScript, JPEG, GIF.

Table 2. Distribution of software packages under study.

Dspace	GSDL	Others	Total
42	7	23	72

Table 3. Country-wise distribution of software packages.

Country	Dspace	GSDL
India	13	4
USA	4	2
UK	1	-
Germany	1	-
Argentina	-	1
Netherlands	1	-
Bangladesh	2	
Azerbaijan	1	
China	2	
Australia	1	
Jamaica	1	
Costa Rica	1	
Belgium	1	
Estonia	1	
Finland	1	
Canada	4	
Mexico	1	
Brazil	1	
Colombia	1	
Ecuador	3	
Venezuela	1	
Total	42	7

Other software like E-print, fedora etc. In the study it

found that Dspace and GSDL are equal installation.

Table 4. Institution category-wise distribution of software packages.

Category	Dspace	Greenstone	Others	Total
Educational institutions	35	5	13	53
Research institutions	6	1	3	10
Consortia	-		4	4
Cultural organizations	1	1	3	5

Table 5. Software distribution among educational institutions.

Category	Dspace	Greenstone	Others	Total
Educational institutions	35	5	13	53

Table 6. Software distribution among research institutions.

Category	Dspace	Greenstone	Others	Total
Research institutions	6	1	3	10

Table 7. Digital library software distribution among cultural organizations.

Category	Dspace	Greenstone	Others	Total
Cultural organizations	1	1	3	5

Table 8. Some examples of repository other than India with URL.

SL No	Software	Institute	URL
1	Dspace	BRAC University Institutional Repository	http://dspace.bracu.ac.bd/
2	Dspace	International Centre for Diarrhoeal Disease Research Digital Repository, Bangladesh (ICDDR,B)	http://dspace.icddrb.org/
3	Dspace	Xiamen University Institutional Repository, China	http://dspace.xmu.edu.cn/
4	Dspace	DSTO Scientific Publications Online Repository, Australia	http://dspace.dsto.defence.gov.au/dspace/
5.	Dspace	University of the West Indies at Mona , Jamaica	- http://www.mona.uwi.edu/
6.	Dspace	Instituto Tecnologico de Costa Rica	http://www.tec.cr/
7.	Dspace	<i>Bolivarium, Venezuela</i>	http://dspace.bolivarium.usb.ve/dspace/

INITIATIVES OF DIGITAL PRESERVATION SYSTEM AND DIGITAL REPOSITORIES IN INDIA

A digital preservation is a digital archive of the intellectual output of an organization/institution. It makes the quality and breadth of scholarship produces at the organisation accessible to others world wide over the Internet. It is a set of services that a University/Organization offers to the term preservation of this wealth of knowledge through digitization projects and digital preservation initiatives. Diverse multi-cultural and multilingual contents are now being documented, preserved with the adoption of Open Source Software System and made available through the internationally acclaimed Digital Preservation and

Repository initiatives such as members of its community for the management and dissemination of digital material created by the institution and its community members. It is most essentially an organizational commitment to the stewardship of the digital materials including long term preservation. An effective digital preservation and institutional repository of necessity represents collaboration among libraries, information technologies, archives and record managers, faculty and University administrators and policy makers (Meitei et al., 2009).

Diverse multi-cultural and multilingual contents are now being documented, preserved with the adoption of Open Source Software System and made available through the internationally acclaimed Digital Preservation and

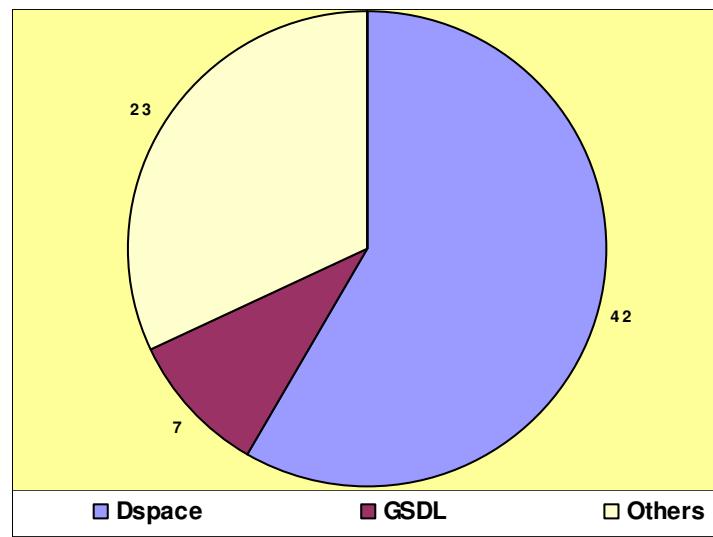


Figure 2. Distribution of software packages.

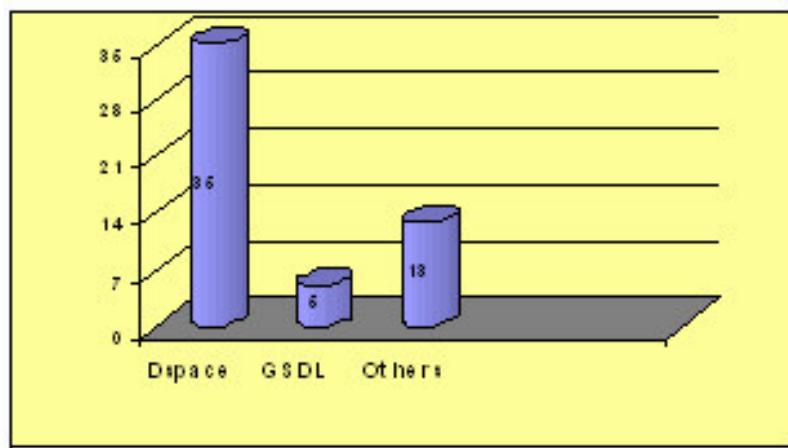


Figure 3. Distribution among educational institutions.

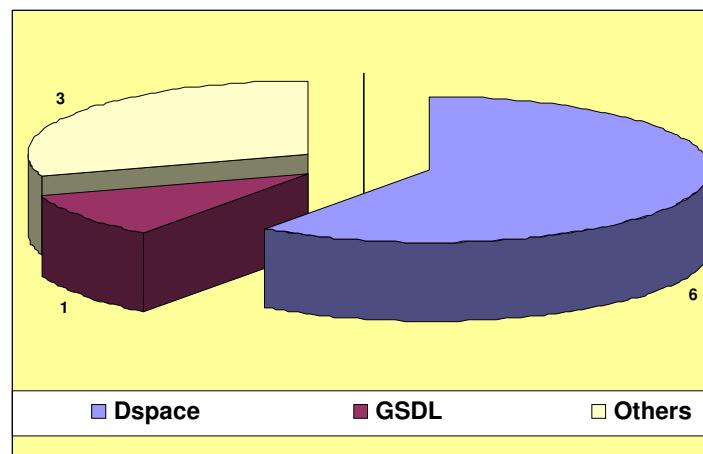


Figure 4. Software distribution among research institutions.

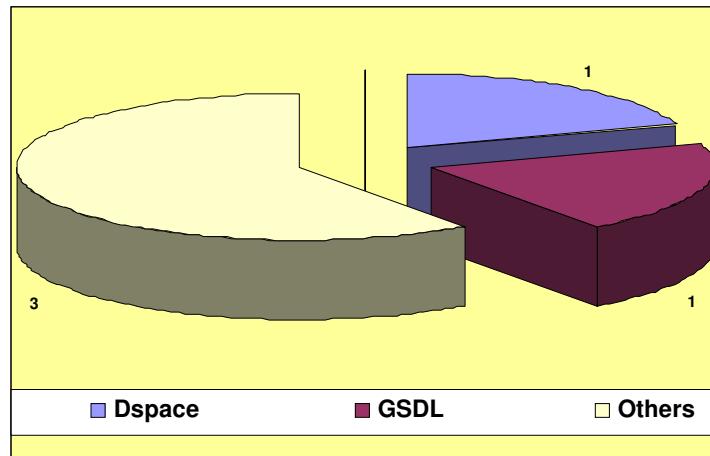


Figure 5. Software distribution among cultural organizations.

Repository initiatives such as (Das, 2008):

National level digital preservations/Repositories:

- Catalysis Database www.eprints.iitm.ac.in
- Software Used: EPrints
- Digital Archive of National Institute of Technology Rourkela <http://dspace.nitrkl.ac.in/dspace/>
- Software Used: DSpace
- Electronic Theses and Dissertations of Indian Institute of Science (ETD@IISc) <http://etd.ncsi.iisc.ernet.in>
- Software Used: DSpace
- Open Access Repository of IISc Research Publications (ePrints@IISc) <http://eprints.iisc.ernet.in/>
- Software Used: EPrints
- IDRC Digital Library <http://idl-bnc.idrc.ca/>
- Software Used: DSpace
- Digital Repository of IIT Bombay <http://dspace.library.iitb.ac.in/dspace/>
- Software Used: DSpace
- DSpace at National Centre for Radio Astrophysics <http://ncralib.ncra.tifr.res.in:8080/dspace/>

Software used: Dspace

- DSpace@IIMK <http://dspace.iimk.ac.in/>
- Software Used: DSpace
- DSpace at National Chemical Laboratory <http://dspace.ncl.res.in/dspace/>
- Software Used: DSpace
- Raman Research Institute Digital Repository <http://dspace.rri.res.in:8080/dspace/>
- Software Used: DSpace
- One World South Asia Open Archive Initiative <http://open.ekduniya.net/Software>
- Used: E-Prints

- Librarians' Digital Library (LDL) <https://drtc.isibang.ac.in/>
- Software Used: DSpace
- OpenMED@NIC <http://openmed.nic.in/>
- Software Used: EPrints

Institutional Repositories:

Digital library:

- Archives of Indian Labour: Integrated Labour History Research Programme www.indialabourarchives.org
- Software Used: Greenstone Digital Library Software
- India Education Digital Library www.edudl.gov.in
- Software Used: Greenstone Digital Library Software
- Vidyanidhi www.vidyanidhi.org.in
- Software Used: DSpace

Conclusion

Open Source essentially empowers less privileged communities though it does not follow that it is meant only for them. There is no denying the fact that OSS enables bridging the digital divide in more ways than one. Libraries in the developing countries are able to support electronic access, digital libraries, and resource sharing because they are able to use OSS. Even libraries in well-developed countries are becoming more inclined towards OSS to improve their services. The Dspace is fairly powerful software. The major advantage of the software is that it allows submission of digital documents by its members. Presently, it lacks METS (Metadata Encoding and Transmission Standard), which will make it much more powerful. Dspace is the most popular among the digital library solutions available in the open source domain. Other digital library software like Eprints is also widely used. Educational institutions dominate in the use

of these packages. However, many institutions have implemented digital libraries, but not all are online. Open access of knowledge is possible only if these repositories has made online. India is benefiting well from the open source movement.

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Annexure 1. Indian Institutions used Digital library software

Software	Institution
DSpace	Indian Institute of Science
DSpace	National Chemical Laboratory
DSpace	University of Hyderabad
Greenstone	Indian Institute of Technology - Mumbai
DSpace	Vidyanidhi - National e-theses repository

Annexure 2.

Software	Institution
GNU EPrints	Indian Institute of Science
GNU EPrints + DSpace	Indian Institute of Management - Kozhikode
GNU EPrints	Indian Medlars Centre, NIC, OpenMED@NIC
GNU EPrints	National Aerospace Laboratory
GNU EPrints	One World South Asia
DSpace	National Institute of Technology - Rourkela
DSpace	Indian Statistical Institute - Bangalore
DSpace	Documentation Research and Training Centre (DRTC)
DSpace	Indian Institute of Technology - Delhi
DSpace	INFLIBNET – Inter University Centre
DSpace	Indian Institute of Astrophysics, Bangalore
DSpace	Raman Research Institute, Bangalore
GNU EPrints	University of Delhi
GNU EPrints	Medknow Publications -MedknowEprints
DSpace	Indian National Science Academy (INSA)
GNU Eprints	Indian Institute of Information Technology
GNU Eprints	Rajiv Gandhi Centre for Biotechnology