ISSN (Print): 0972-2467
ISSN (Online): 0976-2477
SRELS Journal of Information Management, Vol 56(1), February 2019, p. 45-50 DOI: 10.17821/srels/ 2019/v56i1/139265

Dspace or Fedora: Which is a Better Solution?

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Abstract

This paper presents a comparative study of two popular Digital Library Software, Dspace and Fedora. The paper begins with brief descriptions of Open Source Software systems and Digital libraries, and presents a comparison of Dspace and Fedora in two tables based on a set criterion. The study suggests that though Fedora provides the best repository framework as compared to other digital repository software systems, it appeals to high technical end users and as a result there are not as many installations of the software.

Keywords: Digital Library, Dspace, Dublin Core, DuraSpace, Fedora, Metadata, Open Access Initiative Protocol for Metadata Harvesting (OAI PMH), OpenDOAR, Open Source Software, Registry of Open Access Repositories (ROAR), Unicode, Interoperability

1. Introduction

Free and open source software grants users the choice to use, copy, distribute, examine, change and improve the software. These rights are defined in the licenses. Free and open source software require a new kind of competition, different from what is applicable to commercial software as they are not constricted by any cost or fee and can be acquired free of charge via Internet (The Swedish Agency for Public Management, STATSKONTORET, 2003).

Now- a-days libraries are facing challenging situation due to dwindling library budgets and growing demands from users for high end services. It is difficult for small libraries to cope with the problem of finance. With the advancement of technology, libraries are required to provide digital services to local as well as remote users. Infrastructure (e.g. hardware, software) is the main issue for the provision of digital services. Selection of suitable software is the most critical issue. Open source software systems are widely being seen as providing a better option for libraries. There are many open source software packages and library professionals should be techno-savvy so that they can use and handle the software systems and derive maximum benefits from these open source software solutions.

2. Literature Review

Gkoumas and Lazarinis conducted a study to evaluate open source software for Digital Libraries as well as collection management. The findings suggest that open source digital library and collection management tools provide advanced operations and support various metadata and interoperability protocols with user-friendly interfaces. The study suggested that language support for the interfaces should be completed with more languages and some tools with restricted operations must be enhanced to be of practical use Gkoumas & Lazarinis, 2015).

Kumar Das conducted a comparative study of three DL systems, Viz., DSpace, Eprints and Greenstone for establishing digital library. The author developed a comparative chart of the three software systems by examining related documentation and associated technical manuals. While the author recommended, the author also concluded that every package has its own strengths (and weaknesses) that will appeal to various organizations and stakeholders with diverse needs (Kumar Das, 2015). Biswas and Paul explore the usability of popular open source Digital Library software such as Dspace, Greenstone, Eprints and Fedora through online survey. The authors describe the features of the four software packages. The authors concluded that switching to open source software packages is a good solution for libraries with dwindling

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budgets and it can empower less privileged communities. The authors suggested that Dspace is quite powerful and more popular software among the open source DL tools, especially for establishing institutional repositories (Biswas & Paul, 2009).

Pyrounakis and Nikolaidou (2009) conducted a comparative study of five open source software Dspace, Fedora, GreenStone, Keystone and Eprints. Each system was studied based on its unique features and system designs such as object model, collection support, metadata, search and browse, interoperability, etc. The author's identied situations in which a particular software package is appropriate. For instance, if an institution requires a digital repository for scholarly publications and dissertations , the authors suggested that DSpace is the most appropriate software (Pyrounakis & Nikolaidou, 2009).

Kumar assessed DSpace, EPrints and Greenstone using a checklist having different sections and assigning weights to functions. The author rated DSpace as the best solution (Kumar, 2008). DeRidder tried to identify the criteria for choosing the best possible software for creatinga digital library. The author suggested that the librarian should take consider the characteristics such as "usability, interoperability, support costs, and the facility to migrate stuff over time". The author opined that "smart selection needs careful assessment of internal requirements and resources, as well as vigilant assessment of the options" (DeRidder, 2007).

Dion Hoe-Lian Goh, Alton Chua, Davina Anqi Khoo, Emily Boon-Hui Khoo, Eric Bok-Tong Mak, Maple Wen-Min Ng–proposed a checklist for evaluation of digital library software and evaluated four digital library software systems, CDSware, EPrints, Fedora, and Greenstone. Based on the 12 characteristics, the authors found that Greenstone was the only software package that met majority of the criteria in the checklist. In contrast, Fedora and EPrints and CDSware did not perform well (Dion Hoe-Lian Goh et. al., 2006).

3. Open Source Software

Open source software emerged during the 1970s. An American software developer Richard Stallman, considers that distribution of source-code is essential and developed a 'free' version of the widely used 'Unix' operating system. The resulting 'GNU' program was released under a specially created General Public License ('GNU GPL'). This was proposed to guarantee that the source-code would remain open and accessible to all. 'Open source software' was coined as a less controversial and more 'business-friendly' term (The Parliamentary Office of Science and Technology, Postnote, 2005).

Open source software is computer software that has a source code accessible to the general public for use as is or with adjustment. This software usually does not entail a license fee (Ontario, 2013). Wheeler defines Open Source software as "programs whose licenses give users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers)" (Wheeler, 2015).

There are many Open Source Software systems including operating systems, Library Management systems, digital library systems, etc. available on the Internet. The present paper focuses on the Digital Library software systems with special reference to and comparative examination of DSpace digital Library software and Fedora (Flexible Extensible Digital Object Repository Architecture).

4. Digital Library

According to Lesk "Digital libraries are organized collections of digital information. They combine the structure and gathering of information which libraries and archives have always done, with the digital representation that computers have made possible" (Lesk, 1997).

The first and foremost question while establishing Digital Libraries is that of the technical architecture that triggers any digital library system. Libraries will need to enhance and upgrade current technical architectures to accommodate digital materials (Clevland, 1998). Software is the most concerning question regarding technical architecture of digital libraries without which the establishment of digital libraries is not possible. There are many digital library software packages accessible through internet such as Eprints, Dspace, CONTENTdm, Fedora, iTor, Mycore, dLibra, DigiTool, Greenstone, etc.

5. Dspace vs Fedora

DSpace digital library software was developed as a collaborative project between MIT libraries and Hewlett

Packard Research Lab under BSD licenses. The first public version was released in November 2002

Fedora, (Flexible Extensible Digital Object Repository Architecture), was jointly developed by researchers at Cornell University and the University of Virginia. Fedora repository software was first released in 2003 on the Apache / Mozilla license.

5.1 Comparative Analysis of DSpace and Fedora

Table 1 presents a comparative chart for Technical Specifications of DSpace and Fedora.

Table 1. Technical specifications

Sl. No.	Technical Specification	DSpace	Fedora
1.	Developer	MIT press and HP Labs	Cornell University and University of Virginia Tech.
2.	Latest version	DSpace 6.0	Fedora 4.7.2
3.	Operating Platform	Windows (NT/2000/XP) and all POSIX (Linux/BSD/UNIX-like OSes), OSX	Linux, Windows (NT/2000/XP), and Mac OSX
4.	Supported Software	Java 7 or 8, Apache Maven, Apache Ant, Relational Database (PostreSQL or Oracle), Servlet 3.0 container (Tomcat 7+ or similar).	Java 8, Servlet 3.0 container (e.g. Tomcat 7+, Jetty 9+)
5.	Language	Java	Java
6.	License	BSD	Apache 2.0
7.	Standard Protocol	OAI_PMH support	OAI-PMH support

DSpace It is to be noted that Fedora and DSpace became a DuraSpace project in 2009 when the Fedora Commons and DSpace organizations merged to form DuraSpace. DuraSpace is a not for profit organization also provides online technical support for DSpace and Fedora software systems free of cost.

DSpace and Fedora are written in Java language, a general-purpose computer programming language that is concurrent, class-based, object-oriented, and specifically designed to have as few implementation dependencies as possible. It is intended to let application developers "Write Once, Run Anywhere" (WORA), meaning that compiled Java code can run on all platforms that support Java without the need for recompilation" (Java, 2017). DSpace (Documentation) is available in over 20 languages.

5.1.1 License

DSpace is distributed under the terms of the BSD open source license. On the other hand, Fedora is distributed under the terms of the Apache 2.0 open source license.

5.1.2 Standard Protocol

Both the software systems DSpace and Fedora support Open Access Initiative Protocol for Metadata Harvesting (OAI-PMH) (Lagoze & Van de Sompel, 2002).

5.2 Characteristics of Dspace vs Fedora

Below is a comparative description of the characteristics of Dspace and Fedora

5.2.1 Object Model

It is clear from Table 2 that the basic entity in Dspace is an 'item' while it is a 'Digital object' in Fedora. Both (item and digital object) consist of metadata as well as digital content.

5.2.2 User Interfaces

Table 2 indicates that Dspace has two widely used user interfaces that are JavaServer Pages User Interface (JSPUI) and Extensible MarkUp Language User Interface (XMLUI). The JSPUI user interface is quite easy to use at both ends i.e. administrator as well as the user end whereas XMLUI is popular for its various 'Themes and Aspects' that add to Dspace more customizable features (DuraSpace, 2017a).

On the other hand Fedora is flexible in its user interface. Fedora is "designed as the foundation of a repository framework and it integrates with other applications and services (including Hydra and Islandora) using well-defined patterns" (DuraSpace, 2017b).

5.2.3 Interoperability

Interoperability refers to the "basic ability of computerized systems to connect and communicate with one another readily, even if they were developed by widely different manufacturers in different industries. Being able to exchange information between applications, databases, and other computer systems is crucial for the modern economy" (O'Connor, 2017).

Table 2. Comparative chart of characteristics of DSpace and Fedora

Sl. No.	Characteristics	DSpace	Fedora
1.	Object Model	Item	Digital object
2.	User Interfaces	User friendly JSPUI Interfaces XMLUI	Flexible user interface
3.	Interoperability	Yes	Yes
4.	Metadata	Qualified Dublin Core	FOXML, METS, Dublin Core, MODS
5.	Unicode support	Yes	Yes
6.	Content Management	Built in WorkFlows	Not Built in Workflows
7.	Search and Browse	Built in search engine, Discovery search support	Integrate with other search engine such as Apache Solr, Faceted search
8.	Customization level	Flexible and user friendly	Little bit tough
9.	Disaster Recovery	DSpace allows you to export all of your system content as AIP (Archival Information Packages) backup files.	Content in Fedora can be exported as RDF and imported to recovery from disaster.
10.	File Format	DSpace can store any type of file. In addition, it auto-recognizes files of most common formats (e.g., DOC, PDF, XLS, PPT, JPEG, MPEG, TIFF).	Fedora can store any type of file
Number of Installations			
	ROAR[1]	1776	58
	OpenDOAR[2]	1524	49

It is clear from Table 2 that both the software systems under study i.e. Dspace and Fedora are interoperable.

Metadata is "Data about data, describes how and when and by whom a particular set of data was collected, and how the data is formatted" (Webopedia, 2017). Metadata is used for images, videos, spreadsheets and web pages (TechTarget.WhatIs.com, 2017). Dspace uses Dubline core and qualified Dublin core metadata whereas Fedora is working through FOXML, Metdata Encoding and Transmission Standards (METS), Dublin Core, Metadata Object Description Schema (MODS).

5.2.4 *Unicode Support*

"The Unicode Standard is a character coding system designed to support the worldwide interchange, processing, and display of the written texts of the diverse languages and technical disciplines of the modern world. In addition, it supports classical and historical texts of many written languages" (Unicode, 2017) (Table 2).

5.2.5 *Content Management*

Dspace Software system has the advantage over Fedora Software regarding built in Workflows. Fedora system lacks built in workflows (Table 2).

5.2.6 *Search and Browse*

Searching and browsing is the major requirement in any digital library software system. The whole system depends upon this main quality as it controls retrieval of the documents in the database system. Dspace has a built in search engine and supports Discovery while Fedora has to be integrated with other search engine such as Apache Solr,.

5.2.7 *Customization Level*

Customization or modification is another main feature expected of a software system to make it suitable according to the requirements of end users. It is quite easy and flexible to customize the Dspace software system as compared to Fedora which is difficult to customize.

1 Registry of Open Access Repositories, ROAR. Data Retrieved October 19, 2017, from http://roar.eprints.org/
2 Open Directory of Open Access Repositories, DOAR. Data Retrieved October 19, 2017, from http://opendoar.org/find.php

Both the Software systems contain disaster recovery system. DSpace allows export of system content as AIP (Archival Information Packages) backup files whereas content in Fedora can be exported as Resource Description Framework (RDF).

5.2.8 *Favored File Format*

It is noticeably shown in Table 2 that both the software systems can store and support different file formats. Dspace auto-recognizes files of most common formats (e.g., DOC, PDF, XLS, PPT, JPEG, MPEG, TIFF.

5.2.6 *Number of Installations*

Table 2 signifies that Dspace has number of Installations as compared to Fedora system.

6. Discussion

Clearly Dspace has some advantages over Fedora to end users in terms of a built-in end user interface, built-in workflow for content management, ease of customization and search interface.

It is therefore not surprising that there are many more D-Space installations as compared to Fedora. Dspace is still the most suitable and popularly used software system to establish digital/institutional repositories.

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