

AN IN-DEPTH ANALYSIS OF DIGITAL LIBRARY PLATFORMS WITH A FOCUS ON THE DSPACE OPEN-SOURCE SOLUTION

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Abstract:- The purpose of this research paper is to provide a theoretical framework for the Digital Library software and to give readers a better understanding of how to select/use open source software in libraries, with a concentration on digital libraries. OSS continues to make inroads into various categories of human activity, challenging traditional software adoption and use methods. From simple to mission-critical applications, the factors that contribute to the widespread acceptance and use of open source software in various businesses have been the subject of academic inquiry and study (Shivalingaiah, 2006). There has been continuous addition and developments in the Management systems for open source libraries. Therefore, there is need to make up-to-date comprehensive survey to foster the remarkable development of open source software and their application in academic libraries. DSpace software is one of the OSS for DLs examined in the study.

Keywords:- OSS, DSpace, Library Software, Digital Library, Open Source

Introduction:-

The concept of open source software is not new. Although the term "open source" was only established a few years ago, the concept that drives this method of software development has been around for a long time (Muffatto, 2006).

IBM and other companies began selling large-scale commercial computers with free software in the 1960s. The source code for the software was open source, which allowed it to be changed, modified, and enhanced. In other words, the hardware was the product being sold, not the software. This began to shift in the mid-1970s.

Software was made into a commercial product that couldn't be changed or sold again. Stallman was displeased with the revolution and set out to form a new software sharing community in order to return software development to its pre-revolutionary state. If others had not taken up Stallman's ideas, he would have been dismissed as a dreamer. Linus Torvalds and the Linux operating system he created were in the same boat.

In 1990, Torvalds looked at the GNU and MINIX, a UNIX clone, and planned to build the whole KERNEL, Memory, processes, and tasks are managed by the kernel of an operating system. He made his work, LINUX (Linus + UNIX), available to the public in 1991. GNU LINUX, a

comprehensive non-commercial operating system, was created in collaboration between the Linux community and the Free Software Foundation (Torvalds & Diamond, 2001).

The Apache Group was founded in 1994 by a group of programmers in the city of California with the goal of producing a free and trustworthy web server. The group launched Apache 1.0 in December 1995, and it quickly became the most popular HTTP protocol server on the internet.

The free software philosophy's Achilles' heel was the misconception of the word "free," which prevented many software companies from joining the community. The FSF's objective was to increase information and research freedom rather than destroying software's commercial worth (Perens, 1999).

The open source label was established jointly by the Linux community and Eric Raymond at Linux Congress in February 1998. As a better alternative to Free, Raymond introduced the phrase Open Source. For the historic practice of free software development and distribution, this marked the genesis of the phrase Open Source Software and the open source movement. Perens and Raymond created the Open Source Initiative (OSI) in the same month, with the goal of developing a vocabulary to precisely define Open Source Software (OSS) (Perens, 1999). The word "Open Source" was formally adopted by the Open Source Initiative in April of 1998 to reflect the efficiency, reliability, accessibility, flexibility, and creativity that will characterize Open Source Software.

Another significant milestone in the Open Source movement is the Mozilla project, which was launched by Netscape Navigator, at the time the only challenger to Microsoft Internet Explorer. The goal of the development of Netscape Navigator was to beat out Microsoft Internet Explorer. On May 1, 1998, Netscape Navigator registered Mozilla.org as the official domain for the project, with the phrase "the lizard (Mozilla) is free" (Hamerly, 1999)

Many companies began to directly participate in the development and distribution of these projects after the formation of the Open Source Initiative (OSI) and the start of the Mozilla project, and many companies began to directly participate in the development and distribution of these projects after the formation of the Open Source Initiative (OSI) and the start of the Mozilla project (Muffatto, 2006). The widespread adoption of Linux and Apache by IBM, as well as the release of Star Office (Office application software), sparked the creation of a slew of open source apps for the general public.

Library Management Software Packages:-

The systematic approach of managing the whole library collection using a simple and interactive interface, i.e. library management software package, is known as library management. Any computer system would be incomplete without software. It is the main constituent that makes the computer to manipulate data. Software is a collection of interconnected programs that determine the system's processing. A computer is little more than a machine if it doesn't have the right software. The fundamental line of separation between man and machine is software. It is in charge of processing, both numerical and logical. Without programs, instructions, or software, the computer cannot perform anything. The software, unlike the hardware, cannot be touched, yet it tells the computer what to do in a given situation. Library software refers to any computer program that is designed to perform library-related tasks. It could be a simple application for acquisition or cataloguing, or it could be complete

library administration software that handles acquisition, cataloguing, circulation, serial control, and other tasks. It could also be a digital library management program that manages the library's digital resources, or something else entirely, such as a learning management system or a content management system (Panda, 2019).

Digital Library Software:-

1. Greenstone:-

The University of Waikato's New Zealand Digital Library Project developed Greenstone, an open source digital library management software package. More than 40 languages are supported by the software. It has been downloaded 4,500 times a month. It is compatible with all major operating systems (even the iPod). It includes a ready-to-use demonstration for setting up and expanding a digital library. As a result of a collaboration between UNESCO and Human Info, Greenstone was produced and released under the G (NGO). For example, Greenstone software was a semi-finalist in 2006 for the Stockholm Challenge, the world's leading ICT prize for entrepreneurs who use ICT to improve living conditions and economic growth, and it won the 2004 IFIP Namur award, which honors users who raise global awareness of the social implications of In its "Information for All" programme, the United Nations Educational, Scientific and Cultural Organization (UNESCO) An information management resource kit from the United Nations Food and Agriculture Organization (FAO) (Rome) from 2005 is included, along with instructions on how.

The software presents a new way to organize data and make it available through the Internet. The document collections are large (tens of thousands to millions of documents) and have a standardized interface. In library institutions, many collections are stored, each of which is organised uniquely in spite of the fact that they are closely related. Using a configuration file, a library collection's structure is determined. Newspaper articles and technical documents are available, as are MIDI pop music collections and ethnic folk songs, as well as visual art and movies.

Using Greenstone digital tools to make material available is significantly more than simply posting it on the Internet. The collection can now be browsed, searched, and maintained. Prior to being presented to consumers, each library collection goes through a construction process that is totally automated once completed. This builds all of the structures needed for run-time access. The search process makes use of various text and metadata indexes, whereas browsing makes use of metadata such as author and title. When a new collection arrives, it is rebuilt and integrated into the old collection.

The software system is public and adaptable to meet the high expectations of digital libraries. Readers are invited to contribute updates and upgrades under the GNU general public license. Greenstone software is used all around the world and can handle documents in a variety of languages. The United Nations and other philanthropic organisations created Greenstone CDs for distribution in impoverished countries. (Greenstone, 2013)

2. EPrints:-

For constructing Open Access repositories that comply with the Open Archives Initiative Protocol for Metadata Harvesting EPrints open-source software package used for institutional archives

and scientific periodicals. After the 1999 Santa Fe meeting, the OAI-PMH was created, and EPrints was born in 2000 as a direct result of that meeting. Since then, EPrints has become the first and most widely used free open access institutional repository software, spawning the development of other similar technologies. During the Open Repositories 2007 Conference, the third version of the programme was unveiled on January 24, 2007, and its developers hailed it as "a big leap forward in capabilities, providing repository managers and depositors more control and flexibility." As a result of AJAX-based document uploads, deletions, and modifications, workflow As of now, all current browsers provide instantaneous file uploads with a progress bar that In the future, specific "actions" for distinct documents in the workflow will be available as separate plugins, allowing extensions to add specific actions to specific Included in the list of accessible activities are conversion, unpacking (.zip and.tar.gz), additional files, and metadata extraction Administrators employ batch editing to manage the process. In order to update the values of all items that fit the search, an administrator can do a search. The OAI access log script is a way to allow users with a certain privilege access to access-logs using OAI to generate any amount of randomly generated eprints, we've created a new "thumbnail" formats can be introduced. For example, the phrase "full size" can be used to get a large image of a document's front page.

3. DSpace:-

DSpace is a free, open source digital library system developed in collaboration with MIT and Hewlett Packard Labs. It is used to digitally collect, index, store, preserve, share, and redistribute a university's research community's intellectual output. The following are some of the DSpace's key features:

- Dublin core metadata standard,
- customisable web interface,
- OAI compliant,
- workflow process for content submission,
- import/export capabilities,
- decentralised submission process,
- extensible through JAVA API,
- full text search through Lucene or Google,
- PostgreSQL or SQL database that supports transactions, such as Oracle, MySQL, etc.

DSpace Software- Historical Overview:-

As the most extensively used tool for digital libraries, DSpace has spawned a plethora of literature Understanding the historical backdrop is essential to understanding the mission and leaders behind it, as well as the Hewlett Packard Labs and the Massachusetts Institute of Technology (MIT) Libraries teamed up in 2002 to create DSpace. In the establishment of DSpace, Ann Wolpert, the late former Director of the MIT Libraries, played a crucial role in Great research libraries, according to Wolpert, are windows into intellectual creation for members of university and research communities as well as windows into scholarly activity for the general public in today's digital age. It was in the late 1990s that she had the idea for a system that would address this issue, and it came to fruition in 2000 when she worked with HP to create DSpace, a trans disciplinary repository tied to an institution for digital research and educational content generated by members of that institution' It's important to

have a repository like this for scholarly resource access and preservation since the majority of born-digital materials are never published in traditional methods. When large amounts of digital information vanish in an instant due to "bit rot," computer experts discovered it for what it is: a degrading or decaying process. "Digital data" is prone to constantly changing file formats, software programmes, and possible damage to the drums, discs, and other media used to store the data," writes Tansley (2003). In their investigation, HP found that librarians are better allies than IT specialists in this endeavor.

The Release of DSpace version 1.0 :-

Version 1.0 of DSpace was released under the BSD open source license on November 4, 2002. Among the DSpace team were MacKenzie Smith, Mary Barton, Margret Branschofsky, Julie Harford Walker, and Greg McClellan. Except for Peter Breton and Peter Carmichael, who worked for White Rabbit Software and PC Consulting, the team was made up of MIT library personnel and computer scientists from HP labs and MIT libraries. The project was funded for those interested in downloading DSpace, you can do so at sourceforge for example, the Sloan School of Management was one of the first institutions to use DSpace, along with other institutions such as The Center for Technology, Policy and Industrial Development, the Department of Ocean Engineering, as a result, DSpace primarily catered to three sorts End users can access items deposited in DSpace remotely over the Internet. Their text, music, video, photographs, datasets, and other digital stuff is distributed digitally and preserved for a long time. Using DSpace, institutions may access all of their research in one place. Among the digital assets that can be kept in DSpace are articles, preprints, working papers, technical reports, conference papers, books, theses, data sets, computer program, visual simulations, and models, to name These digital materials can be stored in a variety of formats thanks to the software.

DSpace-Technical Features:-

It was designed with HP/UX, Linux, Mac OS X, and Solaris platforms in mind when DSpace version 1.0 Among the prerequisites were Java 1.3-the Standard SDK, Java Libraries (JavaBeans, Java Servlet 2.3 and JSP 1.2, JavaMail API), Apache and Tomcat 4.0, PostgreSQL relational database, Lucene search engine, Jena (an RDF toolkit from HP Lab), OCLC's OAICat, and several other helpful software libraries. As a result, OSS was responsible for every single component that was Due to its three-layer architecture, the DSpace platform was designed with the possibility of future expansion in mind an initial storage layer was at the bottom, followed by a business layer and finally a service layer. Here's a look at the 1.0 architecture of DSpace.

DSpace Workflow:-

Identical to a university or educational institution, the DSpace-based DL's core structure is similar to that of numerous departments from different faculties make up an academic institution. Many sub-components make up a department, such as labs and libraries, for the organization of digital collections in a university-like setting should address the institutional structure in order to facilitate a systematic influx of content. A community structure that corresponds to the university's departments has been created by DSpace in order to address this need. DSpace goes even farther by

allowing users to construct Sub-Communities within a community. Sub-Communities are the subdivisions that make up a community. It could be a department library, a department research lab, or a group of faculty members who contribute digital collections to the DL.

DSpace categorizes digital assets into Collections. The ultimate structural unit is a collection. A collection can be created as part of a Community or as part of a Sub-Community. Based on the investigator's practical expertise of constructing collections in Cusat Digital Library, the notion of community, sub-community, and collection.

The first step is to build a collection before you can begin storing when it comes to assessing authorization for depositing digital objects and the stages of content being archived, different policies and standards may apply to different collections. For each Collection in DSpace, there is a separate entry page that contains relevant information, news, and links.

Building a Collection in DSpace in a DSpace system, collection building is accomplished by the Administrator and E-people. A Community, Sub Community, Collection, or Admins of Items have the power to create Communities, Sub Communities, Collections and Items. They may also delete them, edit those Department directors, project managers, system administrators, and librarians are all examples of administrators. People who have been given authorization by the Administrator to upload objects to a DSpace system are called E-Persons. E-persons can be faculty, library personnel, or project participants. When a Collection is created, the permission for an e-person to add collections is set. E-persons can add content to a collection directly or through the Administrator's check/verification process.

DSpace has a six-step submission process by default. The first three steps are intended to provide a description of the collection. The first level of description comprises information about the file's state, the number of titles, publication data and the amount of files to submit for a certain item, for example; The description level two input form includes author, title, series/report number, identifiers, document type, and language. The subject keywords, abstracts, sponsors, and other remarks are provided in the third level of description in the input form. When you reach the fourth stage, you'll be DSpace requires knowledge of the file format in order to efficiently archive and provide access to a file. The e-person must describe the file format if the system does not recognize it automatically. The metadata and uploaded file will be verified in the fifth step. If the descriptions are incorrect or the file is incorrectly picked, there is a way to go back. DSpace requires a permission to reproduce, translate, and distribute the work globally, so the sixth step includes one. The uploading process is completed when the e-person selects the "Grant License" button. As soon as the file uploads are complete, the e-person will receive an email message.

For each file it stores, DSpace generates an MD5 checksum. A checksum is a method of detecting errors. A file's MD5 checksum is a 128-bit number that functions as a fingerprint. Internally, this checksum is used by DSpace to ensure that files remain intact over time (the checksum of a file is unique). Unified Resource Locator (URL) is assigned to objects when they are added to DSpace (URL). "Handles" are persistent identifiers that may be assigned, managed, and resolved for digital objects and other Internet resources. The Handle System registers DSpace permanent URLs. The Handle System was created by the Corporation for National Research Initiatives (CNRI). DSpace

takes a wide range of digital items, including those that were born digital and those that were digitized from their analogue counterparts. DSpace contains scholarly articles, preprints, working papers, technical reports, theses, conference papers, paper clippings, books, computer programmes, visualizations, simulations, multimedia contents, administrative records, journals, bibliographic datasets, images, audio files, video files, learning objects, web pages, data sets, and other types of content. There are a multitude of file types that might be used to. A file format is a set of rules for encoding data for storage in a computer file. The file format is a critical part of data preservation in a digital library. DSpace recognizes and maintains over 75 file formats, including PDF, Word, JPEG, MPEG, TIFF, and others. Bitstreams are the name for a file that is uploaded to DSpace. Once files have been ingested, they are stored on the file system as a stream of bits without the DSpace has identified two layers of digital preservation: bit preservation and functional preservation. Using bit preservation, you may verify that a file remains unchanged. The file changes with time in functional preservation such that the material remains viewable and useable in the same way. DSpace's uncomplicated format migration preserves the functionality of some file formats. DSpace users create files in a variety of formats. DSpace divides file formats into three categories to handle all of them: supported, known, and unsupported. Functional preservation will be applied to supported formats. All formats are either proprietary or binary, and neither has a clear future. This means that the system has no idea what formats are not supported, and there is no certainty that they will. Dublin Core is DSpace's default metadata structure (DC). The DC schema has the capability of eliciting enough data to represent a digital item. The DC schema is used by DSpace in a qualified form. To offer descriptive, administrative, and structural information, each item in DSpace is represented by a DC record. Descriptive metadata gives details on the item's scholarly content. Preservation metadata, provenance data, and authorization policy data are all examples of administrative metadata. How an item is delivered and the relationships between its various components are described in structural metadata. When an e-person creates a document, the system automatically generates administrative and structural metadata, whereas descriptive.

Open Source Software Packages Have a Lot of Benefits (OSS) Smaller and medium-sized libraries are starting to see a long-term impact from OSS. Libraries who are unable to purchase a commercial library software package due to the high cost of the LMS can use OSS for library administration as an alternative. Users of open source library software have the authority to download, use, edit, distribute, and redistribute the library software's versions. The OSS features are being developed and updated in a collaborative and open manner.

The following are some of the reasons to use OSS:-

- Self-reliance is aided by open source software for libraries.
- Librarians can customise the programme to meet the needs of their library and its patrons.
- It enables libraries to manage their collections more efficiently. In most cases, open source solutions do not require a licence cost.
- There is no need to comply with licencing requirements. You can install the OSS as many times and in as many locations as you need once you have it.

- Support for open source software is available for free on the internet at www.opensource.org. In addition, many IT organisations are increasingly embracing open source with both free online and paid assistance. For example, Lib-Lime, the Koha community, and so on.
- Open source software has technical assistance that is often superior to commercially available solutions. Bugs are identified by users in open source software.
- Collaborative intelligence identifies new advancements in services that will help library workers improve in their careers.
- Open source software is self-contained and suited for both tiny and large libraries.
- OSS allows librarians to improve their abilities in order to install and support the vast array of continually evolving information goods and services.
- Open source software appears to be beneficial based on evidence and research. The OSS peer review process and community standards, as well as the fact that source code is open to the public, encourage excellence in design and coding efficiency.
- Web-based enterprise management allows you to combine or consolidate server, service, application, and workstation management for more powerful task management (Randhawa, 2013).

Conclusion:-

The library OSS is a dynamic universe. The adoption and use of OSS to fulfil several library roles is growing worldwide. OSS applications in libraries are a field of study and development worldwide. While there are various library OSSs, library automation software and DL building are prominent. While Koha, Evergreen and OPALS are widely used for library automation, the OSS domain is recognized for DLs like as DSpace, EPrints, Fedora and Greenstone. DSpace status is determined to be at the top of the OSS for DLs. While libraries respond positively to the use of OSS to provide varied digital resources, a substantial number of libraries are not using OSS technology because of causes that range from lack of consciousness to maturity perception.

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