SOLUTION FOR E-JOURNAL ARCHIVING AND FRAMEWORK FOR EVALUATION OF ARCHIVING SOFTWARE

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Abstract

In the past two or three years, e-journals have become the largest and fastest growing segment of the digital collections. Collections that a few years ago numbered in the few hundreds of titles now number in the thousands, and the rate of growth continues to increase. We need to archive/preserved the copies of e-journals for future generations were the same copies being read by the current generation of users. Archiving of the E- Journal/E- Content addresses two major issues, Firstly, is giving access to the sources. Secondly, its preservation for long – term use. In this paper I will discusses the issues related to e-journal archiving and their possible solution using some open source software like LOCKSS, Dspace, Eprint, etc. In this paper I am also going to discuss the framework for Evaluation of Archiving Software.

Keywords : E-journal Archiving/ LOCKSS/ Framework for Evaluation of Archiving Software.

1. Introduction

Archiving is not a new concept to the librarians as they have been doing this since the libraries started acquiring printed material. Before the advent of electronic journals, research libraries subscribed to printed journals, provided access to, and preserved these bibliographic resources in continual support of the research, teaching, and learning needs of their constituent communities.

The move in recent years towards provision of scholarly journals in electronic form has greatly enhanced the access to and availability of scholarly publications. However the arrangements for preserving long-term access to electronic journals are far from satisfactory. When subscribing to electronic journals, libraries no longer possess a local copy as they did with printed journals. They effectively lease the content of the electronic journals they subscribe to by remotely accessing it on publishers' servers over the computer network. The problem with this common practice is that access to entire back runs of electronic journals could be lost to academic libraries when subscriptions are cancelled or when journals cease publication. The uncertainty of continuing access is a major barrier preventing libraries from moving to electronic-only subscriptions.

The recent endorsement of the statement "Urgent Action Needed to Preserve Scholarly Electronic Journals" by organisations such as the Association of Research Libraries (ARL) and the International Coalition of Library Consortia (ICOLC) highlight the concern in the scholarly community over the long-term future of scholarly electronic journals. There is consensus that a solution to the e-journal archiving problem is urgently needed and that a technically and financially sustainable solution requires collaboration between libraries and publishers.

Archiving of the E- Journal/E- Content addresses two major issues, Firstly, is giving access to the sources. Secondly, its preservation for long – term use. Both the issues can be achieved by using archiving software like LOCKSS, Dspace, Eprint, etc.

2. E-Journal

The concept of an electronic publication to replace or supplement the traditional scholarly journal has existed for twenty years, and serious research about electronic journals has been in progress for past fifteen years. Only in the last five years, however, the infrastructure has been in the developed world for the electronic journal to become a practical proposition: the Internet, software such as gopher and World Wide Web (WWW), inexpensive large- capacity hard disks, and the widespread availability of microcomputers, linked to the Internet, on the desks of individual scholars.

E-journal is an electronic version of a journal that is found and read on the Web in various format like html, pdf, text, etc. The perceived advantages of the electronic journal over the equivalent printed journal are several. Publication is quicker without the delays inherent in printing and postal delivery. Costs are lower; the price of paper, for example, has been rising faster than general inflation for many years. Today modern user-friendly software enables academic editors and referees to undertake themselves tasks that used to require skilled craftspeople such as compositors. And above all, new facilities can be incorporated into journals, such as hypertext links both within and between papers, interactivity between paper and reader, and the inclusion of multimedia features such as animation, video clips and sound into papers.

Two main types of scholarly electronic journal have emerged. One is newly founded, published by its academic editor, and issued free of charge over the Internet, and uses software such as electronic mail, telnet, ftp, gopher and/or WWW to distribute papers to users with varying degrees of technological sophistication. The other is typically the electronic equivalent of an established printed journal, is published by a commercial publisher (for-profit or not-for-profit), and requires a subscription that is often as high as or higher than that of the printed version.

3. E-journal access models

Internet, by its very nature of technology and utility is a remote access model. Seamless access is a possibility through linking information resources like databases and e-journals distributed at several sites. Internet and its secured cousin Intranet have

however, thrown up different access models that fits into the convenience of libraries. Three access models have emerged for e-Journals:

3.1 Remote Access (through Internet)

In this model, the publisher hosts the journal at his website. When the library subscribes to the e-journal, it is provided right of access. Publishers grant the rights to subscribing library through one of the following methods.

1. User-ID and Password
2. IP enabled (Intranet)
3. Combined

3.2 On site, at the library

In this model, the library can host the e-journals within its campus.

3.4 Access through Databases (Link Model)

Access models offered by publishers limit the access to their journals. But, the users often find articles of their interest through database. Over the years, the bibliographic database has emerged as a user's favorite interface for searching and locating information. The concept of seamless access demands instant linking between the article reference in a database to a corresponding full-text article in an e-journal.

4. E-journal Archiving and related Issues

In the past two or three years, e-journals have become the largest and fastest growing segment of the digital collections for most libraries. Collections that a few years ago numbered in the few hundreds of titles now number in the thousands, and the rate of growth continues to increase.

In many ways, archiving and preserving e-journals will be dramatically different from what has been done for paper-based journals. In the paper era, there was large-scale redundancy in the storage of journals. Many different institutions collected the same titles. The copies of journals being saved for future generations were the same copies being read by the current generation of users. Many of the things that helped maintain journals for the long term (binding, repair, sound handling and shelving practices, environmental control, reformatting when usability was threatened) were not differentiated from what a library did to provide current services. Other than in the case of preservation microfilming and the odd instance of shared book storage facilities, there was little conscious coordination of preservation activities, and in fact a level of redundancy was expected and thought useful.

The common service model for e-journals is quite different than that for paper journals. Most e-journal access is through a single delivery system maintained either by the publisher or its agent. There is little replication, and only a few institutions actually

hold copies of journals locally. Libraries can fulfill their current service requirements without facing the issues involved in the preservation of the resources. Further, in the digital realm the issues involved in day-to-day service are quite different from those involved in long-term preservation.

The issue of long-term archiving and preservation of e-journal content has become one of increasing importance. Specifically because of archiving concerns, many research libraries continue to collect paper copies at the same time they pay for access to the electronic versions. This dual expense is not likely to be sustainable over time. Publishers are finding that authors, editors, scholarly societies, and libraries frequently resist moving to electronic-only publication because of concern that long-term preservation and access to the electronic version is uncertain. Of perhaps even greater long-term concern, while libraries continue to rely on the paper copy as the archival version, from the viewpoint of publishers it is increasingly the electronic versions of titles that are the version of record, containing content not available in the print version. There are several issues exist with the e-journal archiving some of them are mentioned below.

5. Issues related to E-Journal Archiving

There are many important technical and policy issues raised by archiving projects, and it is critical that these be discussed by the general community of libraries, publishers, and scholars, and not just left to the archive and publishers involved. Some of the more important questions identified so far in this process include those below:

5.1 What is the publisher/archive/subscriber relationship?

Publishers and subscribers, and publishers and archives, have formal contractual relationships; does there need to be a formal relationship between archives and subscriber?

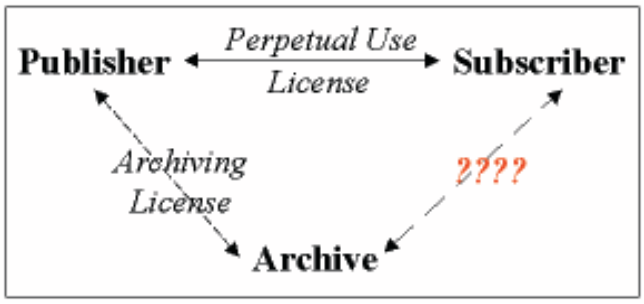

Fig. Publisher/Subscriber/Archive relationships.

5.2 Is archive content usually "dark"?

"Dark" content is that which is not accessible for normal daily use. An archive that keeps its content dark poses less of a threat of competition to the publishers with

whom it is working. A dark archive will also be relieved from having to maintain a current user interface, with all of the bells and whistles that users have come to expect, and from the complex task of maintaining information on who has access to what content. On the other hand, insuring that content that is never used remains sound and free from degradation will be challenging.

5.3 When can archived content be accessed?

If archived content is initially kept dark after deposit, under what conditions can it subsequently be accessed? Many archiving discussions revolve around the concept of "trigger" events, that is, conditions that change the access rule of the archive.

5.4 Who can access archived content?

If a trigger event happens, who gets access? Just subscribers (individual or institutional)? Controlling access in this way is complex. Keeping records of who has the right to access what and implementing appropriate access control mechanisms that recognize differential rights to various archived objects would be a major operational challenge.

5.5 What content is archived?

At first hearing, most people assume that e-journal archiving is basically concerned with the content of journal articles. Indeed, while articles are the intellectual cores of journals, in fact e-journals contain many other kinds of materials. Some examples of commonly found content are:

- Advertisements
- Reprint information
- Editorials
- Events lists
- Errata
- Editorial boards
- Rights and usage terms
- Copyright statements
- Journal description
- Conference announcements
- Various sorts of digital files

Which of these content types need to be archived and preserved for the future? Some of these types of materials will pose issues for publishers. Not all of these items are controlled in publishers' asset management systems.

5.6 Should content be normalized?

The variety of formats of digital objects in an archive will affect the cost and complexity of operation. In order to control such complexity and cost, an archive might want to normalize deposited objects into a set of preferred formats whenever possible. Such normalization can happen at two levels:

- File formats. An archive might prefer to store all raster images in TIFF, for instance, and convert JPEG or GIF images into that format. Controlling the number of file formats will reduce the complexity of format monitoring and migration.
- Document formats. Many e-journal publishers encode article content in SGML or XML (or plan to do so soon). Most publishers create their own DTD (or modify an existing DTD) to suit their specific needs and delivery platforms.

Normalization and translation always involve the risk of information loss. In archiving there may well be a difficult trade-off between information loss and reduced complexity and cost of operation.

5.7 Should a standardized ingest format be developed?

The OAIS model uses the concepts of "information packages," that is, bundles of data objects and metadata about the objects that are the unit of deposit, storage, and distribution by an archive. The model allows transformations to be done as objects move from one type of package to another.

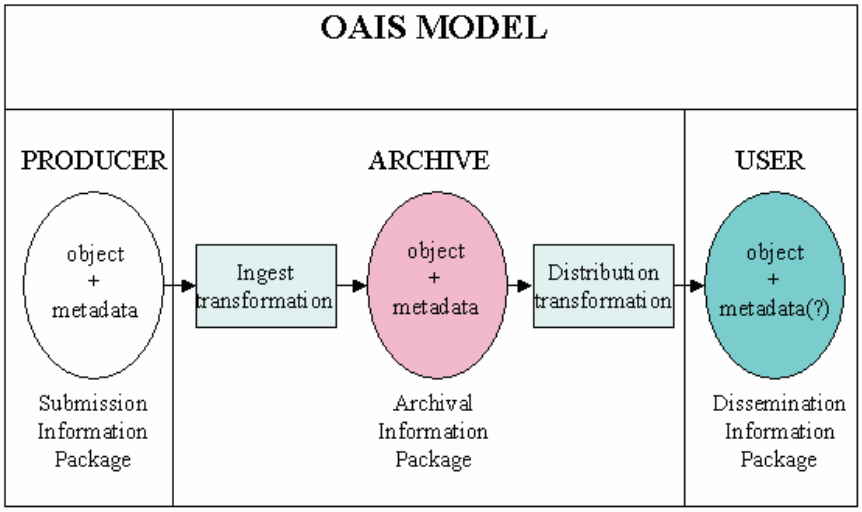

Fig. Information packages in the OAIS model

If as expected any given publisher is depositing content into a number of different archives, and any given archive is accepting deposits from a number of different publishers, standardizing the format of "Submission Information Packages" may reduce

operational cost and complexity for both communities (although at the cost of devising and maintaining such a standard).

5.8 Preserve usable objects, or just bits?

A key element in digital preservation is maintaining the usability of digital objects in current delivery technology as the technical environment changes over time. This process is usually assumed to be one of "format migration," that is, the transformation of objects from obsolete to current formats, although it could also be carried out through emulation, that is, maintaining current programs capable of emulating older technology, thus rendering obsolete formats. Whatever the method, the cost of preservation will be sensitive to the number and types of formats in an archive.

E-journals can contain a very wide range of technical formats, particularly as they begin to accept digital files created during the process of research (statistical datasets, instrument produced datasets, visualizations, models, video and audio files) that help validate, supplement, or further explain the basic content of articles. Whether it will be practical for archives to maintain current usability for such a diverse range of formats is far from clear. It is possible that archives will need to differentiate between formats where usability will be maintained and formats for which the archive will insure that the bits are maintained as deposited and that whatever documentation exists about them is kept useable for future "digital archeologists".

5.9 Who pays what?

Archiving and preserving e-journal content will cost money. How much money is uncertain, and that is one of the many things the Mellon initiative will help clarify. Perhaps the most important single financial issue is how archiving can be implemented to minimize the cost to the community. The question of who pays is likely to be quite sensitive to the magnitude of the cost.

So before starting any archiving project we have to find the solution of the above issues for the success of the project.

6. Solution for E-Journal Archiving

In recent years initiatives to create software packages for electronic repository management have mushroomed all over the world. Some institutions engage in these activities in order to preserve content that might otherwise be lost, others in order to provide greater access to material that might otherwise be too obscure to be widely used such as grey literature. The open access movement has also been an important factor in this development. Digital initiatives such as pre-print, post-print, and document servers are being created to come up with new ways of publishing. With journal prices, especially in the science, technical and medical (STM) sector, still out of control, more and more authors and universities want to take an active part in the publishing and

preservation process themselves. In picking a tool, a library has to consider a number of questions:

- What material should be stored in the repository?
- Is long-term preservation an issue?
- Which software should be chosen?
- What is the cost of setting the system up? and
- How much know-how is required

In the last section of this article I have given the detailed check list for evaluation/ selection of the archiving tools, In this section I will discuss some of the most popular archiving software and their features, LOCKSS [1], EPrints [2] and DSpace [3] which are some of the most widely known repository management tools, in terms of who uses them, their cost, underlying technology, the required know-how, and functionalities.

6.1 LOCKSS

Libraries usually do not purchase the content of an electronic journal but a licence that allows access to the content for a certain period of time. If the subscription is not renewed the content is usually no longer available. Before the advent of electronic journals, libraries subscribed to their own print copies since there was no easy and fast way to access journals somewhere else. Nowadays libraries no longer need to obtain every journal they require in print since they can provide access via databases and e journal subscriptions. Subscribing to a print journal means that the library owns the journal for as long as it chooses to maintain the journal by archiving it in some way or elsewhere there are a number of libraries preserving copies of a journal by binding and/or microfilming issues and making them available through interlibrary loan.

It is this system of preservation that Project LOCKSS (Lots of Copies Keep Stuff Safe) developed at Stanford University is recreating in cyberspace. With LOCKSS, content of electronic journals that was available while the library subscribed to it can be archived and will still be available even after a subscription expires. This works for subscriptions to individual e-journals, titles purchased through consortia, and open access titles. Due to the nature of LOCKSS, a system that slowly collects new content, it is suitable for archiving stable content that does not change frequently or erratically. Therefore, the primary aim of the LOCKSS system is to preserve access to electronic journals since journal content is only added at regular intervals. Key in this project is that an original copy of the journal is preserved instead of a separately created back-up copy to ensure the reliability of the content. It is estimated that approximately six redundant copies of a title are required to safeguard a title's long-term preservation [4]. Participation in LOCKSS is open to any library.

LOCKSS archives publications that appear on a regular schedule and that are delivered through http and have a URL. Publications like Web sites that change frequently are

not suited for archiving with LOCKSS. If a journal contains advertisements that change, the ads will not be preserved. Currently, it is being investigated if LOCKSS can be used to archive government documents published on the Web. In another initiative, LOCKSS is used to archive Web sites that no longer change. The advantage of preserving content with LOCKSS is that it can be done cheaply and without having to invest much time. Libraries that participate in the LOCKSS Project need a LOCKSS virtual machine which can be an inexpensive generic computer. The computer needs to be able to connect to the Internet, although a dial-up connection is not sufficient. Minimum requirements for this machine are a CPU of at least 600MHz, at least 128MB RAM, and one or two disk drives that can store at least 60GB. Everything that is needed to create the virtual machine is provided through the LOCKSS software. LOCKSS boots from a CD which also contains the operating system OpenBSD. The required software such as the operating system is an open source product . Configuration information is made available on a separate floppy disk. Detailed step by step downloading and installation information can be found on the LOCKSS site. In order to be able to troubleshoot problems that may occur, the person who installs and configures LOCKSS should have technical skills and experience in configuring software. Once LOCKSS is set up, it pretty much runs on its own and needs little monitoring from a systems administrator. For technical support, institutions can join the LOCKSS Alliance. The Alliance helps participants to facilitate some of the work such as obtaining permissions from publishers.

LOCKSS collects journal content by continuously crawling publisher sites and preserves the content by caching it. A number of formats are accepted (HTML, jpg, gif, pdf). LOCKSS preserves only the metadata input from publishers rather than local data input from libraries. Libraries have the option to create metadata in the administration module for each title that is archived. When requested, the cache distributes content by acting as a Web proxy. The system then either retrieves the copy from the publisher's site or if it is no longer available there from its cache. Crawling publisher sites requires that institutions first obtain permission to do so from the publisher. This permission is granted through the licence agreement. A model licence language for the LOCKSS permission is available on the LOCKSS page. Publishers will then add to their Web site a page that lists available volumes for a journal. The page also indicates that LOCKSS has permission to collect the content. Currently, LOCKSS is developing format converters that will facilitate format migration on a larger scale. In order to develop this process, LOCKSS is planning to integrate format and bibliographic metadata extraction.

6.2 EPrints

EPrints is a tool that is used to manage the archiving of research in the form of books, posters, or conference papers. Its purpose is not to provide a long-term archiving solution that ensures that material will be readable and accessible through technology changes, but instead to give institutions a means to collect, store and provide Web access to material. Currently, there are over 140 repositories worldwide that run the EPrints software.

EPrints is a free open source package that was developed at the University of Southampton in the UK. It is OAI (Open Archives Initiative)-compliant which makes it accessible to cross-archive searching. Once an archive is registered with OAI, 'it will automatically be included in a global program of metadata harvesting and other added-value services run by academic and scientific institutions across the globe. The initial installation and configuration of EPrints can be time consuming. If the administrator sticks with the default settings, installation is quick and relatively easy. EPrints requires no in-depth technical skills on the part of the administrator; however, he or she has to have some skills in the areas of Apache, mySQL, Perl, and XML. The administrator installs the software on a server, runs scripts, and performs some maintenance. To set up EPrints, a computer that can run a Linux, Solaris or MacOSX operating system is required. Apache Web server, mySQL database, and the EPrints software itself are also necessary (all of which are open source products). For technical support, administrators can consult the EPrints support Web site or subscribe to the EPrints technical mailing list.

EPrints comes with a user interface that can be customised. The interface includes a navigation toolbar that contains links to Home, About, Browse, Search, Register, User Area, and Help pages. Authors who want to submit material have to register first and are then able to log on in the User Area to upload material. Authors have to indicate what kind of article they are uploading (book chapter, thesis, etc) and they have to enter the metadata. Any metadata schema can be used with EPrints. It is up to the administrator to decide what types of materials will be stored. Based on those types the administrator then decides which metadata elements should be held for submitted items of a certain type. Only 'title' and 'author' are mandatory data. In addition to that a variety of information about the item can be stored such as whether the article has been published or not, abstract, keywords, and subjects. Once the item has been uploaded, the author will be issued a deposit verification. Uploaded material is first held in the so-called 'buffer' unless the administrator has disabled the buffer (in which case it is deposited into the archive right away). The purpose of the buffer is to allow the submitted material to be reviewed before it is finally deposited. Users of the archive have the option to browse by subject, author, year, EPrint type or latest addition. They also have the option to search fields such as title, abstract or full text. Available fields depend on which fields the administrator implemented

6.3 DSpace

The DSpace open source software has been developed by the Massachusetts Institute of Technology Libraries and Hewlett-Packard. The current version of DSpace is 1.4.1. According to the DSpace Web site, the software allows institutions to capture and describe digital works using a custom workflow process distribute an institution's digital works over the Web, so users can search and retrieve items in the collection preserve digital works over the long term DSpace is used by more than 100 organisations.

Space is more flexible than EPrints in so far as it is intended to archive a large variety of types of content such as articles, datasets, images, audio files, video files, computer

programs, and reformatted digital library collections. DSpace also takes a first step towards archiving Web sites. It is capable of storing self-contained, non-dynamic HTML documents. DSpace is also OAI- and OpenURL-compliant. It is suitable for large and complex organisations that anticipate material submissions from many different departments (so-called communities) since DSpace's architecture mimics the structure of the organisation that uses DSpace. This supports the implementation of workflows that can be customised for specific departments or other institutional entities.

DSpace runs on a UNIX-type operating system like LINUX or Solaris. It also requires other open source tools such as the Apache Web server, Tomcat a Java servlet engine, a Java compiler, and PostgreSQL, a relational database management system. As far as hardware is concerned, DSpace needs an appropriate server (for example an HP rx2600 or SunFire 280R) and enough memory and disk storage. Running DSpace requires an experienced systems administrator. He or she has to install and configure the system. A Java programmer will have to perform some customising. DSpace comes with user interfaces for the public, submitters, and administrators. The interface used by the public allows for browsing and searching. The look of the Web user interface can be customised. Users can browse the content by community, title, author, or date, depending on what options the administrator provides for. In addition to a basic search, an advanced search option for field searching can also be set up. DSpace also supports the display of links to new collections and recent submissions on the user interface. Access to items can be restricted to authorised users only.

DSpace's capabilities go beyond storing items by making provisions for changes in file formats. Dspace guarantees that the file does not change over time even if the physical media around it change. It captures the specific format in which an item is submitted: 'In DSpace, a bitstream format is a unique and consistent way to refer to a particular file format.' The DSpace administrator maintains a bitstream format registry. If an item is submitted in a format that is not in the registry, the administrator has to decide if that format should be entered into the registry. There are three types of formats the administrator can select from: supported (the institution will be able to support bitstreams of this format in the long term), known (the institution will preserve the bitstream and make an effort to move it into the 'supported' category), unsupported (the institution will preserve the bitstream).

7. Framework for Evaluation of archiving software

It is widely accepted that there is continuously increasing demand for more and better efficient Archiving software which will able to tackle a majority of different situations and problems.

The framework reviewed Eleven basic categories of Archiving in point of their technical and methodological characteristics. The over all Evaluation /comparison process can be implemented in two phase.

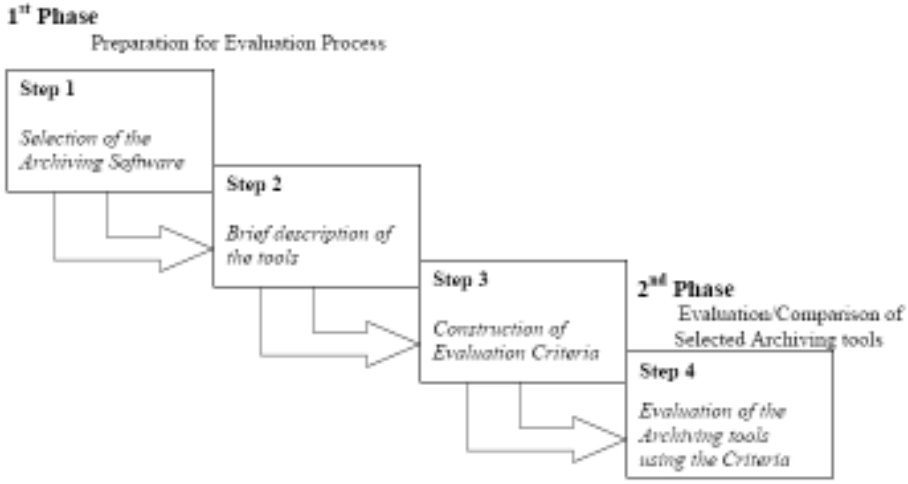

Fig. *Different Phases in Evaluation of Archiving Tools*

The main categories of the criteria that applied for the evaluation of the Archiving Tools are:

1. General
2. Technical features
3. Securities and compliance
4. Flexibility and availability
5. Scalability
6. Remote conectivity
7. Metadata
8. File formats
9. Indexing & searching facilities
10. e- mail notification or subscription
11. policy management

The above eleven main categories of the evaluation criteria has several check point, below I have listed possible check points under each categories:

7.1 General

- Name of the product

- Name of the company /organization
- Address
- Price
- Documentation Available
- Online technical support
- Online demo
- Software requirements
- Hardware requirements
- Version
- Operating System
- Programming Language

7.2 Technical Features

- Graphical User Interface
- Integrates Seamlessly
- Servers (Web Accessible)
- Web harvester (Crawler Based)
- LDAP and windows active directory supports
- Configurable access
- Administrative access
- Supports a variety of name services CADS, WINS.)
- Flexible Storage point
- OAI Compulsion
- Open URL Support
- Persistence identifier support

7.3 Securities and Compliance

- Per file retention period
- Per file WORM protection
- Administrative security control& secure clock
- Audit System
- Data Migration
- Disaster Recovery

7.4 Flexibility and Availability

- Integrity checks for data quality and accuracy
- Choice of disks types and configurations. Can be configured for no single point of failure
- System monitoring
- Tape backup support
- Hardware and software migration
- Preservation of the look and feel. (TIFF, PDF, HTML)
- Standards and interoperability

7.5 Scalability

- Database Used
- Multiple Server Support

7.6 Remote Connectivity

7.7 Metadata

- Administrative metadata
- Preservative metadata
- Use metadata

7.8 File Formats

- Data type (Alphanumeric, Image data)
- Applications (Flat files, Encoded text, Books Overseas publication (Audio
- Formats (Word, PDF, SGML, XML, TIFF; MP3)

7.9 Indexing & Searching Facilities

7.10 E-mail Notification or Subscription

7.11 Policy Management

- Rights Management
- Access rights management
- Copyright declaration
- Security requirements

8. Conclusion

E-journal revolution has set in without doubt. Both the compulsions and advantages of the emerging worldwide digital library scenario and the imperatives of Internet economy are unlikely to leave the libraries with any choice. Managing the complexities and

decision choices thrown up by the new paradigms caused by e-journals, particularly the archiving and copyright issues, will prove to be the major challenge to libraries, publishers and all other involved players.

E-archiving is still in its infancy but nonetheless there are tools for libraries big and small to get an archiving project off the ground. Any archiving project requires time, planning, and technical know-how. It is up to the library to match the right tool to its needs and resources. Participating in the LOCKSS project is feasible for libraries that do not have any content of their own to archive but that want to participate in the effort of preserving scientific works for the long term. The type of data that can be preserved with LOCKSS is very limited since only material that is published at regular intervals is suitable to be archived with LOCKSS. However, efforts are underway to explore if LOCKSS can be used for materials other than journals. As far as administration goes, LOCKSS is easier and cheaper to administrate than EPrints and Dspace. Moreover, LOCKSS has opened up a promising way to find a solution to the problem of preserving content in the long run through format migration.

Institutions that want to go beyond archiving journal literature can use EPrints or DSpace. They are suitable for institutions that want to provide access to material that is produced on their campuses in addition to preserving journal literature. More technical skills are necessary to set them up, but especially with Dspace, just about any kind of material can be archived. EPrints is a viable option for archiving material on a specific subject matter, while DSpace is especially suitable for large institutions that expect to archive materials on a large scale from a variety of departments, labs and other communities on their campus.

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