

EVOLUTION OF DIGITAL LIBRARIES IN THE ERA OF INFORMATION TECHNOLOGY**Anchal Mahana**Gangadhar Meher University, Sambalpur, Odisha
anchal.mahana@rediffmail.com**ABSTRACT**

The rapid advancement of Information Technology (IT) has significantly transformed traditional library systems into digital knowledge repositories. Digital libraries have emerged as an effective solution to address the challenges of information explosion, increasing user demands, budget constraints, and space limitations faced by conventional libraries. This chapter explores the evolution, emergence, characteristics, components, and design principles of digital libraries in the modern information age. It highlights the role of technological innovations such as the Internet, World Wide Web, online storage systems, and metadata standards in facilitating efficient information storage, retrieval, preservation, and dissemination. The study discusses the need for digital information support systems in academic and research environments and examines the transition from traditional and hybrid libraries to fully digital environments. Furthermore, it outlines essential criteria for developing digital libraries, including scalability, interoperability, user-friendliness, and preservation capabilities. The chapter concludes that digital libraries have become indispensable infrastructures for education, research, and knowledge management, enabling equitable and timely access to information resources beyond geographical and temporal barriers.

Keywords: Digital Library; Information Technology; Information Retrieval; Metadata; Digitization; Academic Libraries; Knowledge Management; Electronic Resources; Digital Preservation; Information Infrastructure; Hybrid Library; Library Automation; Information Access; Repository Systems; Information Society.

1. INTRODUCTION

Dr. S.R. Ranganathan, the doyen of Library Science wrote as one of his "five laws of library science" that is "library is a growing organism". Not only to individual libraries grow, the very concept of what it means to be a library has developed and evolved over the centuries.

Due to the advent of IT, libraries and information centres are being influenced to adopt the technologies in the field of their activities. The storage and retrieval of information have changed from printed format to electronic format. Electronic or digital formatted information becomes popular for its various positive attributes. Therefore, on the basis of collections, the nomenclature of the libraries is being changed as 'Digital library', 'Electronic library', 'Virtual library', 'Hybrid library' etc. with the digital or electronic collections such as online public Access Catalogue, CD-ROM databases, Electronic Journals and Internet access becomes the essential components of the library.

As the turn of the millennium, a paradigm shift took place, which coupled with a change in civilization, led to the implementation and dissemination of new form of IT. We are entering into a digital information society and age. This Digital-Yuga has been witnessed a paradigm shift of libraries shift of libraries from traditional to digital library.

2. NEED FOR DIGITAL INFORMATION SUPPORT SYSTEM FOR ACADEMIC AND RESEARCH

There is the need of digital information support system (digital library) for academic and research purpose. Information explosion, demanding budgets of the library, space problem, high information demand of the information seeker, available technologies and easy catering of information compels in the building of a digital library. Even of the well-stocked libraries and well equipped resource centres failed to meet the users demand. For this reason, there is the need of digital library which is the panacea to the age old problem. From today itself to the future, there will be enormous repositories with collections of information distributed in all over the world. Exchange of information and retrieval will be a great routine method to carryout business in each & every sector. The information seekers will range from Specialists to ordinary persons. Information Infrastructure will become an essential part of the all sectors (Especially in academic and research community), and digital libraries will be the only way to achieve information infrastructure.

3. EMERGENCE OF DIGITAL LIBRARIES

The World of IT is changing at a very fast pace, and the convergence of these had huge impact in libraries, Digital Libraries, whose history spans a mere dozen years. Vannevar Bush, the highest-ranking scientific advisor in the U.S. war effort in 1945 proposed for a "future device for individual use which is a sort of mechanized private file and library, a device in which an individual stores all his books, records and communications and which is mechanized so that it may be consulted with exceeding speed and flexibility (Bush; 1947; p 101-108). "In 1960, J.C.R. Licklider, head of the U.S. Department of Defence's information processing Techniques office, envisioned that human brains and computing machines would be tightly coupled together and imagined this to be supported by a "network of 'thinking centres' that will incorporate the functions of present-day libraries together with anticipated advances in information storage and retrieval". The 1970s brought prewritten programs for computer-based storage, indexing and retrieval of information. In

1994, the library of congress announced plans to create a National Digital Library (NDL)([http://LC web.Loc.gov/ndl/per.html](http://LC.web.Loc.gov/ndl/per.html)) by applying the aforesaid and future technologies to both print & non-print materials in its collection. The library of congress forces the NDL as a collaborative effort that eventually will include other collection from other libraries and serve as an integral part of the National Information Infrastructure. In the same year (1994), the National Science Foundation (NSF), the National Aeronautics and Space Administration (NASA) and the Defence Advanced Research Project Agency (DARPA) announced a joint effort to support digital library research to six universities (Witten; 2001;p 1-6).

The hybrid library is in the continuum between the conventional and digital libraries where electronic and paper-based information sources are used alongside each other. The challenges associated with the management of the hybrid library is to encourage end-user to provide information in variety of formats and from a number of local and remote sources in a seamlessly integrated way. The hybrid library aims to bring a range of technologies from different sources together in the context of a working library. In effect a hybrid library maintains all or its major parts of its collection in a digitize form as an alternative to supplement the print material currently found in libraries. It has a web-enabled computerized catalogue (WEBPAC) accessible through the internet and most of the in-house services like acquisition, books processing circulation are computerized. A hybrid library has a strong presence in the internet with a home page for the library providing an integrated access interface, not only to digital collections available locally, but also to the other commercial anon-commercial web-based digitized collections across the world.

4. CHARACTERISTICS OF DIGITAL LIBRARY

The term Digital Library may mean different things to different people, but it is not merely a collection of electronic information. It is an organized system of digital information that can serve as a rich resource for its user community.

A Digital Library emphasizes the equitable and timely access to a vast amount of diverse resources in a shared mode in a given specialty, lifting traditional barriers of time & space. Digital libraries may have the following characteristics associated with them.

1. Digital Libraries are the digital counterparts of traditional libraries and include electronic (digital) as well as print and other (e.g. audio, video, graphics, animation etc.) materials.
2. A Digital Library owns and controls the information. It provides access to information not just pointers to it.
3. A Digital Library has a unified organizational structure with consistent points for accessing the date.
4. A Digital Library is not single entity, it may also provide access to digital material and resources from outside the actual confines of any one Digital Library.
5. Digital libraries support quick and efficient access to a large number of distributed but inter linked information sources that are seamlessly integrated.
6. Digital Libraries have collections that
 - (i) are large and persist over time;
 - (ii) are well organized and managed;
 - (iii) contain many formats;
 - (iv) contain objects and not just their representation;
 - (v) contain objects that may be otherwise unobtainable.

5. WHY DIGITAL LIBRARIES?

With the advent of the below technologies have forced traditional libraries to go for Digital Library and also these forms the basic requirement of Digital Library.

Emergence of internet and web technologies as media of information delivery and access. The internet, particularly the World Wide Web (WWW), allows rapid access to a wide variety of networked information resources extending a uniform interface to a vast number of multimedia resources. The web, being a hypermedia based system, allows linking amongst electronic resources.

Availability of highly evolved, extraordinary simple and intuitive user interface, e.g. Internet Explorer and Netscape Navigator for all prevalent platforms.

Advances in online storage technologies enabling storage of large amounts of contents of increasingly affordable cost.

The Digital Libraries offer significant and unparalleled improvement and value addition to library services. While providing workable solutions to problems traditionally associated with the management of print based collections in traditional libraries improved information retrieval and enhanced document delivery capability is widely accepted. The cost of creating, storing, manipulating and transmitting digital information has decreased considerably providing necessary urge to the Digital Library initiatives worldwide. Rise in acquisition and subscription fees have forced the libraries to find other means to make information available to their users and content aggregators and electronic publishers are providing the means to do so.

Several large-scale digitization projects are aimed at conserving and preserving old, fragile and deteriorating documents of high scholarly value and further it provides increased access and search possibilities. Digital Libraries enable greater access to digital contents can be managed from remote locations and provide a way to enrich teaching and learning environment. Since information in the Digital Library is electronically stored and accessed it is not bound to space and time. Digital Library systems can be accessed simultaneously by multiple users guaranteeing continuous availability of documents. Digital Library implementation can dramatically reduce floor space requirements as compare to conventional shelf-type storage of books and journals.

6. CRITERIA FOR DIGITAL LIBRARY

To develop a Digital Library system, the following criteria can be considered:

Low cost, including all hardware and software components;

Technically simple to install and manage;

Robust

Scalable

Open and inter-operable

Modular

User Friendly

Multi-user (including both searching and maintenance)

Multimedia digital object enabled;

Platform independent (including both client and server components).

7. COMPONENTS OF DIGITAL LIBRARY

Digital library consists of

- User Interfaces or (user)
- Storage Media or (Repository)
- Identifiers

User Interfaces or user

A standard internet browser is used for the actual interactions with the user. This can be Netscape Navigator or Microsoft internet explorer. Through the browser user connects to client server (Repository) URL with TCP technology.

Storage Media (Repository) and Identifiers

Stores and manage digital objects and other information. The interface for this is called Repository Access Protocol (RAP). These Repository will have identifiers with the help of identifiers users can identify internet resources such as digital objects. In other words identifiers users can identify internet resources such as digital objects. In other words identifiers shows the identifier of the repository where the objects are stored.

Repository Consists

a. Data

b. Metadata

c. Meta-object

a. Data

The things which are digitized from the date. The materials selected may include Image text, Audio and Video. This material need to be acquired and process is called data acquisition. This can be done by scanners and digital cameras. The place where all the digitized objects are stored is called repository.

b. Metadata

Metadata is the data about data that describes the content and attributes of any particular item in a Digital Library. Metadata describes the items that are digitized. Metadata is important for Digital Libraries because it is the key to resources. An example of metadata is traditional card record of a book. Each digitized item will have metadata. For the creation of metadata MARC or Dublin Core Format is used. Some of the Dublin core elements are Title, Subject, description, source, language, relation, coverage, publisher and creator. Normally metadata are created using HTML or XML.

c. Meta-object

The repository may have plenty of digital objects in the form of data each of this data will be explained used metadata. The meta-data provides references to the set of Digital objects.

8. PRINCIPLES FOR DIGITAL LIBRARY DESIGN

The following principles guide the development of the architecture.

a. Service Driven

The architecture for the Digital Libraries must be driven by the services it provides and tools required for delivering the service.

b. Open Architecture

The architecture must be open, extensible and support interoperability among heterogeneous distributed system.

c. Scalability

The architecture must be robust, scalable and reliable in a high transaction rate production setting thousands of patrons with a wide variety of background and information needs.

d. Preservation

The architecture must ensure persistent access to collection of the Digital Library, addressing such issues as naming, digital achieving and digital preservation.

e. Privacy

The architecture must be sensitive to privacy issues and support both anonymous and customized access to resources.

f. Practicality

The architecture should represent a flexible and practical approach to standards, recognizing the need to balance the level of information collection with economic constraints.

g. Modularity

The architecture should represent a mix of new technology and legacy pieces, all of which must inter operate while involving at different rates.

h. Time Frame

The time frame required to plan for system migrations in the next year as well as planning for a technology generation framework should be approximately 3 to 5 years.

i. Client Support

The architecture should support a base line level of services, which can be accessed with common desktop configuration and software. Certain higher level services may require proprietary clients but the support of these clients should be determined by Digital Library tool and services group.

9. CONCLUSION

Digitization is the first step in building digital libraries. Besides digitization of documents achieves the purpose of preservation for the future generations and also supports the traditional library mission of collection development, organization and access to presentation. Digital libraries are very important sources of structured, well-organized and well stored information. In fact, it is a collection of disparate systems and resources connected through a network and integrated within one inter-face and are responsible for developing and providing access to shared collections. It should be noted that digitization task time consuming and involves high quality acquisition of hardware, software and also manpower.

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