

DIGITAL ARCHIVES: DESIGN AND DEVELOPMENT

K. R. Mulla* ; Shivakumar A. S* ; Chikkamallaiah** and M. Chandrashekara***

ABSTRACT

[All over the world libraries are undergoing a major transformation. The need of the society is forcing the libraries to undergo such a change. The emerging technology of digital libraries (DL), an offshoot of information revolution, can drastically improve the efficiency and effectiveness of management of physical and financial resources of libraries. The advantages of having a DL are now well understood by librarians, technologists, managers and others. The library has to equip to meet with global trends for the ultimate benefit of information seekers. Several factors play major role in the process of digitization. This paper discusses the transformation of a library from traditional type to the automated to digital form. It also highlights some of the issues involved in such process. Eventually coupled with digital technology, the DL becomes reality for anybody, anytime and anywhere.]

1. INTRODUCTION

The movement towards the electronic information society is pushing libraries to automation, CD ROM networking and digital based movement. Digital Libraries (DLs) provide access to digital information collections. DL includes a combination of structured/unstructured text/numeric data, scanned images, graphics, audio and video recordings etc. DL are required to select acquire, organize, make accessible, and preserve digital collections.

The conventional libraries of books were integrated together with the newly developed non-print learning resources or information resources. Because of the complex media technologies, difficult classification of information resources/artifacts/ media elements, lack of proper storage systems and fast obsolescence of media technologies, the stock and content of learning resources centers/ media centers, could not be sustained. One simple reason from the point of view of providers and users was, the requirement of learning of the skills of operating a variety of hardware, for proper use of software for teaching and learning.

* HKBK College of Engineering, Nagavara, Bangalore
Email: mulla_kamalasab@rediffmail.com; shivaksi@yahoo.com

** Librarian, Indian Institute of Management, Bangalore
Email: chik@iimb.ernet.in

*** Sr. Lecturer, DOSLISc. Manasagangothri, University of Mysore, Mysore-570 006.
Email: chandram5@yahoo.com

The evolution of affordable technologies of computer based networking (Intranet and Internet) and Interaction Television Networking (ITN) by the Space Applications Centers (SAC) and INFLIBNET etc., are compelling us to adopt the digital information resources each in day to day instructional work using various modes contact, offline distance and online distance education. Looking to the theses needs and the revolution in digital technology, a DL with large number of artifacts/information resources is immediately required. By doing so, for the first time, a long awaited dream will possibly be concretized in the form of an effective, interactive and proactive DL, that can be accessed by anyone who requires knowledge.

2. DIGITAL REVOLUTION AND LIBRARY EVOLUTION

In the present era of Information Technology (IT), digital media seems to have overshadowed the print and analog media. The accumulated knowledge of mankind in the form of books in the library and instructional audio and video broadcasting, are unfortunately losing their appeal among the masses. Books, becoming costlier and less affordable for many, access to the instructional radio and television being less flexible, at the same time the need of intellectual society to have access to the knowledge at a distance, demands revolutionary changes in traditional library.

Thus conventional print and non print material (including analog based materials) can be transformed in form of e-books, digital texts, graphics, audio, animation, digital video and also computer assisted learning and training materials and transmitted directly in the users hands globally rather than selected bands of users locally. This has become possible because of the emergence of computer technology to manage and administer the knowledge base (digital resources) and the communication and multimedia technologies to deliver information at a distance.

3. OBJECTIVES OF DIGITAL LIBRARY & ARCHIVES (DLAA)

- Analyze and design computerized information systems for DLAA that can be accessed on both intranet and Internet.
- Develop the computerized information system for the DLAA to effectively and efficiently manage different forms of learning resources of all curriculum areas, other general resources and also web-based resources available in the institution and on the Internet.
- Identify and address issues related to data security, copyright and subscription/licensing.
- Acquire, transform and preserve the existing learning and general resources (physical and analog artifacts) in form of print material, analog audio and video, into digital artifacts/archives.
- Implemented and provide access to the DLAA information system to the library users over Internet and Intranet.

- Preserve the digital artifacts/archives.
- Maintain the digital archives information system.

4. ADVANTAGES OF DLs Vs TRADITIONAL LIBRARIES

- Resources can be easily accessed on the net from anywhere, at anytime and according to individual choice. Faster access to all forms (text, graphics, audio, animation and video) of information on-site and off-site resources, at the desktop.
- Simultaneous access to the same resources and facilitating storing and printing the resources at users end. Resources in digital format can be managed and administered easily as compared to traditional management system.
- Preservation of Intellectual property.

Based on the objectives stated above, the establishment of 'DLAA' was carried out in different phases as described below:

5. PHASE 1: DESIGN ASPECTS

5.1. OUTPUT QUERY & INTERFACE DESIGN

In the process of development of any information system, 'output query and interface design' and 'input data and interface design' are the initial and primary step. The design aspects that was considered in each of the above two steps are detailed below:

- What are the different resources available in a curriculum area of a subject by a author and or a particular publication?
- What are the general resources available that are accessible on-site and off-site by a digital library member?

The different features of this web based interface that were identifiable is stated below:

- (i) The web-based interface should facilitate the DL members/visitors search resources stored on the DL server.
- (ii) Facilitate feature to access the learning resources to registered user through login identification and a password.
- (iii) The interest of the casual visitors interacting with the DL web site is sustained by providing them access to some general resources of interest available on-site or on Internet in the public domain.
- (iv) Facilitate users/visitors to download necessary plug in necessary to access

resources.

- (v) A link that will enable visitors to visit web site to get more information about institution profile.

5.2 INPUT DATA DESIGN

The available resources that could be part of DL were identified and these resources are divided into two broad classes or four categories. The classification/categorization was based on 'Learning' and 'General' resources, the types of available resources and the different users who will access the resources. These details are given in a tabular form in table [1]

5.3 INPUT INTERFACE DESIGN -(AT SERVER END)

(Application Interface Design)

The feature of the application interface (front end) to administer and manage these resources at the server end by the DL administrator was identified and the layout designed. The different features of input data interface that were identified was as follows:

- I. The interface should facilitate addition, deletion, and modification, listing and saving of resources, to and from the resource database (Oracle8i).
- II. Only authorized administrator through login identification and a password may be allowed to administer and manage the DLAA resource from the server system.
- III. Facilitate creation, deletion, and modification of data/information of a member.
- IV. Facilitate navigation and search options in the application interface.

6. PHASE 2: DLAA ARCHITECTURE

6.1 SYSTEM ARCHITECTURE

There are different ways an application can be developed. The design of a system or the system architecture will depend on a lot of factors like the design specifications, user requirements, the number of users, the performance requirements, reliability and maintainability, the scalability requirements and so on. Based on these factors, an application of three-tier architecture in a client server environment was proposed to design for using the latest technology tools. The technology tools that were identified for storing and managing the knowledge base (resource database- 2nd tier) was Oracle8i, Visual Basic (VB) for developing front end Graphic User Interface (GUI) application (1st

tier-which can help to administer and manage the digital library resources) and Active Server Pagers (ASP) ASP-3rd tier to fetch/accessing resources from Oracle8i data based at server end as per the users need through Java Script coding and web browser. The first and the third layers or tiers interact with the second layer and in the best of circumstances that are independent of the individual compositions. The proposed three-tier architecture of the information system is shown in figure [1]

6.1.1. TECHNOLOGY STANDARDS

Based on the technology tools selected to develop DL, the technology standards for transforming different forms of resources available in the institute such as physical/analog artifacts (print and non-print) into digital format were prescribed, as shown in the table [2]

6.1.2. DATA CODING SCHEME

To uniquely identify the resource data in the database table, it is necessary to use consistent data coding scheme, which will distinguish data of one entity set from another. Some of the sample data coding scheme adopted is as given in the table [3]

6.2 INFRASTRUCTURE FACILITIES

The basic infrastructure that was setup for the DLAA is small computer room with dedicated computer server to administer and manage and software to design and develop/transform digital artifacts. Dedicated manpower like librarians, programmer and specialized manpower to acquire, digitize, develop and manage the digital artifacts for implementing the DL were also identified. The basic infrastructure facilities in terms of hardware/software and manpower required.

a). HARDWARE:

- Dedicated server, Juke Boxes, Hard Disk with Terabyte capacity, Professional Scanner, Digital Camera. Workstations

b). SOFTWARE:

Windows NT Server with Internet Information Server (IIS) installed, Oracle 8i, VB, Microsoft Front Page/Interdev, Adobe PhotoShop, Paint Shop Pro, Macromedia Flash, VRML, Audio-Video Processing tools etc.

7. PHASE 3: SYSTEM-DEVELOPMENTAL ASPECTS

An application interface to administer and manage the digital library by the administrator at server end and a data retrieval system (at client end) that will be used by the library users/visitors was developed, based on the design considerations defined earlier.

7.1 INPUT INTERFACE-DEVELOPMENT

(Application Interface-Server End)

As per the three-tier design architecture and the identified features, an application interface using VB was developed to administer and manage digital resources. Some other important features incorporated in the application are to create/manage resource database, member entry, media management, cataloguing, searching a resource from the knowledge base etc. JavaScript and ASP were used to access resources from the data based. The resource database was created with thirteen different data tables, to ensure data integrity, avoid data redundancy and to eliminate the data inconsistency due to data insertion, deletion, and modification. The data normalization up-to three level was considered. Similarly, forms and source codes for administrating login identification cataloging the resources, creating members, curriculum area, subjects, author, publisher, currency, country, media type, source, supplier, resource category, general resource category and general resources were designed and created for manipulating data related to the resources.

7.2 OUTPUT INTERFACE- DEVELOPMENT

(Web Based Interface-Client End)

As per the features desired during the designing phase, a web-based interface was developed for the DL user to access 'General Resources' as well as 'Learning Resource & Institute Archives (LRIA)'. Home page, login page, learning resource page and general resource page using Hyper Text Markup Language (HTML) were developed. Java script coding was also used at client end to create select condition for the searching the resource, which was then processed by triggering ASP at computer server, special features to download 'Plug in' such as 'Internet Explorer' and 'Acrobat Reader' are also provided to the library members to access the resources. Using this web interface the user can access any learning resources of a particular curriculum area, in a subject, written by a author and published by a particular publisher. Features are also provided for having access to the classified resources such as external DLs, e-journal, virtual library etc., on the Internet, access to these Internet web sites will be made available to the users after the institute taken a policy decision and subscribes and takes license for the external resources. A user can also have access to the general resources, which are developed and made available onsite and offsite (Internet public domain) such as institute newsletter e-dictionary, encyclopedia, e-journal, etc.

8. PHASE 4: MAINTENANCE

Maintenance of 'DLAA' is another important phase. A well-organized system was developed to acquire the digital born archives as and when it is developed in the institution. These resources are then made available through the digital system over the Intranet. Time to time, the feedback provided by the members of the DL through e-mail is helping the administrator himself to updates the resources, ensures availability of the resource content and also repairs any broken links of the resources.

9. MANAGEMENT ISSUES

The DL has come into existence and use, recently. To sustain the library, there are certain management issues, which needs to be tackled.

1. Establish a clearinghouse team which will scrutinize new information resources before they get admitted to the DL, the scrutiny/editing need well defined criteria/norms/standards to be established by the institute in near future.
2. Policy decision concerning norms for compensation to the authors needs to be developed.
3. Norms and conditions for partnership with distributed DL of other institutions need to be formulated.
4. The norms for deciding the membership fees by the users of the institute and other potential users of the country, needs to be established.
5. Procedure for registration and collection of membership fees/subscription amount has to be formulated.
6. Exclusive funds needs to be made available for transforming existing printed and analog information resources into digital resources as well as for acquiring digital born resources, developing new digital born information resources and maintaining and updating the resource and technology standards

10. FUTURE DEVELOPMENTAL ISSUES

It is sure that the establishments of DL will speedup at much faster rate in educational establishments. With the increase in number of DL and their beneficiaries, different developmental issues may hinder the progress of the library. To take care of such managerial, operational, administrative and academic issues, it is highly desirable that a cross-country forum to address issues related to DL needs to be established for India and Asia Pacific region. India is not an exception in this race of DL revolution; digital library of India (DLI) initiative was launched in September 2003 by president of India. DLI portal (<http://www.dli.ernet.in>) DLI is being implemented in close collaboration with universal DL project (<http://www.ulib.org>) at Carnegie Mellon University. DLAA

evolution for the Education system, made a well beginning implementing using contemporary web based technologies that are used world over.

The forum shall take policy decisions; evolve ways and means for prescribing norms and standards including technology standards and also for ensuring that all the member libraries follow these norms/ standards. These are many other avenues/issues for future developments of DLs are:

- i. Confirming that no violation of copyright by the DL does occur before any information resources becomes integral part of the library. At the same time, ensuring that the copyright of the intellectual property of DL are also protected.
- ii. Increasing cooperation amongst distributed libraries.
- iii. The networking of the DL will normally occur within the fraternity of institutions pertaining to a particular category such as technical education, management education, science & technology and medical science education etc.
- iv. The forum should also develop a system of deep classification of digital information resources to ensure cross referencing/ searching/using the concept of key words.
- v. The forum should also concentrate upon integration of DL with several instructional/educational endeavors, in contact, offline distance/online distance modes so that ultimately the students acquire competencies implying skills pertaining to all the four domains: cognitive, affective, psychomotor and interactive.

11. CONCLUSION

After a long gap, and era of evolution of electronic media, DL technology will initiate and sustain the effective development, dissemination, classification, and storage/preservation of digital resources, to promote utilization of all kinds of media resources, old and new digital-born ones, for effective life-long learning. The synergy of networking, quick cross-referencing and mouse-click away accessibility of learning resources will change drastically the teaching-learning models in all modes of education and training: contact, off-line distance and on-line distance. The institutions learners using DL can possibly and quickly transform their organizations into an effective learning organization.

REFERENCES

1. Er. S.K. Soni, 'Multi-media Archival for Technical Education in Indian Ocean Region Countries An Indian Proaction', XXVII, Annual Convention of ISTE, MACT, Dec. 1997
2. George Koch and Kevin Loney, 'Oracle 8i - The Complete Reference', 3rd ed., TMH, New Delhi, 1997.
3. Mathew Strebe, Charles Perkins, 'Internet Information Server', 1st ed., BPS Publication, New Delhi, 1998.
4. Evangelos Petroustos, 'Mastering Visual Basic 6', BPB Publications, New Delhi, 1998.
5. Colombo Plan Staff College for Technician Education, Manila, Philippines, 'Leading Change in TET', October, 1999.
6. A Keyton Weissinger, 'ASP in a Nutshell', O'Reilly, Shroff Publisher & Distributors Private Limited, Mumbai, 1999.
7. R. Allen Wyke, 'Pure JavaScript', 1st ed., SAMS, Techmedia Publication, New Delhi, 1999.
8. Sybex Authors Team, 'HTML Complete', 1st ed., BPB Publication, New Delhi, 1999.
9. Nicholas Chase, 'Active Server Pages 3.0 from scratch', QUE, Prentice Hall of India Private Ltd. New Delhi - 110001, 2000.
10. Mike Gundearloy, 'Visual Basic Developer's Guide to ADO', BPB Publications, New Delhi, 2000.
11. Witten Ian. H and Bainbridge David, 'How to Build a Digital Library' Murgan Kaufmann Publishers, San Francisco, 2003.
12. Talawar V G and Biradar B S, 'Digital Resources and Services in Libraries' : Organized by Kuvempu University and ASSIST, 4th ASSIST National Seminar April 30th –May 1st 2004.
13. Murthy. T A V and et all., 'Multilingual Computing and Information Management in Networked Digital Environment: organized by CUST and INFLIBNET, 3rd International CALIBER February 2-4, 2005.

ANNEXURE

Table [1]. Classification/Categorization of Resources

SI.No.	Classification / Resource Category	Available Resources	Users
1.0	Learning Resources	Instructional Materials, Audio-Video Tapes, CBTs, Curriculum documents, Journals/conferences-papers, dissertation, project reports, thesis, Power points etc.	Authorized/Registered Users.
1.1	Classified Resources	External libraries, Online Journals, virtual libraries for which institution subscriptions are required.	Authorized/Registered Users
1.2	Institute Archives	Are the resources that are in particular related to the Institutions properties/ archives that can be assessed by selected identified users in the governing body of the Institution such as Annual report, board resolutions etc.	Identified Members of Institutes Governing Body.
2.	General Resources	Internet based resources that were available on public domain such as e-dictionaries, e-encyclopedias, e-Institute News Letters, e-Reports, e-magazine, e-newspaper, e-online journals, virtual Universities, e-virtual Library etc.	All users

Figure [1]-DLAA: A Three Tier Architecture Technology

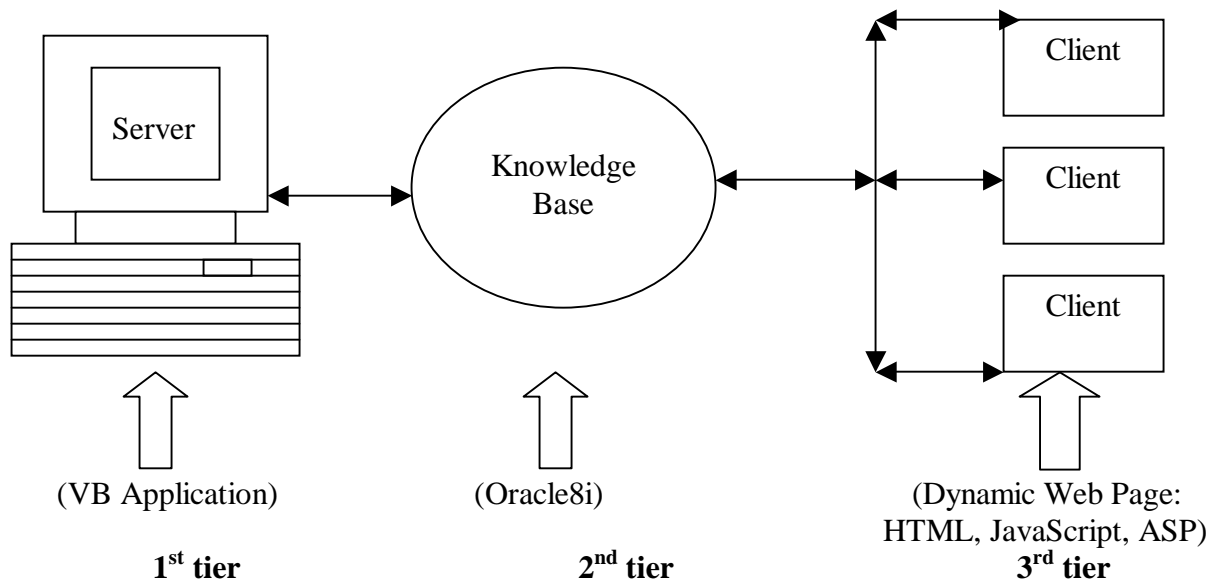


Table [2]. Technology Standards for Data/Resource Transformation

S.No.	Media Resource	Digital Media Format
1.	Textual	PDF (PDF Writer)
2.	Graphical	GIF, JPEG Format
3.	Audio	MP3 Format
4.	Animation	GIF, Macromedia Shockwave, Macromedia Flash, VRML
5.	Video	MPEG format
6.	Computer Assisted Learning	Authored in a Web Authoring Tool

Table [3]. Data Coding Scheme

Entity (Table Name)	Data Coding Scheme (First two characters after removing vowels)
Author	AT
Country	CN
Curriculum	CR
General Category	GC
Media (Learning Resources)	MDL
Media (General Resource)	MDG
Publisher	PB
Source	SR
Subject	SB
Supplier	SP