TRANSFORMATION TO VIRTUAL LIBRARIES : REAL OR VIRTUAL?

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1. INTRODUCTION

In tune with the fast changing developments taking place in the field of information technology, publishing activity has gradually moved from its conventional paper-based industrial set up to electronic publishing environment, literally on to the desktop. This gave way to electronic paper, electronic journal and electronic (digital) library. The increasing number of publishers who produce, the growing number of libraries around the world which acquire and the ready acceptance of users (albeit with little or no resistance) is amply evident in the exponential growth in the number of electronic publications. The increasing share of electronically/digitally available information in a variety of forms like machine-readable and online databases, bibliographic and full-text CD-ROM publications, multimedia products, online journals, computer-processed files and electronic mail, bulletin boards, teleconferencing, etc has made people to think of digital and virtual libraries.

Although optimistic estimates have been made (for example, Lancaster, 1981) that by the year 2000 about 50 per cent of secondary periodicals will be available only in electronic form, the scenario at present is slightly different. Though there is exponential increase in the electronic products and publications available in the market, print publications are not decreasing; the market for printed information by the end of 1997 was substantially larger that what it was in 1992 (Crawford, 1998). This makes it imperative that, the print-on-paper documents will still be strong for some more time.

A modest attempt has been made in this paper about the transformation to virtual libraries and various problems, issues and concerns related to the transformation. The words electronic and digital have been used as synonyms to connote the same idea through out this paper.

2. DIGITAL LIBRARIES

Digital library is a relatively new concept. The term digital library explains the nature of its collection. Many definitions are available in the literature. Digital libraries are electronic libraries in which large number of geographically distributed users can access the contents of large and diverse repositories of electronic objects. Electronic objects include networked text, images, maps, sounds, videos, catalogues of merchandise, and scientific, business and government datasets. They also include hypertext, hypermedia, and multimedia compositions (Yerkey, 1996). A vivid account of what a digital library means, technologies involved and the intellectual property in the cyberspace has been provided by Lyman (1996). Another work useful for those who plan digital libraries is by Saffady (1995), published under Library Technology Reports.

A digital library is understood to have the information stored predominantly in electronic or digital medium. The digital information collections may include digital books, digital/ scanned images, graphics, textual and numeric data, digitised films, audio and video clips, etc. A digital library is expected to provide access to the digital information collections.

The following factors had a catalytic effect in the emergence of digital libraries (Sherwell, 1997):

(a) A well-informed and computer-literate user base has started to demand more information at the desktop,

(b) Library budgets were not able to cope with the users' rising demands for hard copy journal titles,

(c) Users demanding documents for their research were not concerned whether these were held locally in the library or obtained from outside, as long as they could be supplied quickly,

(d) The distinction between library collection management and document delivery - the ownership and access approaches, was becoming increasingly blurred,

(e) The rapid growth in the Internet has demonstrated the potential wealth of information resources available at the click of a mouse button, and

(f) Librarians started giving increased emphasis on providing access to resources available elsewhere rather than   physically possessing resources.

The important characteristics of digital libraries are the storage of information in digital form, direct usage of communication networks for accessing and obtaining information, and copying by either downloading or online/off-line printing from a master file. Digital libraries enable managing very large amounts of data, preserve unique collections, provide faster access to information, facilitate dealing with data from more than one location, and enhance distributed learning environments. They also help to perform searches that are manually not feasible or practical and offer to protect content owners' information (Husler, 1997).

The main functions of the librarian of a digital library is similar to that of the librarian of a conventional library: identify, select, procure, process, organise, provide access, preserve and manage. However, while the former is expected to increasingly deal with documents in digital environment including working with advanced and complex technologies in the management of digital information collections, the latter deals predominantly with the conventional library holdings. Advancements in computer hardware, software, communications and networks made it economically feasible and technically possible to deliver electronic full text to the desktop.

2.1 Digital Library Projects and Initiatives

Many projects and initiatives taken up to create digital libraries have been dealt elsewhere (Berry, 1996; Lakshmana Moorthy and Karisiddappa, 1996; and Srinivasan, 1997). Many special issues of scholarly journals have been brought out on various issues concerning digital libraries (for example, *Communications of the ACM,* April 1995; *DESIDOC Bulletin of Information Technology*, November 1997; *Journal of the American Society for Information Science*, September 1993, and October 1994; and *SIGLINK Newsletter,* February 1995 to name a few. Important amongst the many initiatives launched is the joint initiative of Advanced Research Projects Agency, National Aeronautics and Space Administration and the National Science Foundation of the USA who announced several digital library projects involving Carnegie Mellon University, Stanford University, University of Michigan (Ann Arbor), University of California (Santa Barbara), University of Illinois (Urbana Champaign) and University of California (Berkeley), to advance the means to collect, store and organise in digital format and to make it available for searching, retrieval, and processing via communication networks. Many other universities and also OCLC are have undertaken projects involving digital libraries. The Library of Congress is making efforts to transform traditional print collections into versatile electronic resources under its National Digital Library Program, which aims to digitise 5 million items by the year 2000. Also, in the United Kingdom, the British Library, the ELINOR Electronic Library Project of De Montfort University, University of East Anglia, University of Bath, University College London, University of Wales, University of Ulster, University of Surrey, etc are making efforts towards electronic/ digital libraries.

On the publishers front, in the recent past, many reference books and tools, literary works, religious books and scholarly periodicals were brought out in digital form. Almost all major databases like INSPEC, MEDLINE, BIOSIS, ERIC, CAB Abstracts, Compendex Plus, Metade, MathSci, ABI Inform, AIDSLINE, Agricola, Chemical Abstracts, NTIS, ASTI, etc are available on CD-ROM and printed formats. On the journals front, many commercial publishers like Elsevier, HW Wilson, Silver Platter, Wiley, McGraw-Hill, Academic, Kluwer, etc and professional societies like IEEE, IEE, ACM, ACS, American Institute of Physics, etc are bringing out electronic versions of journals. There are many journals available online only through networks like Internet. In the near future we may expect increased number of digital publications.

In many libraries and information centres, the electronic information component added is steadily increasing. Their slow transformation to electronic libraries has been visible, at least in the case of elite institutions, through the functions and services offered and also in terms of enhanced information access to and increased demands by the library users.

2.2 Challenges, Issues and Concerns

A number of challenges are to be faced before digital libraries could be planned, established and

functioned well. Crawford (1998) provides some food for thought as to when a library should convert into a digital library:

(a) When reading from digital devices is as comfortable, effective, and fast as reading from printed books and serials (or more so), and

(b) When digital reading and storage devices are omnipresent, and

(c) When digital distribution replaces print publishing for all new materials because it is cheaper, faster, and better, and

(d) When all existing library materials are converted to digital form, and

(e) When digital communications facilities are so fast and inexpensive that transmission of publication equivalent is essentially instantaneous and free, and

(f) Given that publishers would not stand in the way of institutions making single purchased or converted publications simultaneously available throughout the institution, nation, or world,

then: (only) libraries will and must convert to digital distribution as a more effective way to carry out their missions.

The problems and issues associated with digital information like acceptability, accuracy, accountability, authenticity, readability, standardisation, copyright and pricing have been dealt by Lakshmana Moorthy and Karisiddappa (1996 & 1997). A few other problems associated with digital libraries are discussed in the following:

(a) Information Accuracy: Most of the digitising projects employ optical character recognition (OCR) technology which is only 95 per cent accurate. About 5 per cent errors remain. Thus 'dean' may become 'clean', 'rivet' may be read 'nivet', etc. Further, copying (electrocopying) without distorting or losing information is rather difficult. It is everybody's knowledge to encounter compatibility problems with respect to the format of the file downloaded or converted from source software files (say WordStar, Word Perfect, MS Word, etc) into target software files (one of the authors (ALM) faced many such problems while editing CALIBER-97 papers which used over half a dozen different software packages).

(b) Compatibility of Hardware/Software: The use of digital collections will pose compatibility problems as witnessed while using IEEE/IEE Electronic Library (IEL). Earlier University Microfilms International (UMI), the publishers of IEL, had a simple configuration of 14" monitor with a dual CD drive for index and text CDs and used Proquest software. When a new publisher IHS took over the publication at the end of 1996, a new configuration was suggested having a high resolution 17" monitor with increased hard disk capacity to load the index, and a Pioneer mini-exchanger (with six drives) for CD-ROM searches. The Proquest software was changed to an altogether new software. The institutions had to buy new computer systems and as a result of procedural delays the IEL CDs of 1997 could not be used for quite some time, particularly in government environment.

Also, due to the breathtaking innovations in computer hardware and software, although backward compatibility is ensured by manufacturing firms, it is to be seen if the computer program which used to create digitised files will still be available a decade from now and still be compatible with the computer configuration at that time. This problem is serious if we consider the closures, sell outs or mergers of many firms dealing in the computer hardware, software and peripherals.

(c) Shelf Life : Another concern is the storage life of electronic media. As against a print-on-paper (acid-free) document or a microfiche/film which have a much longer shelf life, the sturdy CD-ROMs survive about a generation. But, floppy disks, computer tapes and hard disks lost only a few years.

(d) Other Issues : Apart from these, problems like developing electronic catalogues that can retrieve information scattered across digital libraries over a network (say, Internet), finding a cost-effective way to digitise the material without spoiling the original in the process, and making the digital material available while protecting the literary rights of articles, writers and publishers (Chepesiuk, 1997) are to be addressed. There are enormous economic and ecological disadvantages to the all-digital library as users tend to print any

thing that is more than 500 words, and a typical library would spend much more on printing and licenses than its current budget and would use at least 50 times as much paper as at present (Crawford, 1998). A critical yet realistic view of omnipresent electronics, the death of printed text, universal conversion of collections into digitised form, digital communications and computer hardware, copyright vis-a-vis publishers and libraries, and many other related issues have also been dealt by Crawford (1998).

Other concerns of libraries and information centres while transforming in to digital libraries include addition of more and more electronic and digitised information, development and maintaining proper infrastructure facilities for access, and re-appropriation of budgets in the changing information technology environment. Issues of access, licensing and intellectual property must be addressed. Further, techniques for using electronic information for training, teaching and learning are to be mastered.

3. VIRTUAL LIBRARIES

Digital libraries and virtual libraries are not one and the same. All virtual libraries must, by their very nature, be electronic, but not all electronic libraries are necessarily virtual. A library with all holdings on CD-ROMs accessed from stand-alone workstations would be electronic, but it certainly would not be classed as a virtual library. The key characteristics of a true virtual library are (Sherwell, 1997):

(a) There is no corresponding physical collection,
(b) Documents will be available in electronic format,
(c) Documents are not stored in any one location,
(d) Documents can be accessed from any workstation,
(e) Documents are retrieved and delivered as and when required, and
(f) Effective search and browse facilities are available.

There has been increased interest on virtual libraries in recent times. A glance through the literature makes it clear that a majority of the efforts started in a corporate library set up where beating deadlines is all the more important due to heavy competition. The growing demand for increased accessibility, timely and faster delivery of results, and international coverage of business, technology and law has made corporate librarians look for more effective ways to meet the information demands of their customers. Virtual library is a means to meet the information demands in corporate settings. As in the case of digital libraries, here too definitions abound. A virtual library could be (Powell, 1994) :

(a) A library with little or no physical presence of books, periodicals, reading space, or support staff, but one that disseminates selective information directly to distributed library customers, usually electronically.

(b) A more traditional library that has transformed some significant portions of its information delivery channels into electronic format, so that many or most of its customers do not need to visit the library to obtain information.

(c) A library that operates as a nexus of selected information management activities within the organisation, some of them centralised, but most of which happen through the decentralised staff, resources, systems, and outside suppliers, who are accessible and dispersed throughout the organisation.

Whatever a virtual library means, the usage of communication networks and information technology for access, searching, and obtaining is a must and this setting does not include printed material except at the output stage. It facilitates personalised service provided on the user's desktop, and desktop access to information for end-users changes the way libraries and librarians perform their usual business, i.e., serving their clientele.

3.1 Virtual Library Projects

The corporate and business libraries are in the forefront to establish and exploit virtual libraries followed by the libraries of R&D and academic institutions. Experiences of many of these have been reported in the literature a few of which have been analysed in this paper.

The National Institute of Standards and Technology (NIST), USA developed a virtual library as an intranet. A detailed description of NIST's virtual library project has been provided by Ressler and Trefzger (1997). The Web-based user interface lets researchers access both internal and external databases, online

services and CD-ROM databases. It serves both internal and external users. A number of access controls were presented including IP number and password protections.

Tilburg University in 1995 started the virtual library with providing electronic access to Tiff images of over 120 journals of Elsevier in economic and social sciences under a license agreement; PDF files of journals from Kluwer Academic and Academic Press were included at the next phase. During 1995-97, the university exploited the virtual library concept in a big way by delivering full-text information to the desktops of over 2450 PCs in the campus utilising local, external, and Internet/WWW resources. The University also started to create, store, maintain and offer research papers electronically over the Web. This resulted in the regular use of desktop computers by 90 per cent of students and in heavy utilisation of electronic resources by the staff and students alike. Some of the areas identified for closer view include training and user support, under participation by the faculty, regulations for use of computers by students, security measures and policy to maintain a proper and correct use of electronic facilities are the problems identified (Geleijnse, 1997).

Boering and Seymour (1996) describe the virtual library and digital image programs of five educational projects and a problem-based learning series of case studies taken up at the Georgetown University Medical Centre in various disciplines. All these are available on the World Wide Web. Another paper in medical field by Basler and McKeehan (1996) holds that the virtual library concept of the present and future may ultimately have the heaviest impact on the medical college curriculum, discusses the efforts for indexing and cataloguing Internet Medical Resources and lists a number of electronic information resources including reference tools.

3.2 Services in a Virtual Library Environment

What services can be provided in a virtual library environment? Almost all the services offered in traditional and digital library environments and many more. Only the imagination of the librarian is the ultimate limit. A brief scan of literature would give many innovative services offered utilising virtual libraries. Corporate and business information headlines are searched, retrieved and e-mailed to the desktops of individual clients who, on opening their e-mail box, will find them. NEWSFLASH is one such Electronic News Delivery Service which was found very popular, cost-effective and does not violate copyright laws (Raymond, 1994). Toshiba Business Information Centre operates Information Centre News by using OCR technology for creating database of news, government reports; merge with relevant file transferred data selected and downloaded from commercial databases (Mori, 1994). An in-house developed virtual library came to the rescue of a corporate librarian to satisfy the information needs of customers in the face of drastic reduction (90 per cent) of library staff (Matarazzo, 1994).

A virtual library product, the Business Sources on the Net (BSN) was conceived (Westerman, 1994) by seven academic business librarians to be a solution and guide to the Internet users to cope up with the vast business resources available over the Net. BSN is available with 12 of its files covering various subject fields like accounting and taxation, economics investment, personnel management, etc listing various types of sources such as discussion groups, Telnet files, Gopher sites, ftp archives, electronic journals and newsletters, freenets, WAIS resources, WWW, etc. As the Net browsers like Gopher, WWW or WAIS, though helpful, are time-consuming and complicated, this service is finding acceptance from Internet users.

Many titles were/are in vogue to describe a library incharge. These include librarian, library manager, information manager, information officer, information scientist, information resource manager, Knowledge Counselor, and Corporate Intelligence Professional (Ojala, 1993). But librarians are slowly transforming into cybrarians (a term coined by Michel Bauwens of BP Nutrition, Antwerp, Belgium), which emphasises the increasing use and impact of the Web, Internet, cyberspace and the changing role of the librarian as a facilitator in a network of cybrarians. The transformation was made possible because of a variety of information technologies. And it is essential because effective retrieval, use and management of information can make all the difference in an information centre. Provision of external and internal information through a network, networked CD-ROMs, Internet, intranet, online database hosts and SDIs using e-mail are a few services which could be offered by the cybrarians in a virtual library environment.

3.3 Influence of Internet on Virtual Libraries

Internet is enabling inter-connectivity of computers and computer networks at global level. Internet is the global network of over 30,000 networks (in May 1994) with about 29.7 million host computers (in Janu-

ary 1998) spread around the world, dealing with each other through a common set of communication protocols, reaching over 170 countries and providing connectivity to about 70 million users. The growth of Internet has been global and continuous. The subscriber base of the Net is expected to reach 20 million by the turn of the century.

The Internet has changed the notion of a library as a place into a virtual library, i.e., library without walls, shifting the library on to a desktop at the office or home. A variety of technologies are used for accessing the vast electronic information resources available on Internet and the Web. Starting with basic tools like e-mail, and ftp, Internet has shifted to navigation aids like Wide Area Information Servers (WAIS), Netscape and Gopher; Web clients such as Lynx, WinWeb and Cello; and more recently to the consumer-oriented home pages of the Web. Information resources available on the Web are getting inter-linked through Web pages.

Internet catalysed the proliferation of electronic and online journals. Several journals are already available on the Net (some only on the Net), for example, <u>Journal of Universal Computer Science, Electronics Letters Online, Journal of Knowledge Synthesis and Nursing, and Online Journal of Current Clinical Trials.</u> The number of electronic journals and publishers offering their journals on Internet is steadily increasing. Services like 'Uncover' by Blackwell and 'Contents First' by OCLC offer Internet access to table of contents of several thousand journals, followed by online ordering of full text of papers. Institutions have begun to take such services into account while planning their acquisitions, particularly journal subscriptions.

Internet provides seamless access to virtually everything from day today news to specific information on almost all subject fields. You name anything—the chances are that information on it is already available on the Net. One can browse, navigate, cruise or surf the electronic information resources available on the Net.

The large number of electronic information resources available over the Net and the Web distributed all over the world makes it possible to build, virtual libraries and virtual reference sources in many subject areas. Some of the virtual libraries available on the Web and Internet include: (i) The British Library (http:/portico.bl.uk/access/); (ii) The Internet Public Library (http://ipl.sils.umich.edu/); (iii) The Library of Congress (http://www.loc.gov/); (iv) The Magna Graecia Library (http://www.cubozo.unical.it/server/archivi/mg/arc_mg.html/); (v) The University of Michigan (Ann Arbor) (http://www.lib.umich. edu/); (vi) The University of California (Berkeley) (http:// sunsite.berkeley.edu/); (vii) The Vatican Library (http://www. software.com/is/dig-lib/vatican.html/). Some virtual reference collections have been developed and made available on Internet. These include the University of Michigan-Dearborn's Virtual Reference Desk (http://www.umd.umich.edu/lib/vrd/), the Virtual Reference Desk of the libraries of Purdue University (http://thorplus.lib.purdue.edu/reference/index/html) and the Reference Shelf of the library of the University of California-San Diego (http://gort.ucsd.edu/ek/refshelf.html).

An important factor to be considered here is whether the resource is a freely accessible site or fee-based. There are many free sources available on the Net; many are being created and offered free. This helps small and medium libraries with limited resources who can make use of these resources (of course, expenditure on computers and communication facilities is unavoidable). For example, for those who cannot afford Books-in-print, Amazon. com (available at http://www.amazon.com) provides excellent source of current evaluative information on publishers and prices of books which can be useful for determining interlibrary loan needs, collection development policies, etc. As Internet is gaining popularity, even commercial reference sources are becoming increasingly available to subscribers or authorised users through a variety of passwords and authorisation systems (Snavely, 1997). Many authors have listed Internet sites of librarians' interest (see for example, Snavely, 1997; Stewart, 1996 and Wolinsky 1996).

One can access literally thousands of news and information sources on Internet. But that is searching for a needle in the haystack. For those suffering from information overload, customizable news services deliver the required news after filtering out the unwanted information (Muchmore, 1996). The user has to select from a list of general news topics or specify search terms. The news services send the news summaries or full stories to the e-mail box or custom Web page or a proprietary communication network at affordable prices ranging from free to US$ 50 per month.

The electronic information resources available over the Web and Internet are highly disorganised. To overcome the electronic chaos and complexity of locating required information over the Net, a number of projects were undertaken to catalogue and index for facilitating searching Internet-based information sys-

tems. Using these metadata products, the user can access information distributed over a number of locations. These simplify the task of the Internet surfers. Some of such utilities include WWW Catalog, WWW Worm, NetFirst, GEM (Gateway to Educational Material), Web Crawler, Infoseek, OpenText, and Global Network Academy Meta-Library. A number of efforts covering wide ranging current activities associated with the 'bibliographic control' of Internet resources have been reported (Efthimiadis and Carlyle, 1997; Jul, 1997; Schwartz, 1997; Shafer, 1997; Sutton and Oh, 1997; Vellucci, 1997 Vizine-Goetz, 1997 and Weibel, 1997). Metadata home pages are also being published over the Web. Apart from Uniform Resource Locators (URLs), Uniform Resource Identifiers (URIs), Uniform Resource Names (URNs), and Uniform Resource Characteristics (URCs) are coming into vogue (Scwartz, 1997).

Many specific subject oriented guides (such as BSN discussed in section 3.2) and virtual libraries have been developed. A virtual library project in the power engineering field has been described by Ramesh (1995); it is intended to be a central repository for power engineering resources on the Internet and is a distributed cataloguing mechanism supported by various subject maintainers all over the world. A three-dimensional file system navigator (FSN) interface was designed for graphically navigating a large collection of electronic documents available in a virtual library (Rogers et al, 1994).

3.4 Virtual Libraries and the Cyber Law

Leaving aside technical and other problems to usher in virtual libraries, the most important problem is the copyright in cyberspace. Existing copyright laws have not caught up with the technological developments in cyberspace. Conscious users are confused as to which is right and which is wrong. At present there is no clarity about whether the content of electronic resources on Internet are free or priced. Although the copyright statements appear in many cases, they are elusive to locate in some cases. It can be argued that publishers of promotional material, especially advertising and marketing material, on the Web implicitly encourage downloading, printing and copying the material for redistribution to more than one in the same organisation (Ardito and Eiblum, 1998). One can see copyright notices on advertising and marketing material compounding and confusing the situation further.

Even if an electronic resource is a free journal or a newspaper, there is no clear cut law whether it is violation to forward the items from them to colleagues, friends or through listservs. Many electronic papers on Internet allow personal and fair use; many more lack explicit statements if it is free or priced. Further, it is a copyright violation to e-mail a Web page by an intermediary to a colleague or a user, strictly for information sake and no financial gain is involved. How is this acceptable ? The best way can be to provide information about the URL where the piece of information appears. Even downloading e-mail is an offence under copyright law. A number of case studies in cyber law are provided by Rosenoer (1997) which is an excellent information source on the thorny issue.

As we move further towards virtual libraries, we may see more and more authors and publishers may turn to legal redressal. This is one reason that the copyrighted books and other material are not expected to be readily available in cyberspace as they are available in traditional libraries.

4. CONCLUSION

Traditional libraries are meeting places of teachers and researchers supporting formal, interdependent and collaborative learning and research. However, virtual libraries facilitate individual, independent and informal learning.

The impact of the Internet on the research users is such that they expect access to information from wherever they are free of any charges and wish to get not merely bibliographic information, but full original text. Users perceive the Web as an information goldmine and the answer to all their information problems. However, when they attempt to use electronic resources, they sometimes change their perspective. Quite often they realise that to exploit these resources effectively they need training. Searching electronic resources and retrieving information requires training which is not provided to the end-users as yet. The users do not really get the benefits from the technology unless they are trained to have a right perspective and understanding of the electronic resources.

The future of the librarian is inextricably linked with the library and as the role of the library changes so will that of the librarian from custodian to navigator and evaluator of information and information resources, a role that is absolutely crucial in the new Web environment where there are great quantities of

information, but finding the quality in that huge haystack is a difficult task (Duncan, 1997).

The librarians (or cybrarians) in the age of virtual libraries are expected to be

(a) Enhanced service providers in a proactive manner,

(b) Masters of copyright, licensing and electronic redistribution regimes,

(c) Coordinators working with various specialists overseeing information infrastructure, networks and network applications, and

(d) Skilled organisers of knowledge resources including training of staff and end-users.

It has become increasingly common to find references to the Internet electronic resources in literature. The number of such references is on the increase. It is also becoming common to submit research papers by floppies in word-processed files and print files or send by e-mail. Yet paper and printed magazines and books persist and will be the primary sources of information for some more time much the same way those libraries all over the world which use MARC and a variety of computer-based catalogues, OPACs, etc yet retain their card catalogues. Some studies in document management have reported that about one per cent of the total published information is in digital form, 3-4 per cent in micro form and 94-95 per cent is still in print form. It was reported that 5 per cent of the information would be stored on computers by the year 2000 which would be equal to 600 Petabytes (PB—6,00,000 TBs). The remaining 95 per cent (11,400 PBs or 11.4 million TBs), will be in print form which in terms of documents, will amount to 228 trillion (Kempster, 1996). So we will be dealing with printed material for quite some time to come.

Libraries are important treasure houses of knowledge for preservation and act as information resource centres both for the individuals and the community alike. Libraries will continue to be the meeting and learning places to play important social, cultural, technical and pedagogic roles in the future.

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REFERENCES

Ardito, Stephanie C and Eiblum, Paula. Conflicted copyrights — inevitability : Death, taxes and copyright. *Online,* January-February 1998, **22**(1), 81-85.

Basler, Thomas G and McKeehan, Nancy. Vitual library and the medical collge curriculam. *In* Proceedings of the Fourth International Conference on Image Management and Communication, 20-24 August 1995, Oahu, USA. New York, IEEE, 1996. pp. 140-148.

Berry, John W. Digital libraries: New initiatives with worldwide implications. *IFLA Journal,* 1996, **22**(1), 9-17.

Boering, Naomi C and Seymour, Anne. The virtual library and digital image programme. *In* Proceedings of the Fourth International Conference on Image Management and Communication, 20-24 August 1995, Oahu, USA. New York, IEEE, 1996. pp. 149-156.

Chepesiuk, Ron. The future is here: America's libraries go digital. *American Libraries,* January 1997, **28**(1), 47-49.

Crawford, Walt. Paper persists: Why physical library collections still matter. *Online,* January-February 1998, **22**(1), 42-48.

Duncan, Moira. The electronic library at work. *Aslib Managing Information,* June 1997, **4**(5), 31-34.

Efthimiadis, Efthimis N and Carlyle, Allison. Organising Internet resources : Metadata and the Web. *Bulletin of the American Society for Information Science,* October-November 1997, **24**(1), 4-5.

Geleijnse, Hans. Moving from digital to the virtual library. *In* Proceedings of the Forum on Research and Technology : Advances in Digital Libraries, 7-9 May 1997, Washington, DC. New York, IEEE, 1997. pp. 56-62.

Husler, Richard P. Digital library: Content preservation in digital world. *DESIDOC Bulletin of Information Technology,* 1997, **17**(6), 7-14.

Jul, Eric. Cataloguing Internet resources : Survey and prospects. *Bulletin of the American Society for Information Science,* October-November 1997, **24**(1), 6-9.

Kempster, Linda. A snapshot of the optical disk future. *International Journal of Micrographics & Optical Technology,* 1996, 14(2), 2-7.

Lakshmana Moorthy, A and Karisiddappa, CR. Copyright and electronic information. *In* Access to Electronic Information: Papers presented at Sixteenth Annual Convention and Conference on Access to Electronic Information, 25-29 January 1997, Bhubaneswar, edited by M Mahaptra, DB Ramesh, KN Kittur, P Padhi and JR Sahu. New Delhi, SIS, 1997. pp. 403-416.

Lakshmana Moorthy, A and Karisiddappa, CR. Electronic publishing: Impact and implications on library and information centres. *In*
Digital libraries: Dynamic storehouse of digitized information. Papers presented at the SIS 96: Fifteenth Annual Convention and Conference, 18-20 January 1996, Bangalore, edited by NM Malwad; TB Rajashekar; IK Ravichandra Rao & NV Satyanarayana. New Delhi, New Age International Publishers, 1996. pp. 15-35.

Lancaster, FW. The future of library in the age of telecommunications. *In* Telecommunications and libraries: A primary for librarians and information managers, edited by DW King and others. White Plains, Knowledge Industry, 1981.

Lyman, Peter. What is a digital library? Technology, intellectual property, and the public interest. *Daedalus : Journal of the American Academy of Arts and Sciences* (special issue on Books, bricks and bytes), Fall 1996, **125**(4), 1-33.

Matarazzo, James M. Introduction. *Special Libraries,* Fall 1994, **85**(4), 251-252. (Quoted Bauwens, Michel. The BP Nutrition virtual library: Acase study, *In* Information for management: A hand book, edited by James M Matarazzo and Mirian A drake. Washington, DC., SLA, 1994. pp. 159-165).

Mori, Akio. The Toshiba Business Information Centre moves toward the virtual library. *Special Libraries,* Fall 1994, **85**(4), 277-280.

Muchmore, Michael W. News you choose. *PC Magazine,* 9 April 1996, 199-222.

Ojala, Marydee. What will they call us in future? *Special Libraries,* Fall 1993, **84**(3), 226-229.

O'Kane, Kevin C. World Wide Web-based information storage and retrieval. *Online and CD-ROM Review,* 1996, **20**(1), 11-20.

Powell, Alan. Management models and measurement in the virtual library. *Special Libraries,* Fall 1994, **85**(4), 260-263.

Ramesh, VC. Browse the power engineering virtual library. *IEEE Computer Applications in Power,* October 1995, **8**(4), 35-38.

Raymond, Sandy. NEWSFLASH! or one Cybrarian's quest for Electronic News Delivery. *Special Libraries,* Fall 1994, **85**(4), 270-273.

Ressler, Sandy and Trefzger, Bill. Development of the NIST virtual library. *IEEE Internet Computing*, September-October 1997, **1**(4), 35-41.

Rogers, Bill; Cunnigham, Sally Jo and Holms, Geoff. Navigating the virtual library. *In* Proceedings of the

ANZIIS 94—Australian New Zealand Intelligent Information Systems Conference, 29 November-2 December 1994, Brisbane. New York, IEEE, 1994. pp. 467-471.

Rosenoer, Jonathan. CyberLaw : The law of the Internet. New York, Springer, 1997. 362 p.

Saffady, William. Digital library concepts and technologies for the management of library collections: An analysis of methods and costs. *Library Technology Reports,* May-June 1995, **31**(3), 221-385.

Samuelson, Pamela. Copyright and digital libraries. *Communications of the ACM,* 1995, **38**(4), 15-21,110.

Schwartz, Ray. Uniform Resource Identifiers and the efforts to bring "bibliographic control" to the Web : An overview of current progress. *Bulletin of the American Society for Information Science,* October-November 1997, **24**(1), 12.14.

Shafer, Keith. Scorpion helps catalog the Web. *Bulletin of the American Society for Information Science,* October-November 1997, **24**(1), 28-29.

Sherwell, John. Building the virtual library : The case of SmithKline Beacham. *Aslib Managing Information,* June 1997, **4**(5), 35-36.

Snavely, Loanne. Building the virtual reference shelf: How to get the most for your money. *Information Outlook,* July 1997, **1**(7), 24-28.

Srinivasan, Padmini. Digital library projects in the United States. *DESIDOC Bulletin of Information Technology,* 1997, **17**(6), 15-21.

Stewart, Barbara. Internet advantages for the technical services librarian. *DESIDOC Bulletin of Information Technology,* May 1996, **16**(3), 29-48.

Sutton, Stuart A and Oh, Sam G. GEM : Using metadata to enhance Internet retrieval by K-12teachers. *Bulletin of the American Society for Information Science,* October-November 1997, **24**(1), 21-24.

Vellucci, Sherry L. Options for organising electronic resources : The coexistence of metadata. *Bulletin of the American Society for Information Science,* October-November 1997, **24**(1), 14-17.

Vizine-Goetz, Diane. From book classification to knowledge organisation : Improving Internet Resource description and discovery. *Bulletin of the American Society for Information Science,* October-November 1997, **24**(1), 24-27.

Weibel, Stuart. The Dublin Core : A content description model for electronic resources. *Bulletin of the American Society for Information Science,* October-November 1997, **24**(1), 9-11.

Westerman, Mel. Business sources on the Net: A virtual library product. *Special Libraries,* Fall 1994, **85**(4), 264-269.

Wolinsky, Judith. Internet sites of librarian's interest. *DESIDOC Bulletin of Information Technology,* May 1996, **16**(3), 21-28.

Yerkey, A. Neil & Jorgensin, Corinne. A course in digital libraries. *DESIDOC Bulletin of Information Technology,* 1996, **16**(1), 31-39.