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# The role of a digital librarian in the management of digital information systems (DIS)

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## Abstract

Stresses that the multimedia nature of the next generation of digital libraries requires the digital librarians (DL) to be essentially a type of specialist librarian who has to manage and organize the digital library, handle the specialized tasks of massive digitization, storage, access, digital knowledge mining, digital reference services, electronic information services, search co-ordination, and manage the archive and its access. The digital librarian acts as guardian of the information superhighway/the universal digital library or the global digital library and acts as a symbiotic human-machine guru. This article also highlights the roles and functions of a DL in information retrieval, content delivery, navigation, and browsing. It envisages the professional education and training for digital librarians in the management of digital information systems. It denotes the DL's interface functions, roles, skills and competencies for the management of digital information systems in the important areas of imaging technologies, optical character recognition, markup languages, cataloguing, metadata, multimedia indexing and database technology, user interface design, programming, and Web technology. This paper finally advocates and targets the task of creating a new job title – digital librarian – to take care of digital libraries and to manage the digital information system.

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## 1. Introduction

In an era of digital information, electronic technology, WWW's growing popularity and the tremendous growth of CD-ROM products, digital libraries offer a huge range of multimedia information, everything from movies, speeches, images and photos to sounds, text and beyond. The amounts of online, CD-ROMs and other digital sources of information are exploding and infrastructure for accessing material improves almost daily. In building the next generation of digital libraries, multimedia and artificial intelligence will play several important roles. The multimedia nature of digital libraries requires digital librarians for the locating of relevant information efficiently and cost-effectively and disseminating it in a wide variety of a formats of digital information system (DIS). The advent of digital libraries presents a plethora of challenges and opportunities to the digital librarian. Digital librarians add value and can make digital libraries truly useful and user friendly.

A digital librarian, a type of specialist information professional who manages and organizes the digital library, combines the functionality for information, elicitation, planning, data mining, knowledge mining, digital reference services, electronic information services, representation of information, extraction, and distribution of information, co-ordination, searching notably CD-ROMs, online, Internet-based WWW, multimedia access and retrieval. The ultimate goal of a DL is to facilitate access to information just-in-time to the critical wants of end users and additionally to facilitate electronic publishing.

The digital librarian plays a distinctive and dynamic role in easy accessing of computer-held digital information including abstracts,

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indexes, full-text databases, sound and video recording in the digital formats. For finding the right information at the right time, the research, education and training, learning and developmental work and disseminating to the user in required format are the basic requirements of DL.

## 2. Need for a digital librarian in the management of DIS

Necessity is the mother of invention. The emerging global digital libraries or world-wide digital information centers generate the need for creating a new job-title "digital librarian" to manage their digital knowledge resources. The huge digital libraries are emerging as knowledge warehouses. Digital librarians are required to:

- manage the digital libraries;
- organize digital knowledge and information;
- disseminate digital information from the computer-held digital information;
- provide digital reference services and electronic information services;
- provide knowledge mining from the emerging knowledge warehouses;
- handle the tasks of massive digitization, digital storage process, and digital preservation;
- provide universal access and retrieval of digital knowledge, ultimately access to all;
- catalogue and classify digital documents and digital knowledge.

## 3. Digital library

Digital libraries are electronic libraries in which large numbers of geographically distributed users can access the contents of large and diverse repositories of electronic objects – networked text, images, maps, sounds, videos, catalogues of merchandise, scientific, business and government data sets – they also include hypertext, hypermedia and multimedia compositions (Yerkey and Jorgensin, 1996).

A digital library is understood to have the information stored predominantly in an electronic or digital medium. The digital information collection may include digital books, digital scanned images, graphics, textual and numeric data, digitized films,

audio-video clips, etc. A digital library is expected to provide access to the digital information collections.

A digital library may be considered to be any of these (William, 1995):

- (1) machine-readable data files;
- (2) components of the emerging National Information Infrastructure;
- (3) various online databases and CD-ROM information products;
- (4) computer information storage devices on which information resides;
- (5) computerized networked library systems.

As practitioners today, we find this definition to be the most useful one:

A digital library maintains all, or a substantial part, of its collection in computer-processible form as an alternative, supplement, or complement to the conventional printed and microfilm materials that currently dominate library collections (Williams, 1995).

The component characteristics of digital libraries are the storage of information in digital form, direct usage of communication networks for accessing, obtaining information, and copying by either downloading or online/offline printing from a master file. Digital librarians 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 and offer to protect the content of the owner's information (Husler, 1996).

## 4. The role of a digital librarian in the management of DIS

Digital information system management refers to the overall competencies (knowledge, know-how, skills and attitudes) necessary to create, store, analyze, organize, retrieve and disseminate digital information (text, images, sounds) in digital libraries or any type of information. To describe the roles of the digital librarian, the following concepts are introduced to understand further.

### 4.1 Guardian of information superhighway (ISH)

The information superhighway is a vision or a metaphor. It envisions a fusion of the two-way wired and wireless capabilities of telephones

and networked computers with a cable TV's capacity to transmit hundreds of programs. Services would be delivered by telecommunications networks, cable TV networks, and the Internet and mobile communications (William *et al.*, 1995). Infrastructure that provides band width-on-demand and information-on-demand services are called information superhighway. There will be two types of information services such as public (free) services and commercial services. The use of existing telephone, fax, analogue TV broadcast services will be supported in the initial information superhighway. In addition, new services such as videophone, multimedia electronic messaging, digital TV/HDTV broadcast and movie and video-on-demand service, will be provided (Lu, 1996).

#### **4.2 Guardian of the global digital library/ the universal digital library**

The digital library is really a transitory phase towards the universal digital library, a vast distributed information and active repository accessible from anywhere with increasing improved indexing, extraction and summarization techniques. It will be a library without walls or national boundaries.

#### **4.3 Digital librarian acts as symbiotic human-machine guru**

The digital librarian acts as an intermediary in the task of massive digitization of information, its storage, dissemination, managing the archive, and making available digitized networked information to the end users. Digital librarians and computers depend on each other for processing and dissemination of digital information and both are inter-related.

#### **4.4 Navigation, browsing and filtering**

The navigation of the future would tend to integrate with the human-assisted information retrieval from the networked universe and would support rapid information navigation and precision retrieval. The digital librarian is an expert in navigation, browsing and filtering, digital reference services and electronic information services from the digital information sources.

#### **4.5 Multimedia search and indexing**

A multimedia digital library requires not just standard indexing and retrieval, but also

sub-document indexing and summarization techniques – more than that of paper documents.

#### **4.6 Knowledge and data mining**

The digital librarian will require a limited knowledge of data mining and discovery of knowledge from digital libraries to extract unmet information needs of users. For this purpose, unsupervised learning techniques such as clustering, and composite term discovery techniques etc., are useful.

#### **4.7 Search and retrieval co-ordination**

It requires comprehensive knowledge of the retrieval engines and indexing structure so that the digital librarian can achieve the goal of creating information queries with respect to the search system.

#### **4.8 Digital librarian's interface functions and roles in the management of DIS**

A fundamental role of a DL in digital libraries is to act as an intermediary who brings together users and information (see Figure 1). Digital library access tools are the right set of tools used in novel ways to tackle a plethora of challenges and opportunities for information access technology and faster access (Kikuchi *et al.*, 1996).

#### **4.9 Digital information access**

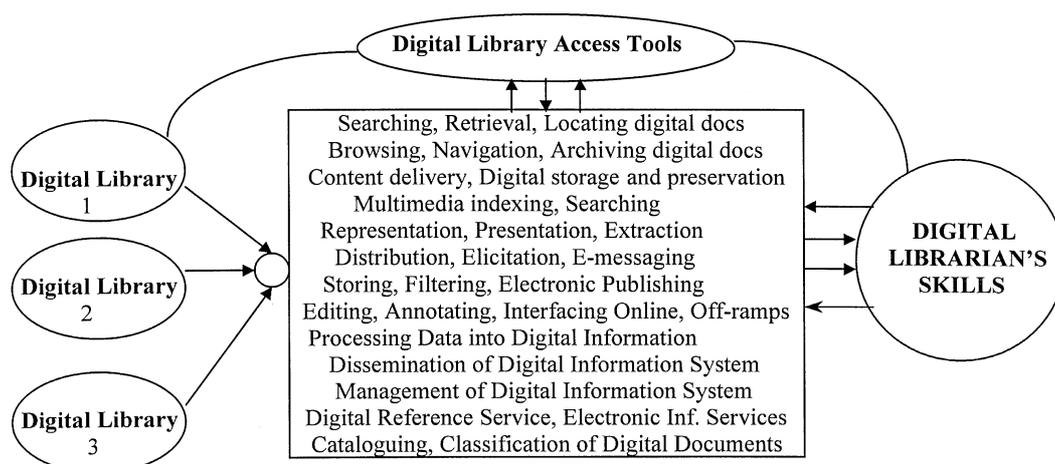
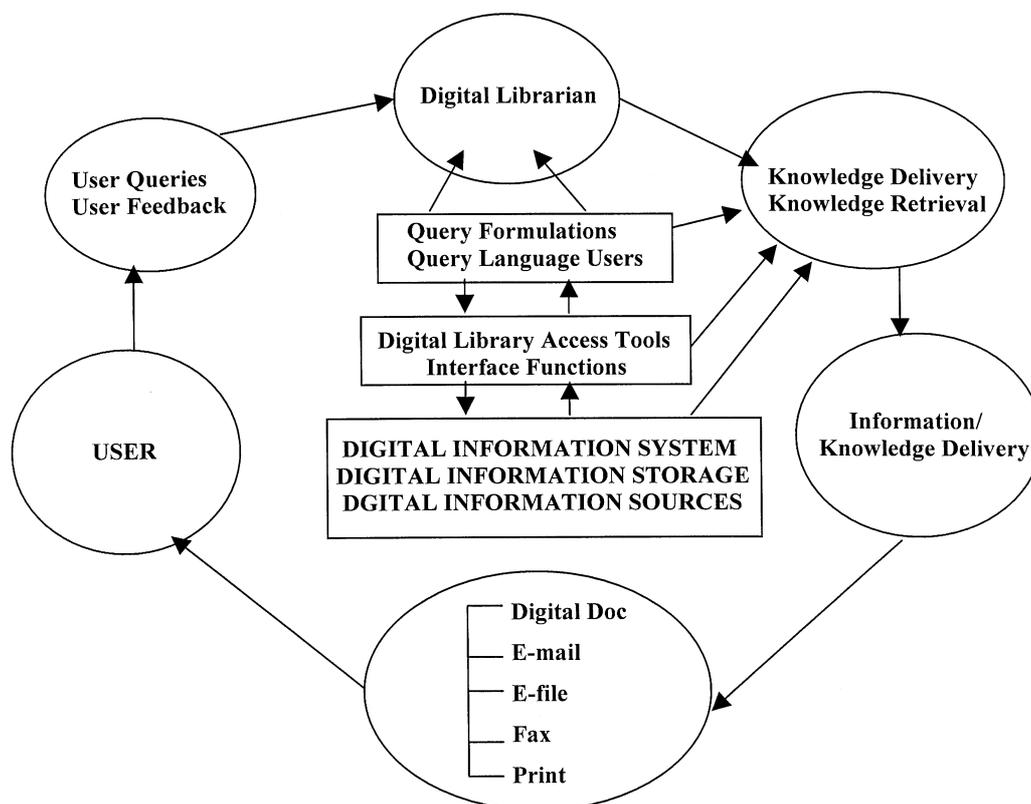
There is a variety of information retrieval techniques, including metadata searching, full-text document searching. In knowing what can or cannot be retrieved from the digital library information sources, the digital librarian acts as an expert in the acquisition of digital information (see Figure 2).

##### *4.9.1 Accessing and retrieval of digital information through digital library access tools*

The method used to store, find and retrieve digital information from DIS is called the access method. The technology used to access information digitally provides "navigation paths or digital library access tools" through the digital information system (DIS).

##### *4.9.2 Mobile information access: a vision of tomorrow*

The ability to access information on demand at any location confers competitive advantage on individuals in an increasingly mobile world. The data from shared file systems; relational databases, object-oriented

**Figure 1** Digital librarian's interface functions, skills, roles in the management of DIS**Figure 2** Digital information access and retrieval

databases, and other repositories must be accessible to programs running on mobile computers.

### 5. Digital library access tools, pools and sources of digital information for the digital librarian

There are various tools available to use in digital information systems and they facilitate in accessing, searching, browsing, navigating,

retrieving, indexing, storing, organizing and dissemination of digitized information. The list given below is the digital information sources and pools, and these are used as digital access tools which ultimately aim to facilitate universal access to all:

- Online public access catalogues (OPACs): meta-databases (describe, provide link to other databases/digital information sources; online databases (Knight-Rider, OCLC, MEDLINE).

- Internet-based tools: e-mail networks, mailing lists, electronic conferences, World Wide Web, Website home pages, Wide Area Information Services (WAIS), Web browsers, Gopher systems, and Veronica Archie, FTP, Telnet, Usenet, Newsgroups, BBS, Listservers, discussion groups.
- Digital networks/networking: BLAISE, MEDLINE, NICNET, DELNET AGRIS, INIS, all sorts of networks.
- Hypertext/Hypermedia.
- Multimedia (high bandwidth computer networks).
- Multimedia networking protocols.
- Cellular and pager networks.
- Electronic publishing tools.
- Net-dwelling software agents.
- Electronically fax/commercial vendors.
- Telephone/TV.

## 6. Components of a digital information system

The components of a digital library may include:

- (1) personal library system for the users;
- (2) organizational library system for serving groups of individuals;
- (3) new users as well as existing local or distant database users;
- (4) database servers to handle remote requests; and
- (5) a variety of system functions to coordinate, manage the entry and retrieval of digital information.

## 7. Competencies and skills of a digital librarian in the management of DIS/ digital libraries

The competency of a digital librarian is represented by different sets of skills, attitudes and values that enable a digital librarian to work as a digital information professional or digital knowledge worker and digital knowledge communicator (Sreenivasulu, 1998). There are skills and competencies that the digital librarian should develop. One is the ability to manage the digital libraries and digital knowledge in terms of digital knowledge management. The following are the skills and competencies required for a

digital librarian in the management of digital information systems and digital libraries:

- (1) Internet, WWW:
  - navigation, browsing, filtering;
  - retrieving, accessing, digital document analysis;
  - digital reference services, electronic information services;
  - searching network databases in a number of digital sources and Web sites;
  - creating home pages, content conversion, downloading techniques;
  - Web publishing, electronic publishing;
  - archiving digital documents, locating digital sources;
  - digital preservation and storage;
  - electronic messaging, connectivity skills;
  - Web authoring.
- (2) Multimedia, digital technology, digital media processing:
  - multimedia indexing, image processing, object-oriented processing;
  - interactive digital communications and visualization;
  - cataloguing and classification of digital documents, digital content;
  - searching and retrieval of text, images and other multimedia objects;
  - speech recognition, image visualization;
  - advanced processing capabilities exploiting digital medium;
  - conferencing techniques including teleconferencing, video conferencing.
- (3) Digital information system, online, optical information:
  - interfacing online and off-ramps, twists and turns of digital knowledge;
  - development of digital information sources;
  - digitization of print collections;
  - competency to manage CD-ROM network station;
  - development of machine readable catalogue records;
  - design and development of databases;
  - design and development of software agents for digital libraries;
  - conversion of print media into digital media;
  - knowledge in digital knowledge structures.

There are additional skills that the digital librarian should develop. One is the ability to think in terms of knowledge networks (Owen, 1999):

(1) Internal networks:

- personal networks;
- project teams, competence groups, GroupWare;
- internal digital knowledge resource;
- intranets.

(2) External networks:

- external knowledge resources;
- external personal networks;
- customers, suppliers, partners;
- extranets.

## 8. Professional education and training for the digital librarian in the management of digital information systems/digital libraries

For more than 25 years, schools of information studies have been adapting their curricula and teaching activities to the new information technologies (IT). All of those changes have occurred within the broad umbrella of information studies. The new digital information system (DIS) creates a major shift in the paradigm of the information transfer process (Deschatelets, 1997).

Included as a supplement here is a syllabus for a course on digital information systems, prepared by Prof. M.A. Gopinath, Documentation Research and Training Centre, Bangalore (Gopinath, 1996). In this course, each component is considered as a separate paper. The components of each course paper are outlined. The syllabus meets to a large extent the educational requirements of the digital librarian. In addition to that, digital information system management will require co-operation between different academic units. To accomplish that, both creativity and certain entrepreneurial spirit will be required.

- *Digital information system*: international dimensions of digital information system (DIS); technological and behavioral dimensions of DIS; components of digital information system; information system activities; input of data resources; processing of data into information; output of information products; storage of data resources; control of system performance.

- *Digital information management* (Deschatelets, 1997): computerized text analysis; database creation; database distribution; design of interfaces; design of retrieval languages document structuring; language-related industry (e.g. translation, terminology, software); network-related activities (e.g. Internet, intranet, extranet, LAN, WANs); optical-based information products (CD-ROMs, CDI, DVD); telecommunications; virtual reality; communication formats; competitive intelligence; data mining; knowledge mining; technology watch.
- *Digital technology*: computer system components; central processing unit primary and secondary storage capacities; types and trends in computers, computer peripherals; computer software, application software, data resources management.
- *Digital technology media processing*: online tutorial; filter enhancements; frame-viewer for digital document distribution Internet/WWW publishing support through distribution; common interfaces; searches within hierarchical classification or domains; searches against keywords or expressions containing Boolean logic; give users easy access to information, services irrespective of their physical location; building more intelligence to applications and services; manage-wise systems; desktop management; network analysis; virus protection; Windows and multimedia presentation; CD-ROMs; simulations; visualizations.
- *Knowledge base through digital libraries*: interface features; multimedia system and multimedia stream playback; multimodel and hypermedia; information retrieval/access system; training support; surrogation and storage; intellectual property systems; digital preservation system; network system; World Wide Web.

Apart from the above outlined curriculum, the following papers are also aimed at training the digital librarian with innovative vigor and approach (Sood and Sreenivasulu, 1998):

- Online information access and retrieval.
- Information networks and networking.
- Advanced information technology.

## 9. The role of a librarian transforms into that of a digital librarian

What will be the role of a librarian in the future? It seems to fit in with the notion that the library will disappear as an institution. The Internet will become a significant force in the information world. If work becomes decentralized and teleworking becomes the norm, we are going to have “Virtual libraries”, with a vast increase in the range and variety of digital information resources. The “electronic cottage” worker becomes the norm, working on a contractual basis for different kinds of organizations, connected to corporate databases and information files online (Wilson, 1995).

The logical sequence of this is that the librarian, too, becomes a predominantly online worker, supporting the citizen/worker by selling services. Finding relevant information faster than the competitors, faster than a non-information-worker can find it, and surviving on the basis of superior knowledge of the networks and digital information resources available through them. We already have the words to describe these roles: digital librarian, digital information professional, cybrarian, and information broker.

A different view of the future might be one where a “digital library” is more like a “knowledge warehouse”, where a complex system of professionals whose expertise supports access to information acts as an intermediary to a variety of digital and other sources (Kuny and Cleveland, 1998). Although, at this stage, it is difficult to define what the role of the digital librarian will be, in the long term, a few things already are clear. It is especially important to understand that the ultimate goal is not just to facilitate access to digital information just-in-time to the critical want of end-users and additionally electronic publishing, but to create and develop digital knowledge channels, digital knowledge sources which allow synergy between partners leading to mutual exchange and enrichment of digital knowledge domain.

## 10. Conclusion

It is ironical that all these technologies are under way, but not yet co-ordinated and targeted at the task of creating a digital

librarian. Reference librarians, cybrarians or information brokers will be augmented by digital librarians in the digital world.

The digital librarian will become the guardian of digital information and will be the vehicle to preserve democratic access to information. The digital librarian’s role will be increasingly towards offering consultancy to the users in their efforts in providing digital reference services, electronic information services, navigating, searching and retrieval of digitized information through Web documents that span the Universal Digital Library or the Global Digital Library. The digital librarian will be an embodiment of a digital information professional or digital knowledge worker, who will ensure that the digital libraries are used effectively and with ease. Digital librarians with newly acquired skills can play a meaningful and leading role in the networked information society of the millennium. Digital librarians add values and can make digital libraries truly useful and user friendly.

The digital librarians, who, imbued with an ethic of equitable access, will function as well-trained intermediaries in a heterogeneous information environment – an environment that if not actively hostile to users is certainly confusing – and will find and make sense of the vast amounts of digital knowledge for their users. The knowledge that “digital librarians” bring to this knowledge environment would make sense of a multiplicity of digital collections and resources, provide access to a network of key contacts, identify cost-effective strategies for information retrieval, and assist users in the publication and creation of new knowledge.

Redirecting the focus of librarians’ attention and resources from the development of “digital libraries” to the development of “digital librarians” will be vital to the future of the profession. The time has come to invest in people and not technology (Lankes, 1998). Central to the vision of the new digital library is a digital librarian who cares about people. Digital library collections will be more appreciated with the “intellectual processes and services” that a digital librarian might provide.

It can be said that the digital librarian working in the digital knowledge domain is a specialist in the area of digital libraries, digital information systems and digital knowledge

sources. The digital librarian can be manager of a digital library, digital information centre or a librarian of the electronic library, which may be a division/section of a traditional library. It has to be clear that this is a fairly modest role, which offers excellent perspectives for the digital librarian.

Several personal characteristics plus the new skills and competencies are essential for the digital librarians to create and manage digital library collections and services. Demonstrated skills and sophisticated expertise competencies are needed for digital librarians to manage the digital information system (DIS) in the important areas of imaging technologies, optical character recognition, markup languages, cataloguing, multimedia indexing, database technology, user interface design, programming, and Web technologies.

Exit librarian – Enter digital librarian/cyberarian (Exit, 1998).

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