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Digital Library: Link to E-learning

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Abstract

Today 's library includes sophisticated tools that make it easy to find the best information resources, delivering them to one's desktop or mobile computing device at the push of a button. While there are still many challenges to realizing the potential of digital information, digital library technologies and practices have developed enough so they are within reach of every type and size of educational institution.

This paper presents the key concepts of what the digital library can be, its key components, link to e-learning and the Campus Enterprise and some of the future directions. It is clear that digital library technology is becoming an essential enabler of library services.

1. Evolution of Digital Collections

One of the most precious treasures of the British Library is the irreplaceable 11th century manuscript of "Beowulf," an epic poem describing the heroic adventures of a Scandinavian warrior. The manuscript was donated to the British Museum in 1700 and was nearly destroyed in a fire 30 years later. With scorched edges and brittle pages, the manuscript continued to deteriorate over the next century of handling by scholars. Although the degradation was halted in the mid-1800 by mounting each manuscript leaf in a protective frame, much damage had already been sustained and sections of this great work can now only be known through historical transcripts.

In 1993, the British Library initiated the Electronic Beowulf Project to capture, enhance, and preserve forever this cultural artifact in digital form. Not only has the manuscript been captured in its current form, but also it is now available for study anywhere. This is only one example of how, throughout the world, libraries, museums and archives are digitizing the important documents and images of our culture, both to preserve them for future generations and to make them more accessible to our own.

The barriers of space and time in the search for knowledge are also being eliminated. Today, students, researchers, Information professionals, and the general public can directly access many of the world 's rarest artifacts — from high-quality images of each page of the Gutenberg Bible to a digital likeness of the Mona Lisa — right at the desktop or other Web-enabled device, at any time and from any location. Audio recordings of historic speeches or exotic birdcalls, video clippings from televised news programs, geospatial data, and more are being delivered directly to the desks of students and researchers. Thanks to the creation of digital libraries, scholarly research is accelerating dramatically without the limitations of physical access.

Many important advances in digital library techniques came about through research projects sponsored by the U.S. National Science Foundation (NSF) and the U.K. Joint Information Systems Committee (JISC). In 1999, these

projects began expanding internationally when NSF linked its digital library research program with similar activities being undertaken by JISC, resulting in the JISC-NSF International Digital Library Initiative. Since then, many other groups have become involved in the expansion of digital library technologies and techniques, including the European Union, Association for Computing Machinery (ACM), the Institute of Electrical and Electronics Engineers (IEEE), the International Federation of Library Associations (IFLA), the American Library Association (ALA), the Coalition for Networked Information (CNI), and the Digital Library Fed ration (DLF).

2. Defining the Digital Library

Debate rages among librarians and knowledge professionals as to what constitutes a digital library. There are many definitions, ranging from the electronic catalog that describes physical items in a "brick and mortar "library to advanced multimedia environments housing all-digital collections. **H. Thomas Hickerson**, Associate University Librarian for Information Technologies & Special Collections of Cornell University, believes that it is time to erase the line between physical and digital libraries. He further says "a major portion of library activities are technology-supported and have been for years. The Internet has had an incredible impact, but libraries have a history of managing large systems and using technology to deliver bibliographic information".

Digital library is the electronic extension of functions, users typically perform and the resources they access in a traditional library. These information resources can be translated into digital form, stored in multimedia repositories, and made available through Web-based services. The emergence of the digital library mirrors the growth of e-learning (or distance learning) as the virtual alternative to traditional school attendance. As the student population increasingly turns to off-campus alternatives for lifelong learning, the library must evolve to fit this new educational paradigm or become obsolete as students search for other ways to conveniently locate information resources anywhere, any time.

3. Goals

Digital libraries began to appear on the campus in the early 1990s as research and development projects centered within computer science departments, sometimes funded by government grants. Campus librarians were often uninvolved in these early projects, which focused on digitization technology, metadata schemes, data management techniques, and digital preservation. **Dan Greenstein**, former Director of the Digital Library Federation and now Head of the California Digital Library, characterizes this experimental period as the "second-generation digital library" exploring new opportunities and developing new competencies. With this new knowledge in hand, Greenstein suggests that the third-generation digital library abandoned this experimentation and the "build it and they will come" philosophy that characterized early digital collections, focusing instead on fully integrating digital material into the library's collections through a modular systems architecture. "This modular approach is fundamentally liberating since it permits libraries to think creatively about how to build upon services supplied by others."

As these projects matured and led the way toward more practical digital library implementations, the library began to take a more central role. Digital library use shifted to a large and diverse campus audience, and information technology (IT) groups began to partner with the library to develop campus-wide standards for the deployment and operation of digital libraries as an integral part of the education enterprise. This development paralleled the development of heightened student requirements for access to library resources.

With the advent of the Internet, individual's expectations for access to information have increased dramatically. It is no longer considered practical or acceptable to travel to a specific location during certain hours to locate needed information. Library patrons are not satisfied to locate an item of interest that is housed at yet another physical location, request the item, and then wait days or weeks for the item to arrive at the building where it was requested. Patrons increasingly expect instant access to all the information

resources they require, from any location, at any time, and from any device. This is the objective that the digital library is fulfilling.

With digital libraries, an individual can:

- Gain access to the holdings of libraries worldwide through automated catalogs.
- Locate both physical and digitized versions of scholarly articles and books
- Optimize searches, simultaneously search the Internet, commercial databases, and library collections
- Save search results and conduct additional processing to narrow or qualify results
- From search results, click through to access the digitized content or locate additional items of interest

All of these capabilities are available from the desktop or other Web-enabled device such as a Personal Digital Assistant or cellular telephone. Additionally, the user can customize his or her information request so that search results reflect individual needs and preferences.

4. Key Components

A fully developed digital Library environment involves the following elements:

1. Initial conversion of content from physical to digital form.
2. The extraction or creation of metadata or indexing information describing the content to facilitate searching and discovery, as well as administrative and structural metadata to assist in object viewing, management, and preservation.
3. Storage of digital content and metadata in an appropriate multimedia repository. The repository will include rights management capabilities to enforce intellectual property rights, if required. E-commerce

      functionality may also be present, if needed to handle accounting and billing.
4. Client services for the browser, including repository querying and workflow.
5. Content delivery via file transfer or streaming media.
6. Patron access through a browser or dedicated client.
7. A private or public network.

To interoperate with the existing library infrastructure, the digital library must be designed to work with existing library catalogs and incorporate industry standards, formats, and protocols. The term "digital library" is often used to describe any multimedia management system holding digitized information, but this does not mean it will deliver true library application functionality. Thus, these digital library components must also be tailored to capture, encode, and deliver information according to the standard practices adopted by the library industry. Because of the rapid pace of technological changes, some standards are concrete and others are emerging.

5. Link to E-learning and the Campus Enterprise

The development of digital libraries must be considered in the overall context of initiatives to unify the IT structures of the campus and to transform the learning process through innovative technology.

Economic, social, and cultural pressures are forcing schools and universities to reinvent themselves. As in the business process re -engineering activities of the last decade that transformed corporate enterprises, education organizations are now viewing themselves in a new light. New types of students and changing student expectations are driving the integration of core campus functions and deployment of student services on the Web. Fragmented, monolithic approaches are falling away as educators realize the need to link learning and administrative resources in a more effective way to become a "knowledge enterprise" in the 21st century version of the traditional campus.

During the past decade, steep decline in the cost of commodity components, combined with the availability of high bandwidth networks, have made sophisticated IT applications for education affordable. A mix of sophisticated digital and Internet-based services and rapidly expanding global digital content have made possible a Virtual Learning Environment (VLE) that delivers the capability to enhance the classroom experience or conduct learning apart from a physical campus. The digital library is a core component of this VLE.

"These developments are extending the role of the library, and changing the relationships between the library and other parts of the academic enterprise" according to **Clifford Lynch**, Director of the Coalition for Networked Resources (CNR) and a noted authority on digital libraries. "I think we will see a continued evolution from thinking about digital collections to thinking about networked information services, which will integrate authoring, analysis, and distribution tools that facilitate the reuse and re-purposing of digital content. In almost all cases, the collections and services must be integrated into the institutional, national, and worldwide fabric of research and teaching."

The NSF in the United States has joined with the JISC in the United Kingdom to sponsor a major research program called "Digital Libraries and the Classroom: Test beds for Transforming Teaching and Learning." This program will promote the use of large-scale, distributed digital content and advanced networking technologies for learning. Running from 2002 to 2007, the sponsored projects are expected to demonstrate how integrating recent technical developments with digital content improves the learning experience of students and provides new models for classroom instruction. Evaluating the impact of these projects on student achievement, retention, recruitment, and on institutional structures and practices will be important elements of the initiative.

6. Future Directions

The pace of change in digital library technology and its applications has accelerated in recent years as the focus has begun to shift from R&D to full-scale deployment. Several key trends are emerging and will continue to gain momentum:

- The shift from text and image-based systems to audio and video will continue. As network bandwidth becomes more economical and streaming technologies improve, increasing numbers of institutions will have access to the practicality of full multimedia solutions.

- Broadly accepted best practices will emerge for digitization, rights management, preservation, metadata encoding, and other key digital library processes. The library discipline is highly collaborative and has a history of sharing successful approaches. Debate about these issues will recede as proven techniques mature and spread.

- Standards will move from the discussion and trial stage to widespread adoption. As library industry thought leaders work through existing standards organizations to agree on common approaches, software vendors focusing on the Library market will incorporate these agreed-upon standards into their product lines.

- As the center of digital library activity shifts from computer science experiments back to mainstream library implementations, the next generation of digital library development and deployment will focus on standardization, usability, and productization — providing great reusability for library patrons, increased interoperability among digital collections, and more cost-effective choices for institutions just beginning digitization programs.

- Growing dependence on digital information resources will create market pressure for the creation of cooperative solutions for long-term preservation. The charter of library consortia will enlarge to

accommodate development of mass storage facilities serving a range of institutions. This will be more cost-effective and more reliable than individual solutions.

- Even now, course management systems providers and textbook publishers are starting to work together. As more texts are published electronically, this linkage will become stronger. In time, digital libraries and learning management systems will be routinely integrated, re-purposing the same digital content as both course content and reference material. E-learning will continue to blur the lines between course content, textbooks, and reserve materials provided by libraries as these all become digital content managed in common repositories or through common gateways. Digital libraries will be routinely linked to campus e-learning and administrative systems to provide a one-stop virtual campus.

It is clear that digital library technology is becoming an essential enabler of Library services. It is certain that all libraries of the future will be characterized by technology-based information services that extend and enhance the traditional mission of libraries in our society.

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